

# SCIENCE

5 February 1965

Vol. 147, No. 3658

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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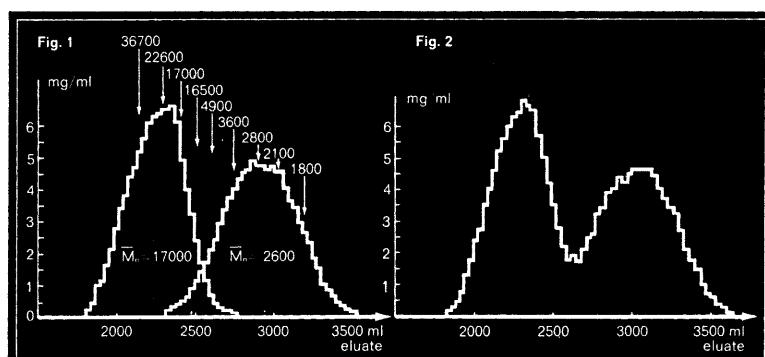


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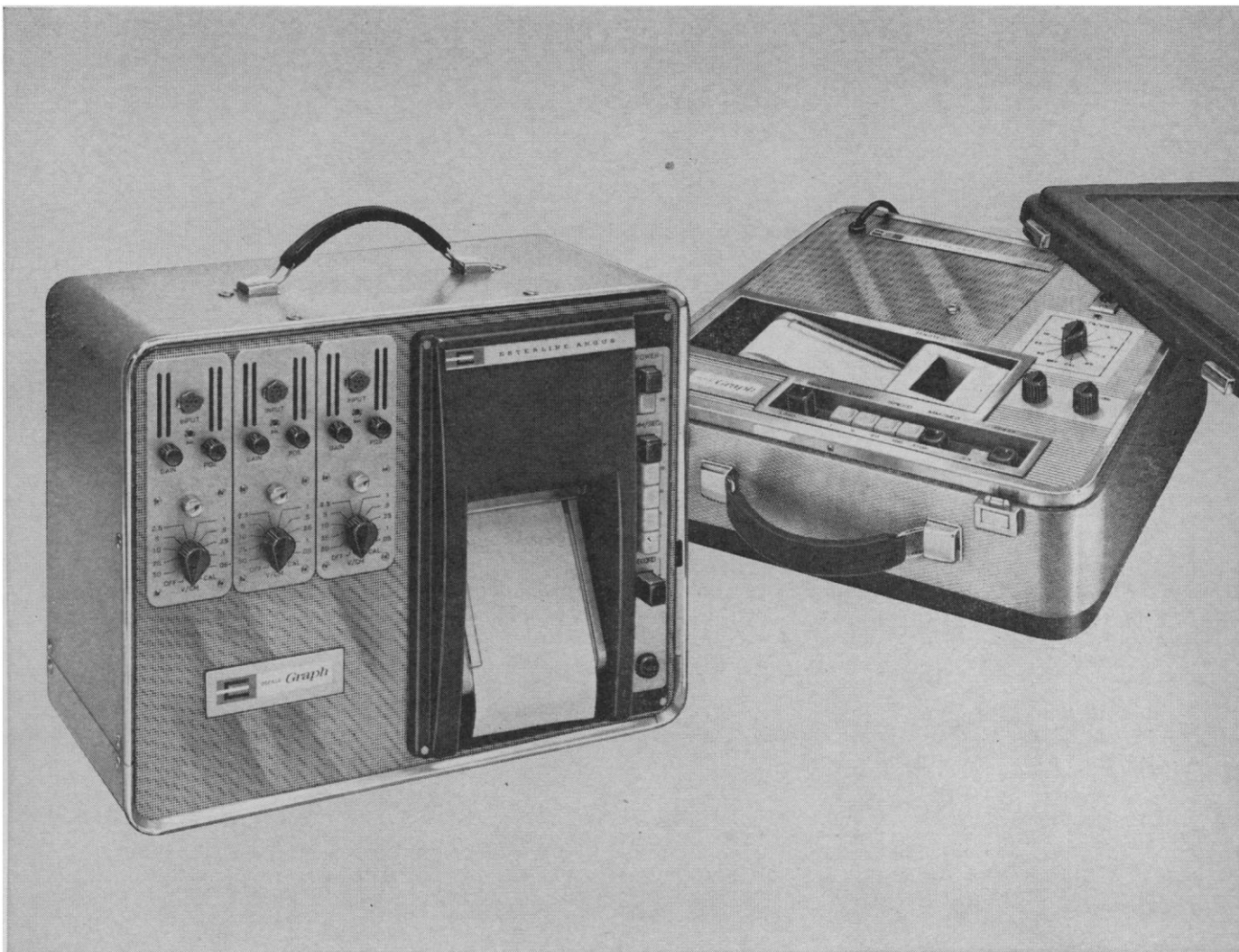
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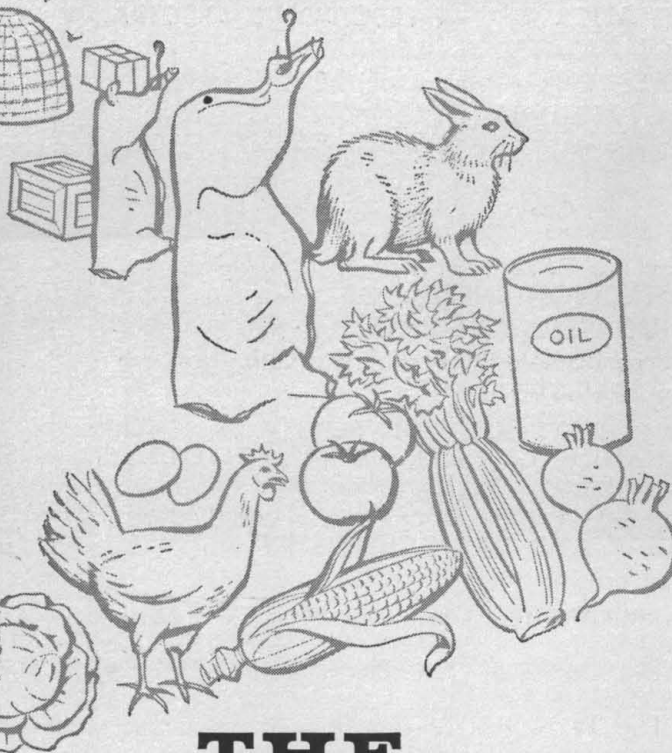
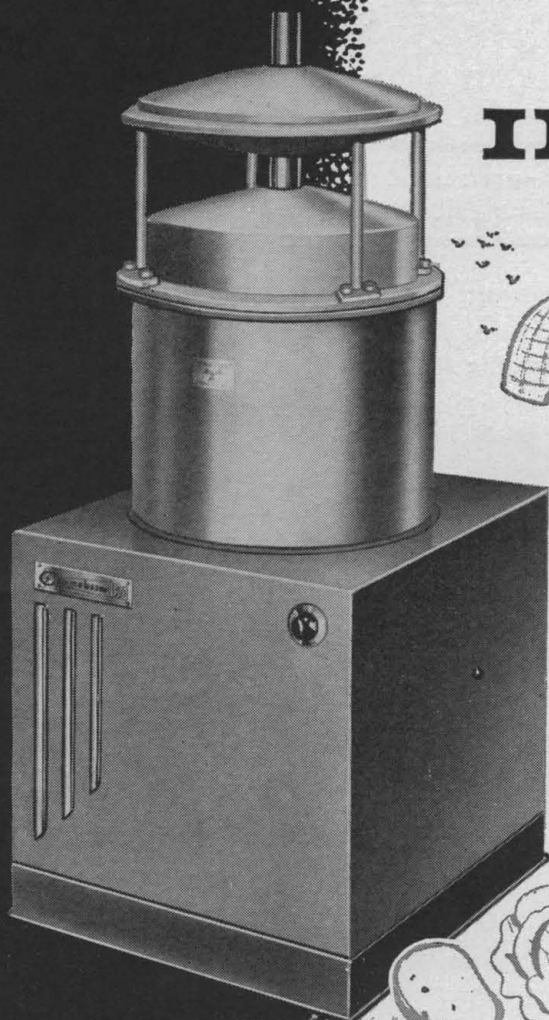
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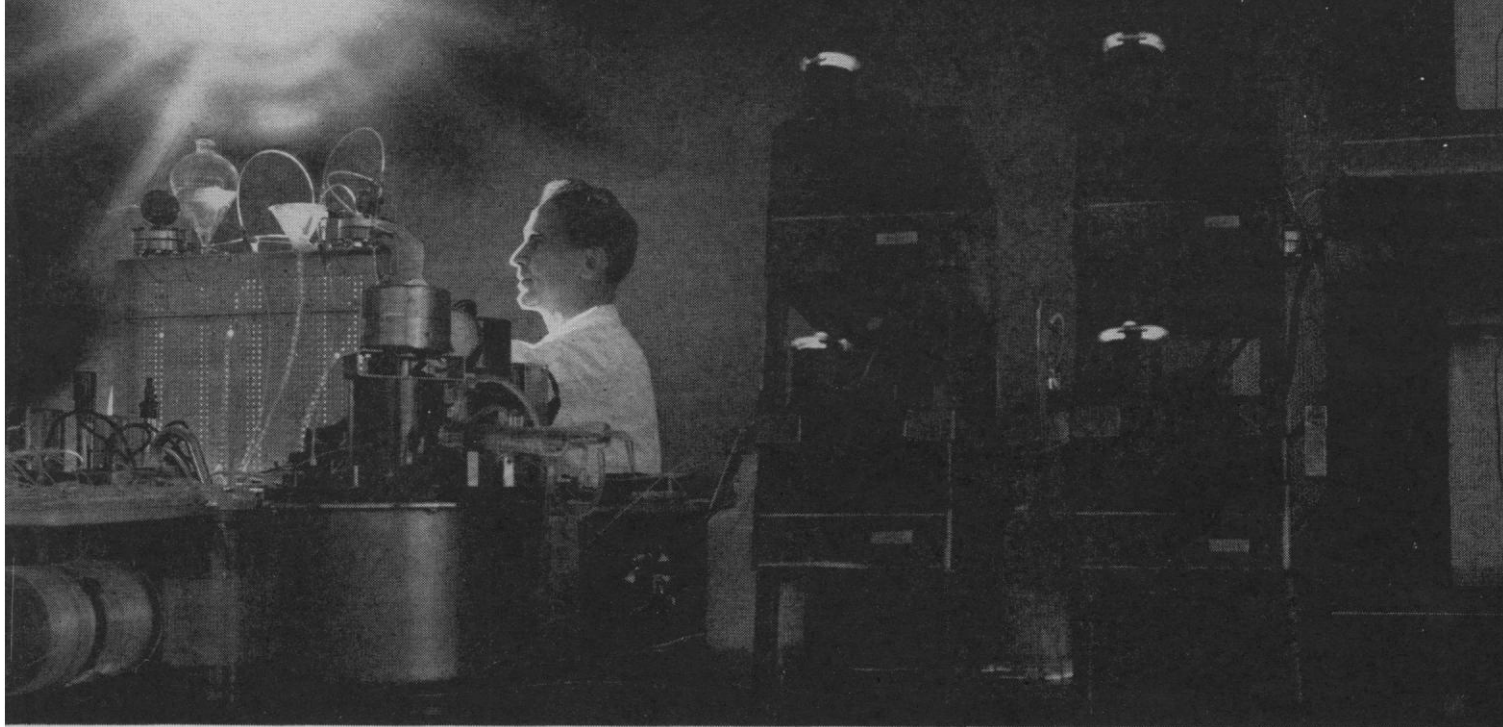
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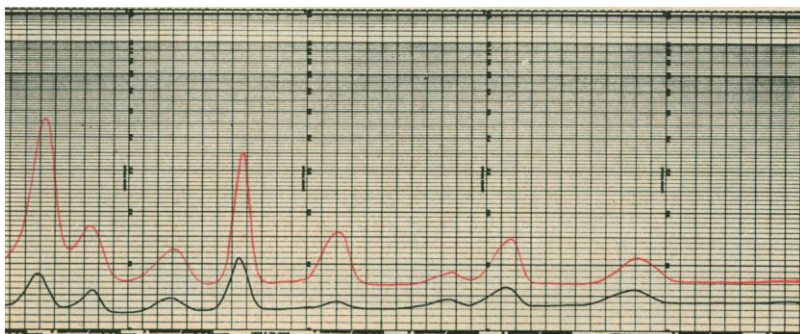
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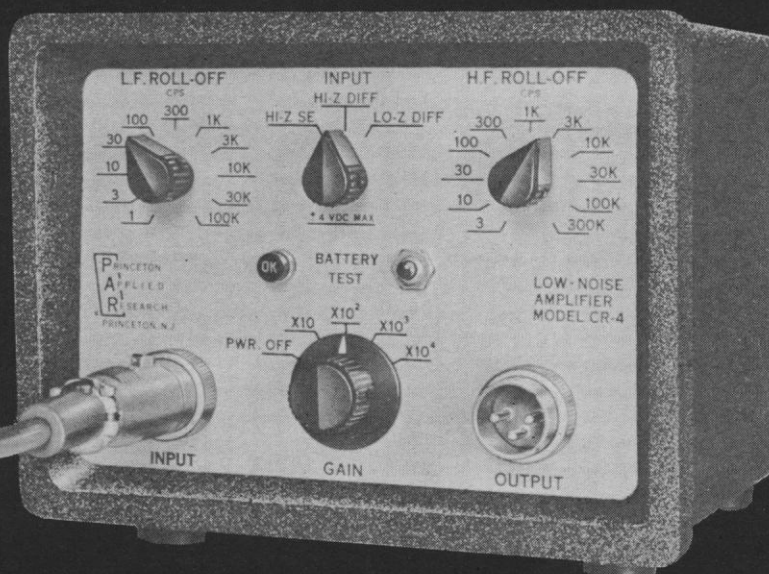
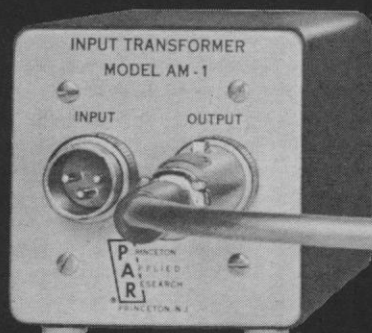


*Section of a chromatogram showing tryptic hydrolyzate of performic acid oxidized bovine pancreatic Ribonuclease before and after alkaline hydrolysis.*

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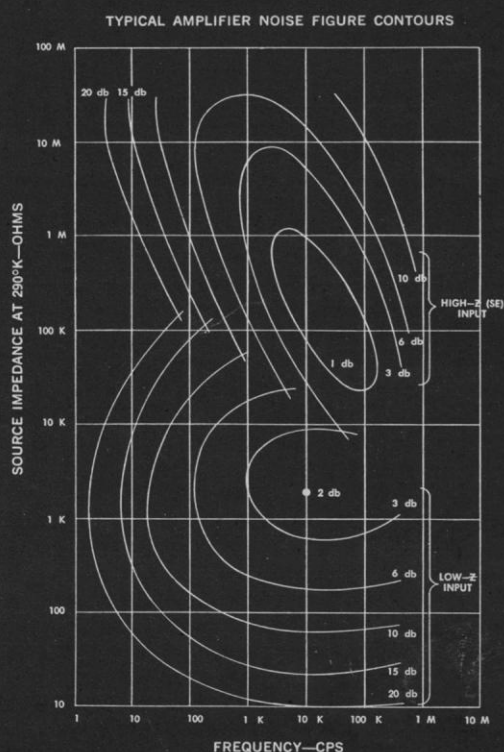
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$$F = 20 \log_{10} \frac{\text{total measured amplifier noise (including Johnson noise)}}{\text{calculated Johnson noise}} \text{ dB}$$

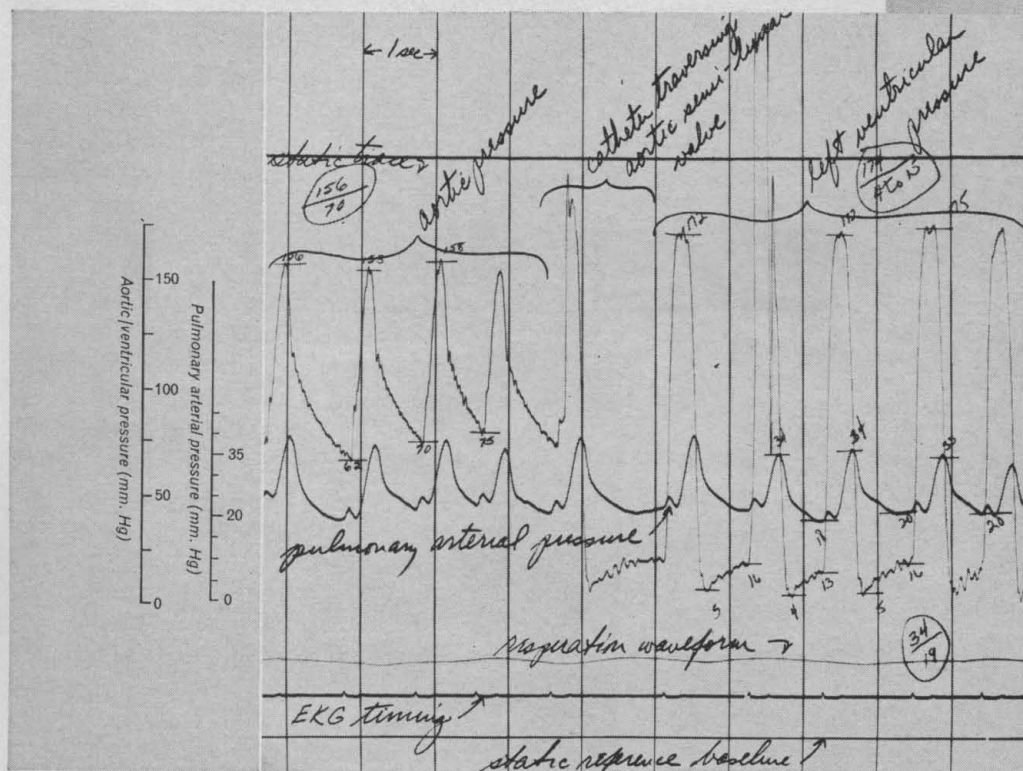
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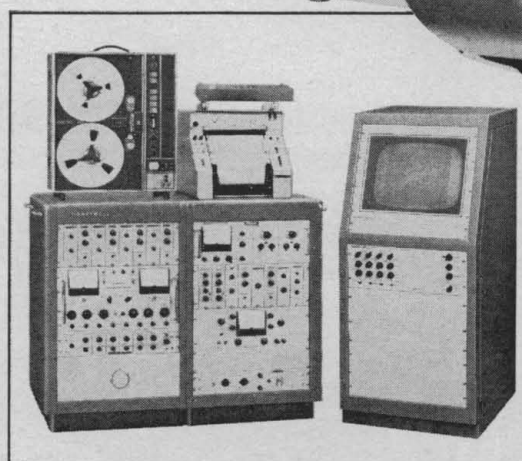


Record shown 1/3 actual size is from a 36-channel Visicorder; illustrated is a 14-channel instrument.

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Shown at right is a medical data acquisition system consisting of a 24-channel Visicorder oscillograph, a Model 8100 FM portable tape recorder/reproducer (8 channels, DC to 10KC), and a Multi-trace oscilloscope which simultaneously displays up to 8 channels on a 17" scope. Such a system is custom-engineered from standard modules by our physiology/electronics engineering department to meet every data acquisition need of basic and clinical medical research.

For complete details on using Honeywell data acquisition to handle the information from your research, please write to Dr. D. C. Sutfin, Mail Station 407, Honeywell-Denver, Denver 80217. In Canada, Honeywell Controls, Ltd., Toronto 17.



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## Honeywell

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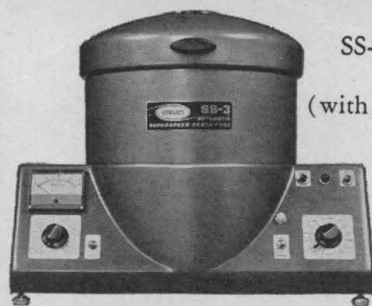
You may ask why buy a superspeed centrifuge when perhaps many of your projects require only low speeds, say, about 3,500 RPM. *Reserve power* is one answer! Whereas the ordinary centrifuge feels the strain early when asked to perform continuously at 3,500 or 5,000 RPM, the SORVALL SS-3 and SS-4 are merely "loafing along" at such speeds. Think what this means in terms of instrument life. Reserve power is also a mighty handy thing for that special job where extra high G's are called for. With SORVALL, they're *there* when you *need* them. And, of course, with the SS-3 and SS-4 you get the added advantages of rotor versatility, Gyro-Action Self Centering Direct Drive\*, reliable controls (automatic on the SS-3), and unique safety rotor-chamber guard and cover\*. Why settle for just an ordinary centrifuge when the same amount of dollars will buy you a long-term investment? Interested? For further information ask us for illustrated literature number SC-2SS.

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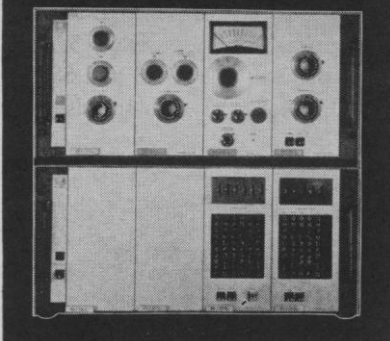


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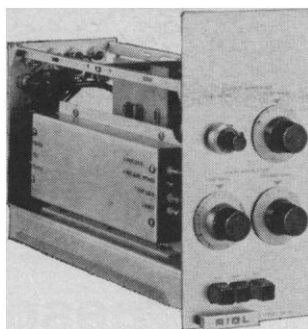
Today you can fulfill your experimental needs with the most complete, useful, and versatile system of modular nuclear instruments currently available — RIDL's Designer Series.\* And tomorrow, when those needs change or new ones arise, you will find they are still being met as the series is expanded.

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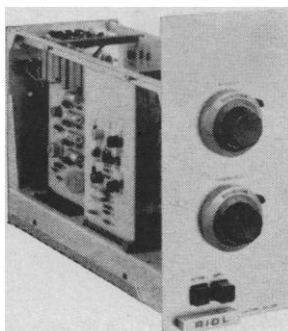
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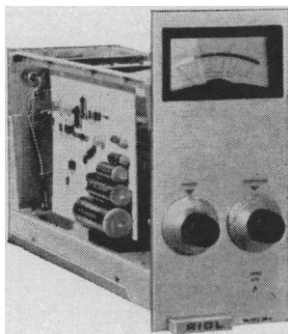
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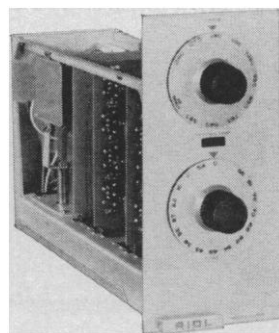
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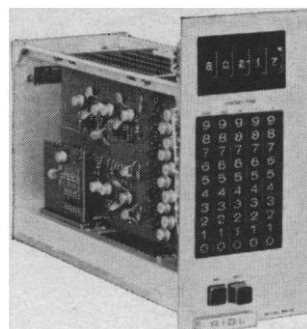
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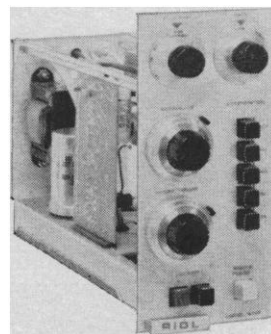
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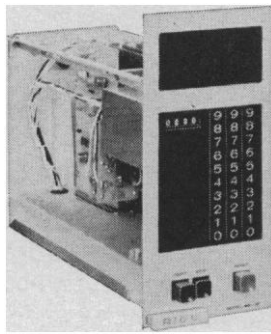
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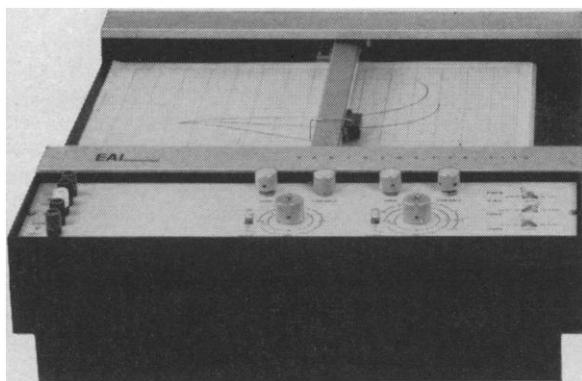
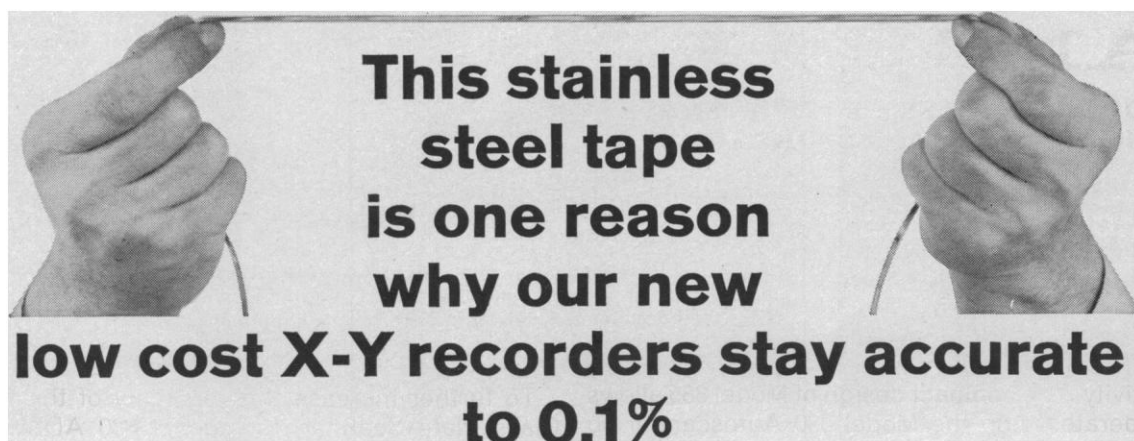


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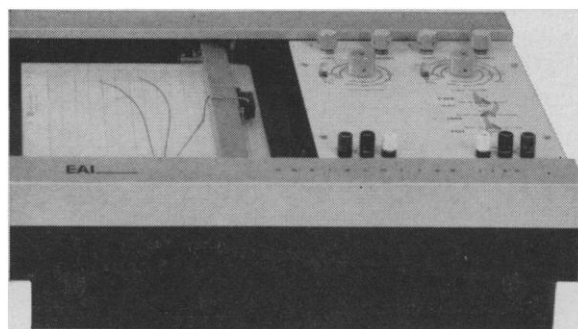
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To facilitate the scanning of either paper or TLC chromatograms, an automatic power and gas control system incorporated in the Model 885 Glass Plate Scanner switches both electronics and counting gas supply from the Model 880 to the Glass Plate Scanner when power is applied.

To further increase the versatility of the Model 885 Glass Plate Scanner, the Model 880 ADS digital integration system may also be used to provide quantitative evaluation with digital presentation of radioactive zones.

For additional information on the new Model 885 Glass Plate Scanner, write Vanguard, P. O. Box 244, LaGrange, Illinois, or one of the local sales offices.



Model 885 shown atop the Model 880 Autoscanner

Model 885  
Glass Plate Scanner



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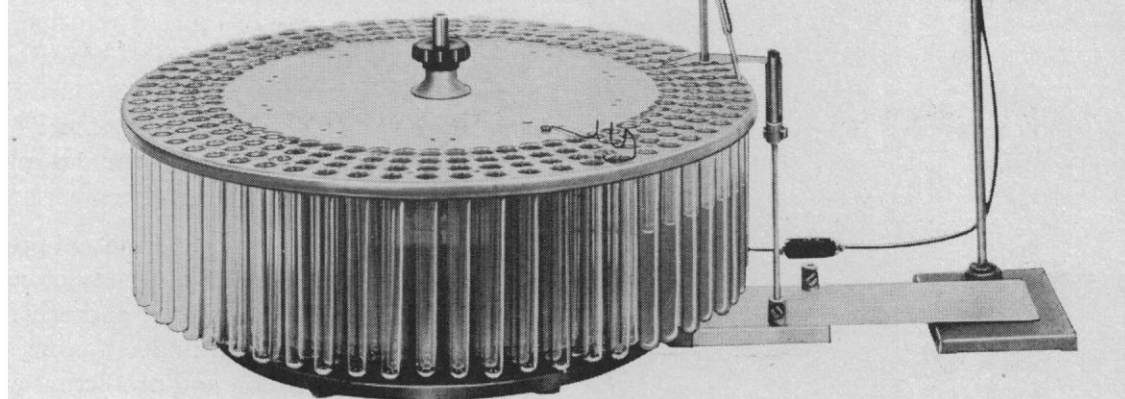
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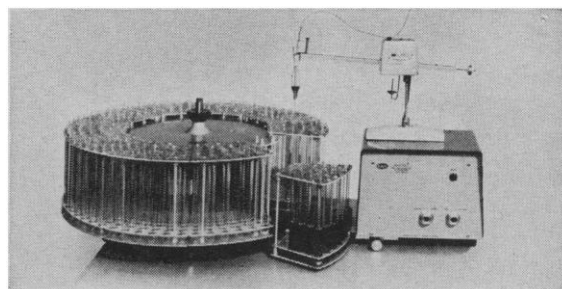
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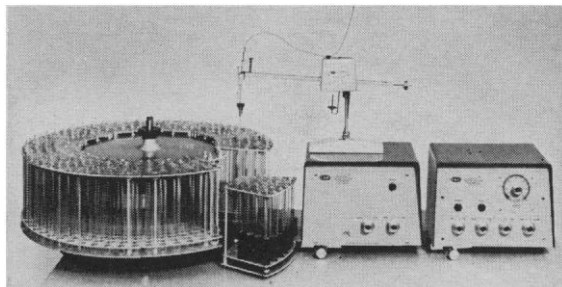
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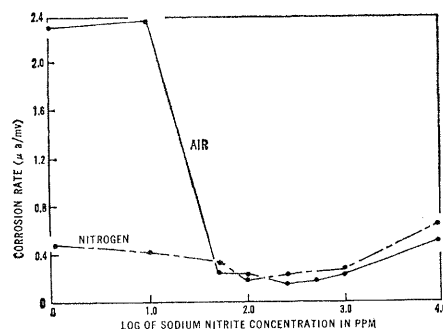
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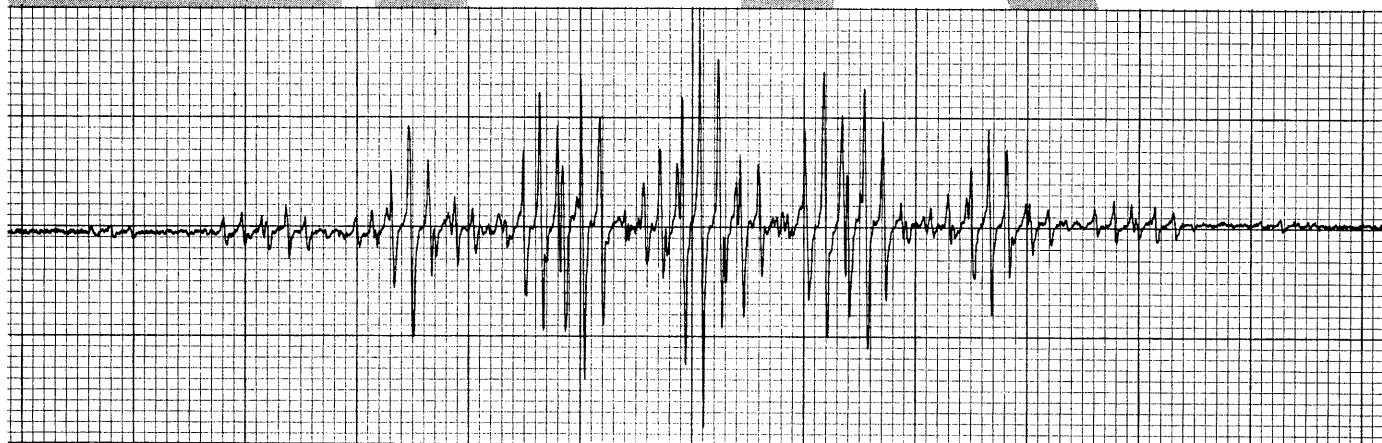
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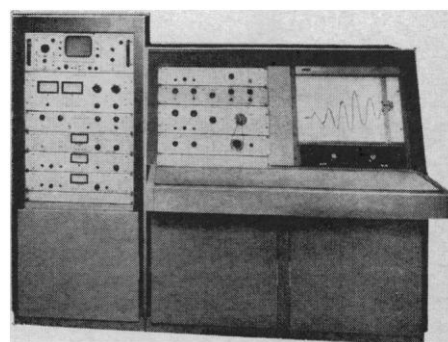
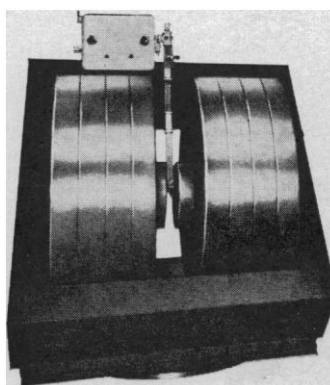
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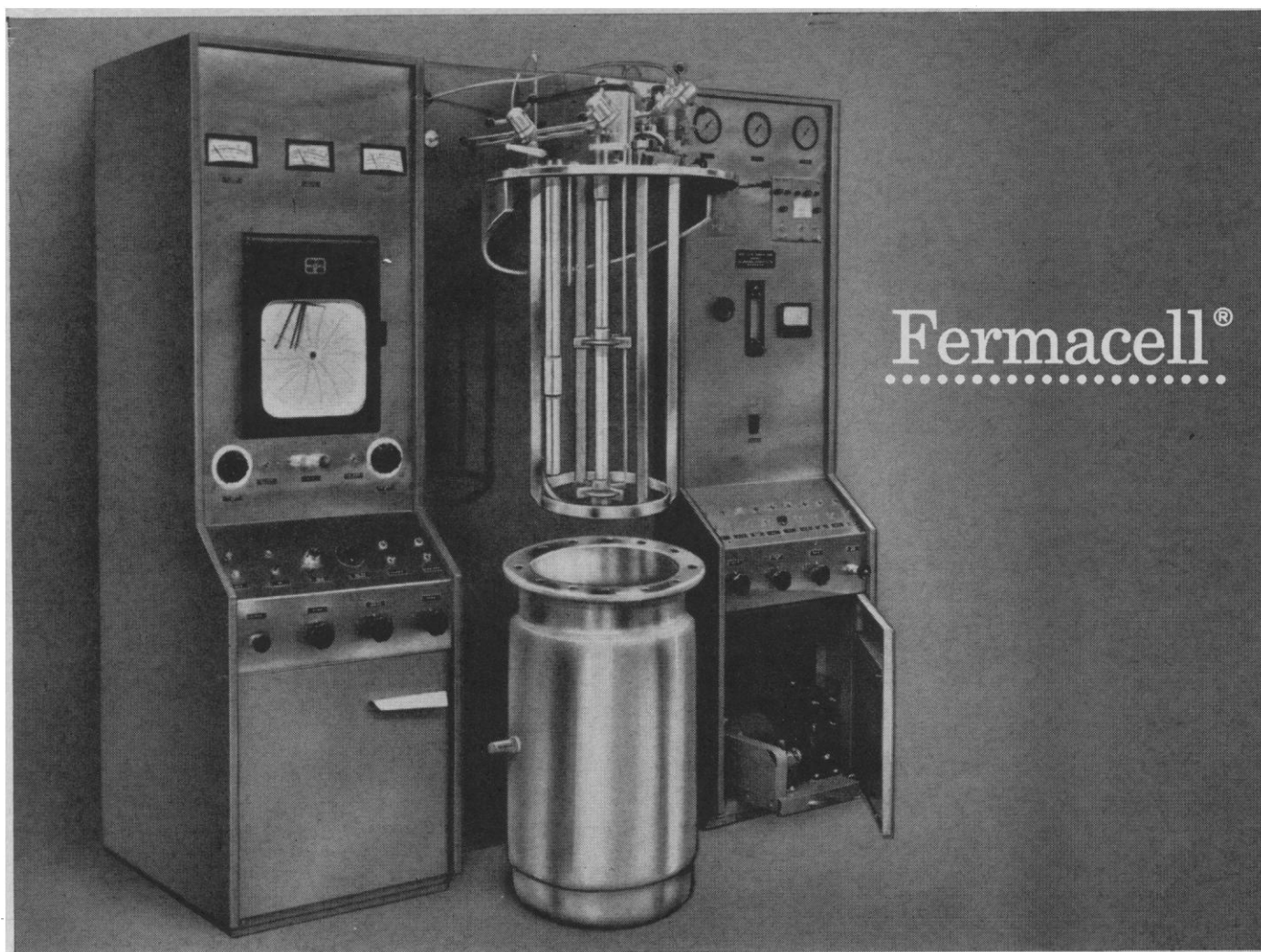


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is used for growing aerobic and anaerobic bacteria, streptomycetes, molds and yeasts, as well as mammalian and plant tissue cultures.

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**Extremely Versatile** for a wide range of microbial studies. Components are designed for simple removal and cleaning as well as flexibility of operation. Choice of interchangeable spargers and impellers in four different models.

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### Cyanogen (CN)<sub>2</sub>

Cyanogen, also called Dicyan and Oxalonitrile, is a colorless, flammable, toxic gas at room temperature and atmospheric pressure with a characteristic almond-like odor. It is supplied in 8 oz., 2 lb. and 5 lb. cylinders as a liquefied gas under its own vapor pressure of about 60 p.s.i.g. at 70°F. Cyanogen has a minimum purity specification of 98.5% by volume. The following is a typical analysis of the gas as supplied by Matheson:

	Vol.
Cyanogen	99.14%
Hydrogen Cyanide	3200 ppm
Carbon Dioxide	0.5%
Chlorine	nil
Water	nil
Nitrogen	trace
Hydrogen Chloride	nil
Cyanogen Chloride	400 ppm

### Physical constants (partial listing) of Cyanogen are as follows:

Molecular Weight	52.04
Vapor Pressure @ 70°F.	60.1 p.s.i.g.
Specific Volume, 70°F., 1 atm.	7.4 cu. ft./lb.
Boiling Point @ 1 atm.	-6.1°F. (-21.17°C.)
Freezing Point @ 1 atm.	-18.2°F. (-27.9°C.)
Density, Liquid @ b.p.	0.9537 g./cc.
Critical Temperature	259.8°F. (126.55°C.)
Critical Pressure	855.5 p.s.i.a. (58.2 atm.)
Latent Heat of Vaporization @ b.p.	5.778 kcal./mole
Specific Heat, Gas Cp, 15°C., 1 atm.	0.4095 cal./g/°C.
Specific Heat, Gas Cv, 15°C., 1 atm.	0.3260 cal./g/°C.
Specific Heat Ratio, Cp/Cv	1.256
Viscosity, Gas, 20°C.	107 micropoises
Surface Tension @ b.p.	21.98 dynes/cm.
Heat of Dissociation	77±4 kcal./mole
Trouton's Constant	22.94
Heat of Formation	73.8 kcal./mole
Flammability Limits in Air	6-32%

Because cyanogen burns with a very hot flame it is of interest as a gas for welding and cutting heat-resistant metals, as a rocket and missile propellant when mixed with an oxidizing agent such as Ozone or Fluorine, as a fumigant, and as an intermediate in many organic chemical syntheses.

### Recommended Controls

Single Stage Regulator: Matheson #19C-160  
Needle Valves: Matheson #57-160 and #59

### Nickel Carbonyl Ni (CO)<sub>4</sub>

Nickel Carbonyl is a volatile, toxic, mobile liquid with a musty odor. It melts at -25°C. and boils at 43°C. Its vapor pressure at 68°F. is 315 mm. Hg.; specific gravity at 17°C., 1.32. Its molecular

weight is 170.73. It is supplied in 1, 5, 10, 25, and 150 lbs. quantities in cylinders pressurized with carbon monoxide to 15 p.s.i.g. at 68°F. Cylinders containing 25 and 100 lbs. of Nickel Carbonyl are supplied with a goose-neck eductor tube. Nickel Carbonyl is practically insoluble in water and does not react with water or aqueous acids or alkalis. It is highly soluble in many organic solvents, such as ethanol, ether, benzene, and chloroform. In Nickel Carbonyl, the four carbonyl groups form a tetrahedral arrangement and are linked covalently to the metal through carbon rather than oxygen. Its properties reflect this unusual coordination structure. Nickel Carbonyl begins to decompose at 50°C. into Nickel and Carbon Monoxide. In many reactions, the properties of Nickel Carbonyl are those of Nickel and Carbon Monoxide. Thus Nickel Carbonyl, when reacted with Bromine, gives Nickel Bromide and Carbon Monoxide. However, with Grignard reagents its reactions are those of Carbon Monoxide. Nickel Carbonyl is oxidized rapidly by atmospheric Oxygen to Nickel Oxide, with liberation of Carbon Monoxide. Nickel Carbonyl is used as a catalyst in carbonylation reactions. It is also used (in the Mond process) as a way to refine Nickel. Nickel Carbonyl has been used to obtain metallic mirrors and to coat objects with a thin film of Nickel.

### Recommended Controls

Needle Valve: Matheson #50-320  
Lecture Bottle Control: Matheson #31

### Deuterium, Technical Grade D<sub>2</sub>

Now at a new lower price.

This heavier, stable isotope of ordinary hydrogen is a colorless, odorless, flammable gas. It is shipped as a non-liquefied gas in high pressure steel cylinders at varying pressures depending on the quantity packaged. Cylinder sizes are 7, 14, 50, 100, 500 and 1000 liters. Matheson's technical grade Deuterium has a minimum purity of 98.0 atom percent. (Matheson also offers Deuterium as a 99.5 atom percent gas.)

### Physical constants (partial listing) of technical grade Deuterium are as follows:

Molecular Weight	4.032
Specific Volume (70°F., 1 atm.)	97 cu. ft./lb.
Boiling Point @ 1 atm.	23.59°K. (-417.1°F.) (-249.5°C.)
Triple Point	18.71°K. (-425.9°F.) (-254.4°C.)
Freezing Point @ 121 mm. Hg	18.58°K. (-426.1°F.) (-254.5°C.)
Specific Gravity (Hydrogen=1)	2.0
Density, Gas (32°F., 1 atm.)	0.01122 lb./cu. ft.
Critical Temperature	38.35°K. (-390.55°F.) (-234.75°C.)
Critical Pressure	241.55 p.s.i.a. (16.432 atm.)
Latent Heat of Fusion @ Triple Point	52.3 cal./mole
Latent Heat of Sublimation @ 18.58°K.	355.4 cal./mole
Latent Heat of Vaporization @ b.p.	293 cal./mole
Flammable Limits in Air	5-75% (by volume)

Deuterium is used in tracer applications, in reaction rate studies, and exchange reaction studies, i.e., reactions in which one or more deuterium atoms trade places with light hydrogen atoms in some ion or molecule.

### Recommended Controls

Two Stage Regulator: Matheson #8-350  
Single Stage Regulators: Matheson #1L-350, #1H-350 and #36  
Needle Valves: Matheson #50-350, #52-350 and #31

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is no unique theory that describes a given phenomenon, as is easily proved by making a trivial modification of any given theory which does not change its description of the set of phenomena that are on hand. The theory that endures is the one that describes a large set of phenomena compactly. This involves the minimization of a subjective quantity, human effort, which, like many quantities in engineering, is not capable of exact measurement. A theory is modified or abandoned when it fails to describe a phenomenon that it should describe. A theory does not necessarily have predictive power, and it may not necessarily be capable of predicting numerical values in a useful way. For example, consider the problem of designing a pulse circuit using diodes and transistors. Many have felt the desirability of applying digital computers to this task, but only a few have achieved any significant degree of success. Fundamental philosophic difficulties have impeded progress. To see this, first note that if the transient performance (response to arbitrary time-varying waveforms) of the circuit can be computed, then by known procedures a circuit can be designed (component parameter values obtained) given a circuit configuration. The determination of a circuit configuration is a creative act. To compute the transient response to a given waveform by known methods requires that differential, integral, and other equations be available for each component. A semiconductor diode is a physical device whose operation is described by solid-state theory. However, the equations describing the response of a real, physical diode to arbitrary stimuli have not been obtained. In principle, quantum mechanics applied to the physical structure of the diode could give quantitative answers, but no computer smaller than the universe could solve the problem in a reasonable time. The band approximation and the diffusion theory serve only to describe but do not give quantitative, useful results except for nearly ideal cases. The circuit designer has to design his circuit to use real devices obtainable from a manufacturer. He is limited to only those tests that can be made at the diode terminals. For linear black boxes, systematic procedures exist for obtaining accurate describing equations, but none exist for nonlinear systems. This problem is very similar to that faced by the physical scientist

in constructing a mathematical theory on the basis of experiment or experience. That is, if a general synthesis procedure for nonlinear systems based on terminal properties could be found, the pulse-circuit-by-computer-design problem could be done mechanically, and the procedure would be of inestimable value to the physical scientist.

H. J. GRAY

412 Colonial Park Drive,  
Springfield, Pennsylvania

### For Complexity

Szent-Györgyi's suggested resolution of the problems of teaching associated with expanding scientific knowledge (4 Dec., p. 1278) would have the undesirable effect of perpetuating an underlying assumption of simplicity or parsimony in the "laws of nature" that is directly contradicted by the increasing complexity evident in the very "explosion" of scientific knowledge to which Szent-Györgyi addresses himself.

As I have attempted to document in detail elsewhere ["Parsimony in psychology," *Psychol. Rept.* 11, 555 (1962)], an inappropriate adherence to simplicity of scientific investigation and explanation has been a major deterrent to progress in experimental psychology, and probably in other fields of science as well. It is most unfortunate that current scientific methodology offers no satisfactory guarantee that an excessively simple principle or technique will be rejected merely because it is too simple to cope with the empirical facts. Consequently, it becomes exceedingly difficult in practice to rid science of oversimplified formulations, especially when so many scientists, like Szent-Györgyi, appear dedicated to the proposition that the many presently unresolved "riddles of nature" will ultimately yield to a single simple and general explanation. . . .

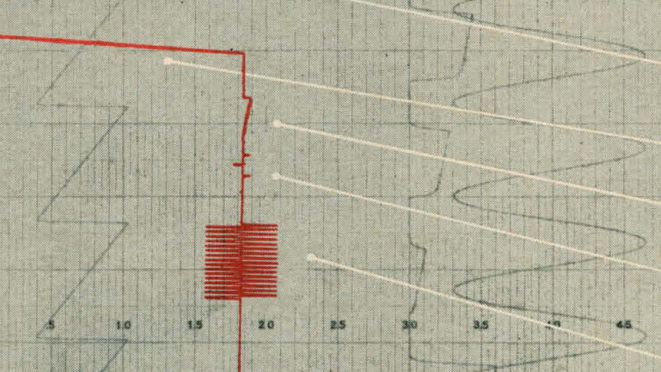
Our teaching will be far more helpful and effective if we attempt to convey the great importance and excitement attached to the complexities of science and the investigation thereof, rather than misleading the student by emphasizing an underlying simplicity which he probably will never experience.

WILLIAM F. BATTIG

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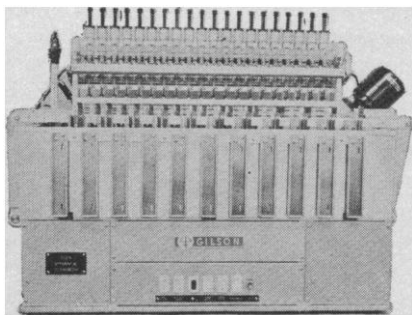
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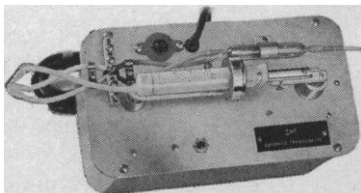
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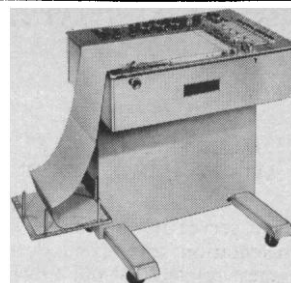
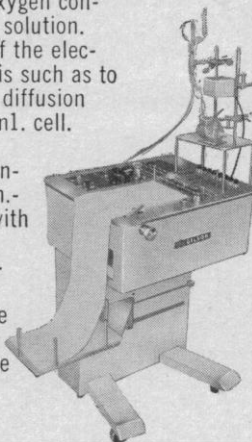
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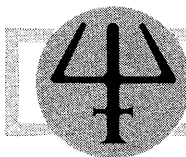
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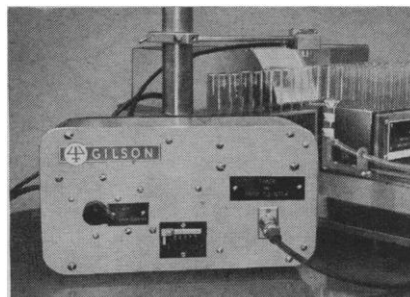
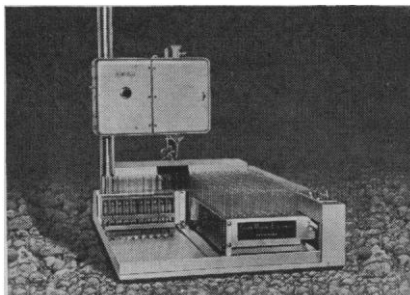
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## The Federal Science Budget

In the 1966 federal budget, which was summarized in *Science* last week, one explanatory statement concerning funds proposed for the National Science Foundation will be of particular interest in the universities, for it states an objective that must have been involved in much of the thinking concerning basic scientific research and higher education: "Major emphasis in 1966 is on providing funds in the Foundation budget to maintain an adequate rate of growth in Federal support for research in colleges and universities. Funds are also included for increased support for graduate training in the sciences and engineering and for strengthening science programs at developing institutions."

Accordingly, the President requested that NSF funds for research grants be increased by 51 percent, enough to allow an increase from 2900 grants in 1965 to 4300 in 1966. Funds for institutional grants—including the new science development grants—are 27 percent above 1965.

Relatively smaller increases are planned in the budgets of other agencies. Research grant funds requested for the National Institutes of Health are up by 8 percent. NASA plans to increase expenditures for research in physics and astronomy by 23 percent and in the biosciences by 5 percent.

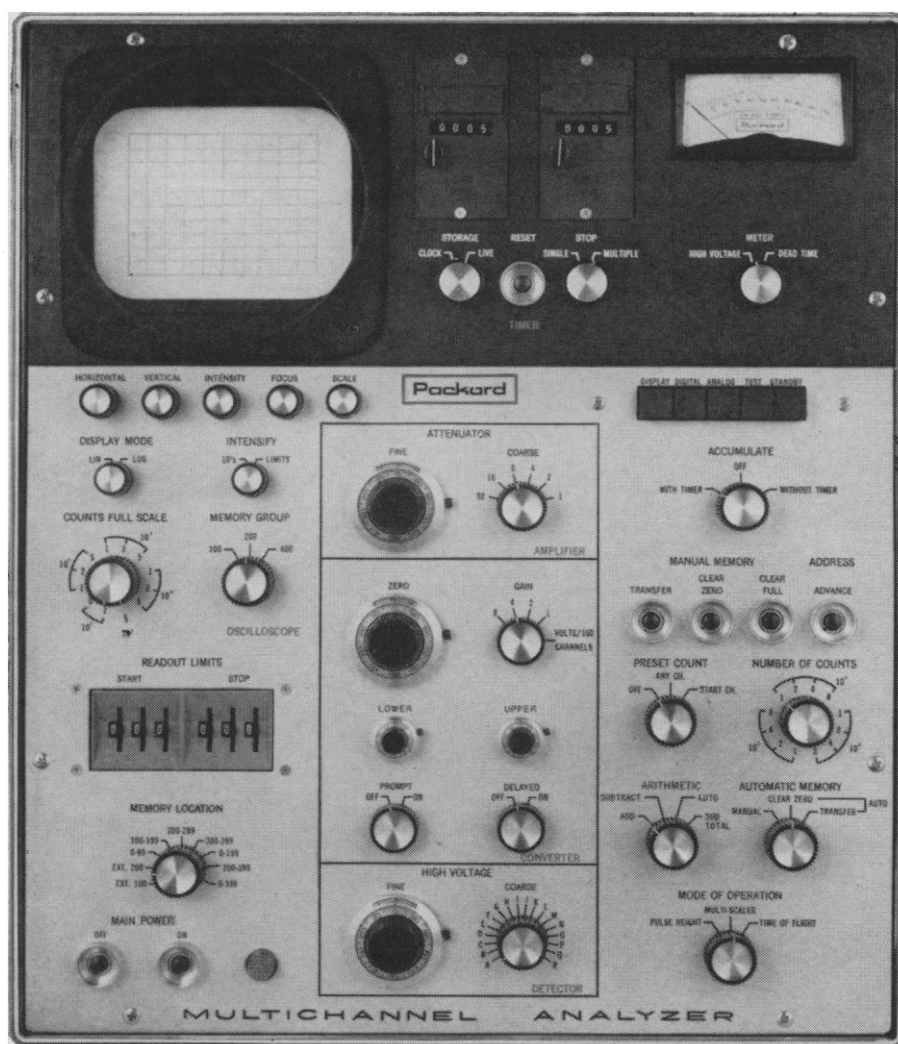
Money for fellowships and traineeships in the NSF budget would increase the number of graduate students supported from 7725 to 8810. The NIH fellowships and training grant funds are scheduled to increase by 13 and 7 percent, respectively. A larger budget for the Office of Education will allow an increase in the number of graduate fellowships from 5883 to 10,494, and in the number of student loans, from 317,000 to 340,000. The Office of Education fellowships and loans will go to students in many fields, including science and engineering.

Of related interest is the fact that the President has requested \$98 million for the Office of Education (in comparison with \$37 million in 1965) "for invention and testing of new ways of learning, including design of curricular materials."

From 1948 through 1964, the total federal R&D budget increased at an average rate of about 20 percent a year. Obviously that rate could not be sustained much longer; the annual total now exceeds \$15 billion and represents more than 15 percent of the entire budget. Warnings of a necessary leveling off are clearly being borne out; the 1965 and 1966 totals will exceed those for the previous year by from 2 to 5 percent.

At the basic research end of the spectrum, however, substantial increases continue; there has been an average increase of 12 percent a year for the past 2 years. Ten years ago about 7 percent of federal R&D money went into basic research. The percentage has increased to 12 in 1964, 13 in 1965, and a budgeted 14 in 1966.

Congress will have its way with all these figures. There would be no violation of precedent if some were decreased and others increased. But at this stage it is clear that there is a leveling off in the total of R&D funds and that there continue to be substantial increases for basic research and the support of graduate students.—DAEL WOLFLE



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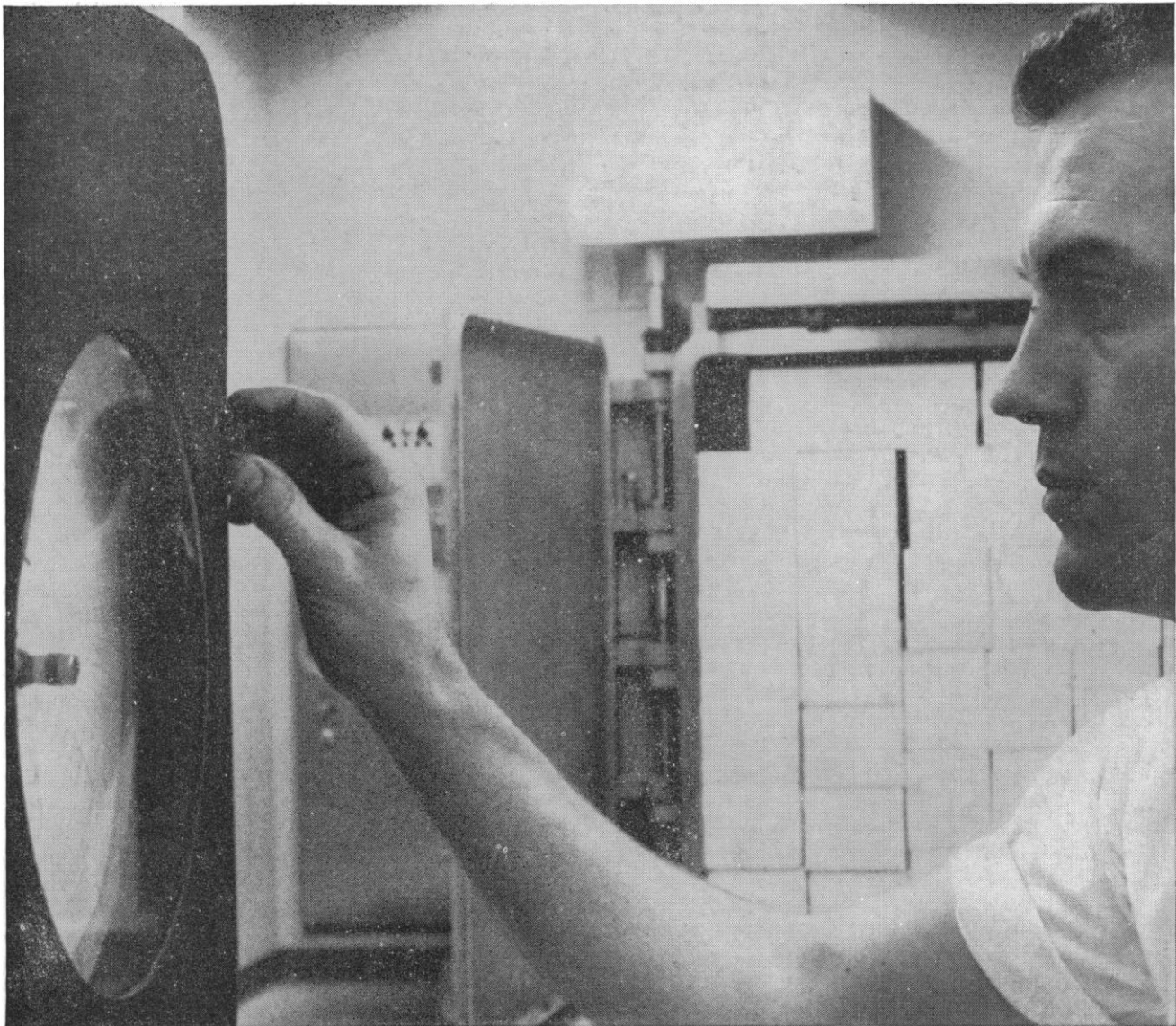
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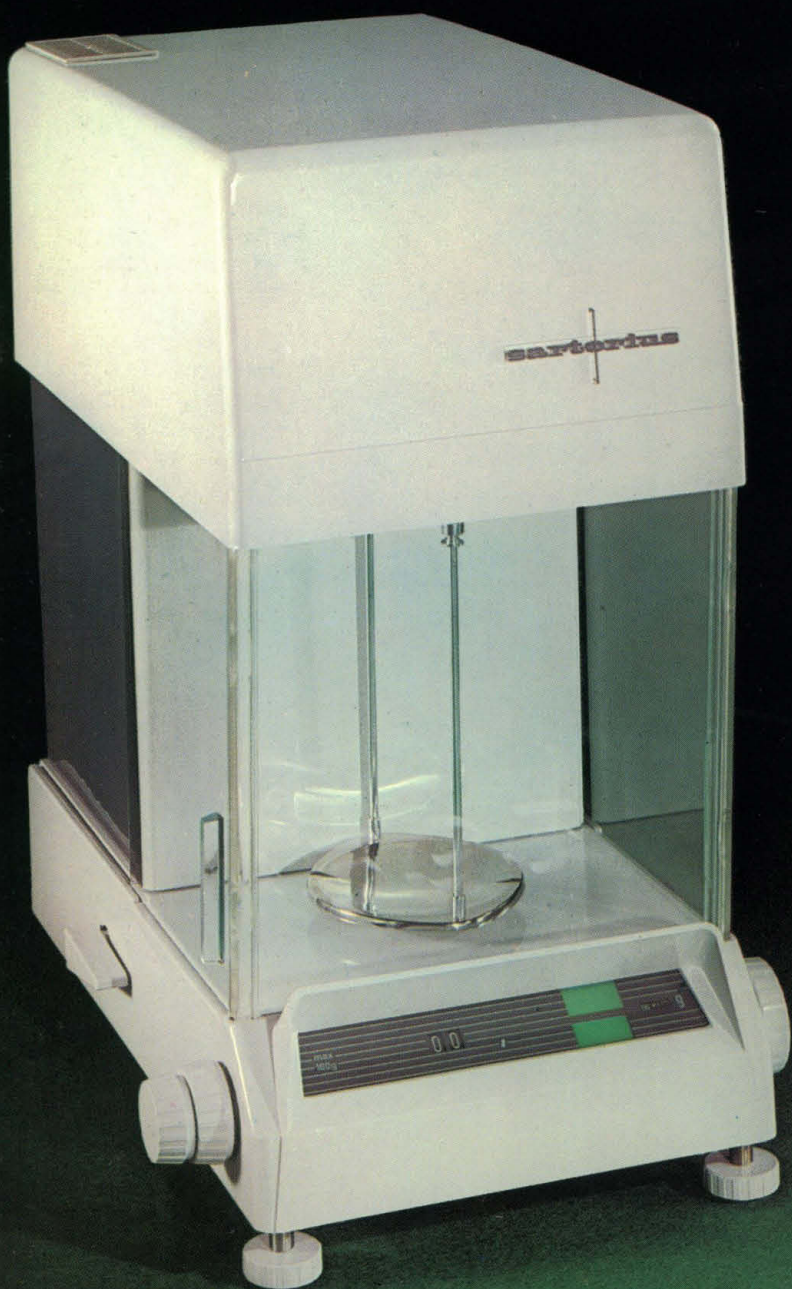
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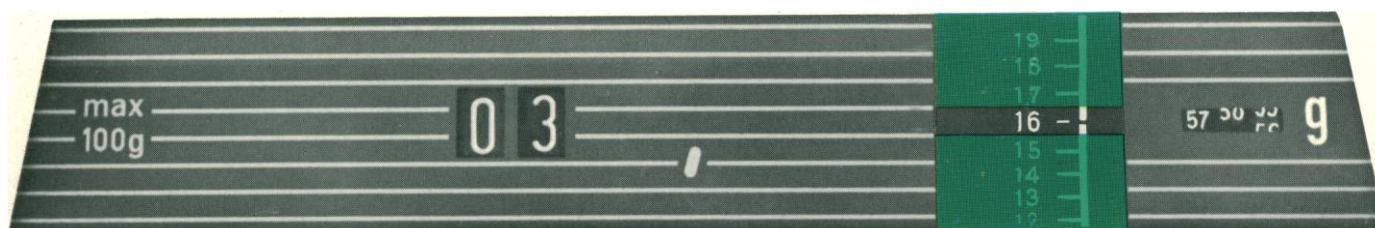




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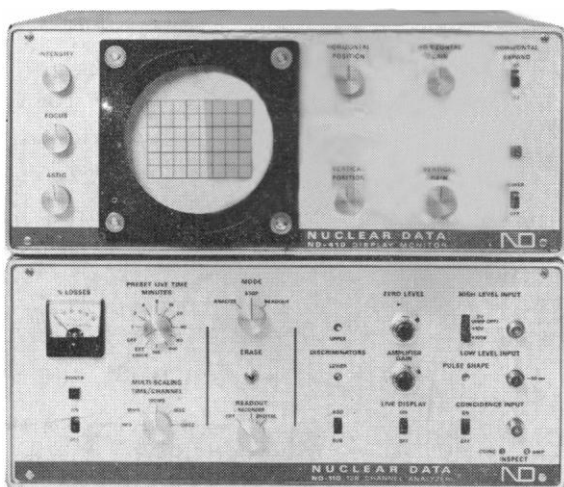
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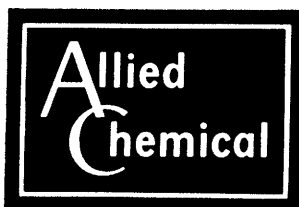
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tional forms must be taken into account. The transitional forms are non-bacterial phases, including the L-phase, in which the organism preserves its generic identity, survives, and multiplies.

Data suggesting the possible pathogenic activity of transitional forms have been gathered from cases of subacute bacterial endocarditis, rheumatic fever, Reiter's syndrome, rheumatoid arthritis, staphylococcal osteomyelitis, and other chronic or recurrent diseases. Transitional forms isolated from patients have multiplied in tissue culture and occasionally exhibited cytopathogenicity. In cell-free culture media, these forms could revert to the parent bacteria. As a model, in a case of subacute bacterial endocarditis, transitional forms persisted for 5 years, were resistant to all antibiotics, and remained capable of reversion to bacterial form in vivo. Changes in morphological form of the organism could be correlated with changes in the clinical symptoms of the patient. The capacity of transitional forms to survive, multiply, and revert in vivo would suggest intrinsic pathogenic potential.

Discussion was enthusiastic and lengthy. Concerning the formation of protoplasts in vivo, L. Muschel (University of Minnesota) commented on early contributions of his group with Gram-negative bacteria, such as *E. coli*. E. A. Mortimer (Western Reserve University) presented preliminary results from experiments in mice inoculated intraperitoneally with several strains of group A streptococci. The L-forms were recovered from heart blood in about half of the instances and from peritoneal exudate in the remainder; L-forms and streptococci both were isolated at death of mice. By reversion, as well as other techniques, the L-forms have been shown to be derived from the group A streptococci. A reverse relationship may exist between virulence for mice and the production of L-forms. Although it was believed that the L-forms were produced in the mice, one could not be absolutely certain that they were not produced in vitro on L-form medium. In any event, this appeared to be an exciting way to produce these L-forms of group A streptococci, and another facet of host-parasite relationships may be observed.

Louis Dienes (Massachusetts General Hospital, Boston) closed the meeting with observations suggesting that

L-forms may take part in some pathological processes. T. M. Brown (George Washington University) had expressed similar views in comments on antibody studies of human material (presented with H. W. Clark and J. S. Bailey) which indicate that the rheumatoid factor is associated with *Mycoplasma* immunologic complex. Antibody studies by Y. Crawford (Naval Medical Research Unit No. 4, Great Lakes, Illinois) have suggested L-forms in streptococcosis.

T. R. HAMILTON

University of Kansas Medical  
Center, Kansas City 3

### Marine Microorganisms

Many disciplines of science—chemistry, geology, physics, biology—are involved in marine research. One rapidly developing field is marine microbiology. In order to introduce other workers to this field, a conference on biology of marine microorganisms was held in Berkeley, California, 21–23 December 1964. Approximately 70 participants from all parts of the United States attended.

The conference opened with a discussion of microbial environments in the sea. After introductory remarks by M. B. Allen (Kaiser Foundation Research Institute) two extremes of environment were described—the deep sea, by C. E. ZoBell (Scripps Institution of Oceanography), and the surface film, or neuston, by R. E. Norris (University of Washington). Techniques used in the study of marine microorganisms were also described—methods for the collection and study of bacteria (C. E. ZoBell), chemical methods (J. D. H. Strickland, Scripps Institution of Oceanography), collection and preservation of phytoplankton (R. W. Holmes, Scripps Institution of Oceanography), and the collection and cultivation of living phytoplankton (M. B. Allen).

The principal types of marine microorganisms were described and discussed. These included marine bacteria (J. Liston, University of Washington), marine fungi, including those living as endosymbionts with invertebrates (H. Whisler, University of Washington), and diatoms and dinoflagellates (R. W. Holmes). R. E. Norris discussed the still little-known nanoplankton which he suggested might better be called cryptoplankton because it includes all



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the phytoplankton, large and small, not amenable to preservation by usual methods. M. B. Allen mentioned some effects of pollution on the marine biota.

Various activities of marine microorganisms were considered. The primary production of organic matter by photosynthetic microorganisms in the sea was discussed by J. D. H. Strickland. R. Y. Morita (Oregon State University) presented recent results from his laboratory on the effects of low temperature on marine bacteria and the factors responsible for obligate cryophily. The nutrition of phytoplankton and the possible role of soluble organic compounds produced by phytoplankton in the nutrition of zooplankton were discussed by M. B. Allen. (Allen also commented on the cycles of nitrogen and sulfur.) C. E. ZoBell described various geomicrobiological activities of marine microorganisms.

A general discussion period concluded the conference.

M. B. ALLEN

*Kaiser Foundation Research Institute,  
Richmond, California*

## Forthcoming Events

### February

8-10. American Astronautical Soc., annual, Denver, Colo. (Miss G. W. Heath, Flight Safety Foundation, 468 Park Ave. S., New York 10016)

8-11. Managerial Implications of the Emerging Technology, Washington, D.C. (P. W. Howerton Center for Technology and Administration, American University, 2000 G St., NW, Washington 20006)

8-12. American Soc. for Testing and Materials, spring meeting, Cleveland, Ohio. (ASTM, 1916 Race St., Philadelphia, Pa.)

9-10. International Soc. of Terrain Vehicle Systems, U.S.-Canadian regional meeting, Houghton, Mich. (E. W. Niemi, Dept. of Mechanical Engineering, Michigan Technological Univ., Houghton)

10-11. Corrosion of Water Supply Systems, 7th sanitary engineering conf., Urbana, Ill. (B. B. Ewing, Univ. of Illinois, Urbana)

10-12. American Educational Research Assoc., annual, Chicago, Ill. (R. A. Der-shemer, 1201 16th St., NW, Washington, D.C.)

10-12. National Assoc. Corrosion Engineers, conf., Calgary, Canada. (T. J. Hull, NACE, 980 M&M Bldg., Houston, Tex. 77002)

10-13. National Soc. of College Teachers of Education, annual, Chicago, Ill. (E. J. Clark, Indiana State College, Terre Haute)

10-13. American College of Radiology, annual, Philadelphia, Pa. (F. H. Squire,

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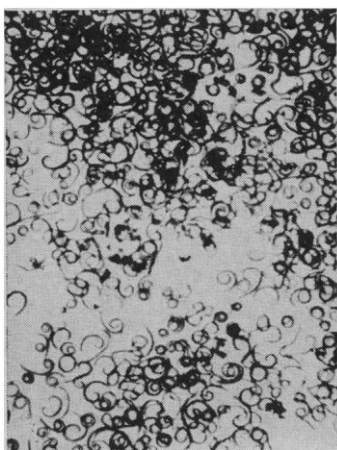
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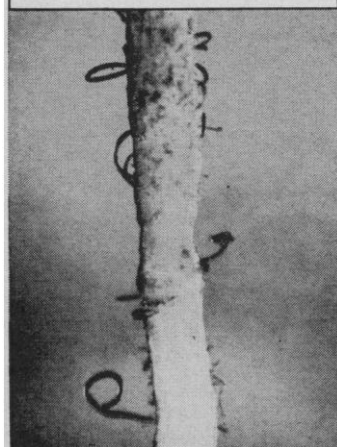
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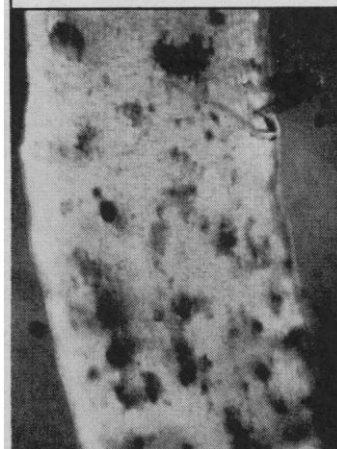




Photomicrograph of a mass of spiral nematodes showing their characteristic spiral shape. 6X.



Specimens penetrating a small root of boxwood. 24X.



Boxwood root showing lesions caused by *R. buxophilus*. Note the two specimens partially embedded in the root. 48X.



Spiral nematodes are soil-inhabiting, plant-parasitic organisms, the first one being described by deMan in 1876. They're found in temperate and tropical countries throughout the world. They feed on their host ectoparasitically and are detected in the soil or partially or completely embedded in their particular hosts. They are the cause of stunted, non-vigorous plants with reduced root systems. And they're small—only about 1mm in length.

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All photomicrographs of a spiral nematode, *Rotylenchus buxophilus*, were originally published in *University of Maryland Agricultural Experiment Station Bulletin A-85* in 1956 by A. Morgan Golden, Nematologist, Crops Research Division, ARS, USDA, Beltsville, Maryland.

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Presbyterian—St. Luke's Hospital, 1753 West Congress St., Chicago, Ill. 60606)

11-13. **Biology of Human Variation**, conf., New York Acad. of Sciences, New York, N.Y. (NYAS, 2 E. 63 St., New York 10021)

12. **Science Programs for General Education and the Preparation of Elementary Teachers**, conf., Long Beach, Calif. (A. F. Eiss, National Science Teachers Assoc., 1201 16th St., NW, Washington, D.C.)

12-17. **All Science Conf.**, annual, Karachi, Pakistan. (N. Ahmad, Secretary General, Pakistan Assoc. for the Advancement of Science, Karachi)

13-15. **National Assoc. for Research in Science Teaching**, annual, Chicago, Ill. (J. D. Novak, Bio-Science Dept., Purdue Univ., Lafayette, Indiana)

14. **Scientific Conference on Psychoanalysis**, 3rd annual, Council of Psychoanalytic Psychotherapists, Inc., New York, N.Y. (Miss M. Nelson, 1965 Conference Program, Box 255, East Setauket, Long Island, N.Y.)

14-11. **German Foundation for the Developing Countries, Public Health Training Problems in Asia**, intern. seminar, Berlin, Germany. (GFDC, Tagungsreferat, Agrippinenstrasse 10, 53 Bonn, Germany)

14-18. **American Inst. Mining, Metallurgical and Petroleum Engineers**, annual, Chicago, Ill. (R. W. Taylor, AIME, 345 E. 47 St., New York, N.Y. 10017)

14-18. **Society of Economic Geologists**, annual, Chicago, Ill. (E. N. Cameron, Room 30, Science Hall, Univ. of Wisconsin, Madison)

15-17. **Flight Testing Conf.**, American Inst. of Aeronautics and Astronautics, Huntsville, Ala. (D. L. Raymond, AIAA, 1290 Avenue of the Americas, New York, N.Y. 10019)

15-17. **American Standards Assoc., Inc.**, Chicago, Ill. (ASA, Inc., 10 E. 40 St., New York, N.Y. 10016)

15-20. **Impact of Mendelism on Agriculture, Biology, and Medicine**, intern. symp., New Delhi, India. (A. T. Natarajan, Secretary, Indian Soc. of Genetics and Plant Breeding, Division of Botany, Indian Agricultural Research Inst., New Delhi 12)

17. **Use of Enzymes in the Food Industry**, seminar, New York Inst. of Food Technologists, Inc., New York, N.Y. (A. Bolaffi, Jell-O Division Laboratories, General Foods Technical Center, Tarrytown, N.Y.)

17. **Colors in Food**, seminar, New York Inst. of Food Technologists, Inc., New York, N.Y. (A. Bolaffi, Jell-O Division Laboratories, General Foods Technical Center, Tarrytown, N.Y.)

17-19. **American Acad. of Occupational Medicine**, annual, Columbus, Ohio. (G. M. Hemmett, AAOM, Eastman Kodak Co., 343 State Street, Rochester 4, N.Y.)

17-19. **Solid State Circuits**, intern. conf., Inst. of Electrical and Electronics Engineers, Philadelphia, Pa. (R. Emberson, IEEE, Box A, Lenox Hill Station, New York, N.Y. 10021)

17-21. **American College of Cardiology**, annual, Boston, Mass. (Executive Director of the College, Empire State Building, New York, N.Y. 10001)

18-19. **Mechanical and Transplant Heart Substitutes**, symp., Heart Assoc. of

Southeastern Pennsylvania, Philadelphia. (L. L. Perry, HASP, 318 S. 19 St., Philadelphia 19103)

18-20. **Skin Bacteria** in Infection, symp., San Francisco, Calif. (Administrative Secretary, Div. of Dermatology, Univ. of California, San Francisco Medical Center, San Francisco 94122)

19-20. **Comparative Psychopathology**—Animal and Human, annual symp., American Psychopathological Assoc., New York, N.Y. (F. J. Kallmann, APA, 722 W. 168 St., New York 10032)

20. **Reliability**, 6th annual West Coast symp., American Soc. for Quality Control, Los Angeles, Calif. (A. S. Golant, Rocketdyne, Canoga Park, Calif.)

20-26. Caribbean **Dental** Convention, 4th annual, Port of Spain, Trinidad. (K. Henry, Dental Assoc. of Trinidad and Tobago, 109 Frederick St., Port of Spain)

21-22. Chicago **Dental** Soc./Acad. of Dentistry for the Handicapped, Chicago, Ill. (R. T. Kirk, Acad. of Dentistry for the Handicapped, Box 213, Springfield, Ohio)

21-25. Technical Assoc. of the **Pulp and Paper** Industry, 50th annual, New York, N.Y. (A. E. Dembitz, TAPPI, 360 Lexington Ave., New York 10017)

22-26. American Soc. for **Metals**, western metal and tool exposition and conf., Los Angeles, Calif. (ASM, Metals Park, Ohio 44073)

22-26. Society for **Nondestructive Testing**, spring convention, Los Angeles, Calif. (SNT, 914 Chicago Ave., Evanston, Ill. 60202)

23-24. National **Dairy** Engineering Conf., East Lansing, Mich. (C. W. Hall, Agricultural Engineering Dept., Michigan State Univ., East Lansing)

23-25. **High Polymer** Conf., East German Chemical Soc., Magdeburg. (East German Chemical Soc., Unter den Linden 68/70, Berlin W.8)

24-26. **Biophysical** Soc., 9th annual, San Francisco, Calif. (R. B. Setlow, Biophysical Soc., Oak Ridge National Laboratory, P.O. Box Y, Oak Ridge, Tenn. 37831)

24-26. American **Crystallographic** Assoc., Suffern, N.Y. (W. L. Kehl, ACA, Gulf Research and Development Corp., P.O. Box 2038, Pittsburgh, Pa. 15230)

24-28. Canadian Assoc. of **Radiologists**, annual, Toronto, Ontario. (Miss A. I. Ekstrand, CAR, 1555 Summerhill Ave., Montreal, Canada)

25-26. Society for **Information Display**, 5th natl. convention and symp., Santa Monica, Calif. (R. E. Bernberg, 591 Tiger-tail Road, Los Angeles, Calif. 90049)

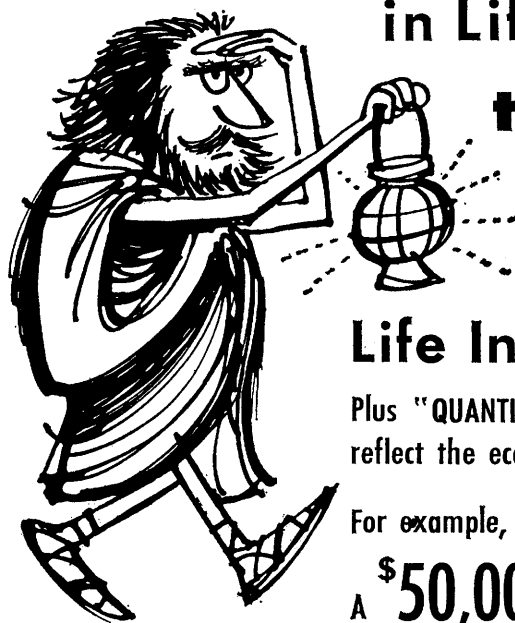
25-27. American Acad. of **Forensic Sciences**, annual, Chicago, Ill. (W. J. R. Camp, 1853 W. Polk St., Chicago 12)

26-27. American **Physical** Soc., Norman, Okla. (R. G. Sachs, Argonne National Laboratory, Argonne, Ill. 60440)

27-15. Apr. **Commonwealth Mining and Metallurgical** Congr., Australasian Inst. Mining and Metallurgy, Australia and New Zealand. (AIMM, Osborne House, 299 Little Collins St., Melbourne, C.I., Victoria, Australia)

28-3. **Gas Turbine** Conf., American Soc. Mechanical Engineers, Washington, D.C. (D. J. Schneider, ASME, 345 E. 47 St., New York, N.Y. 10017)

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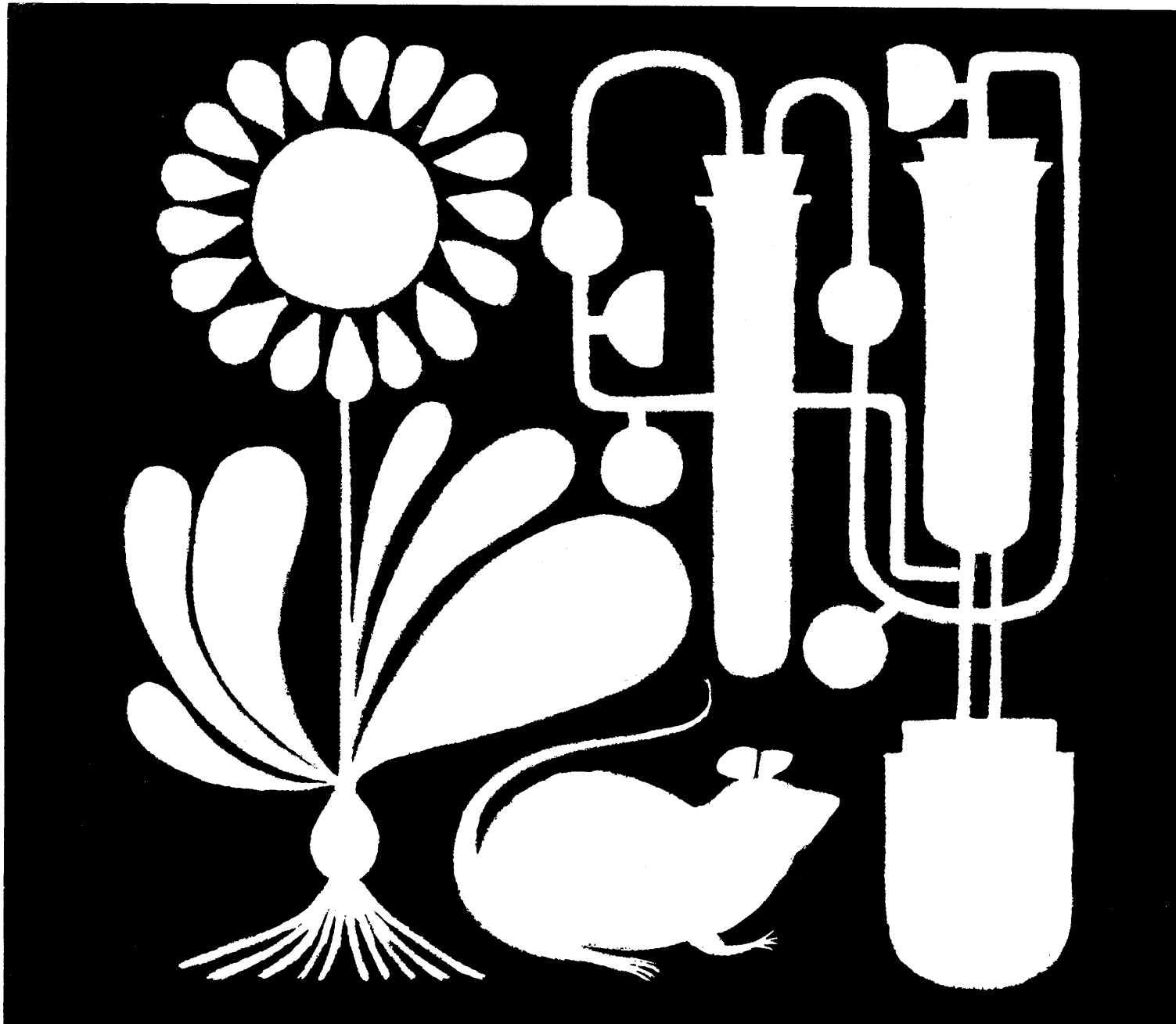
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strument includes a roll of self-sticking tapes which are prenumbered from 1 to 25; every set of 25 numbers corresponds line-for-line with the position of the digital printout for 25 consecutive samples. When all planchets are counted, a set of 25 numbers is cut off the roll and positioned next to the readout for each planchet, thus identifying the samples permanently. List: \$2650.—D.J.P. (Atomic Accessories, Inc., 811 West Merrick Road, Valley Stream, N.Y.)

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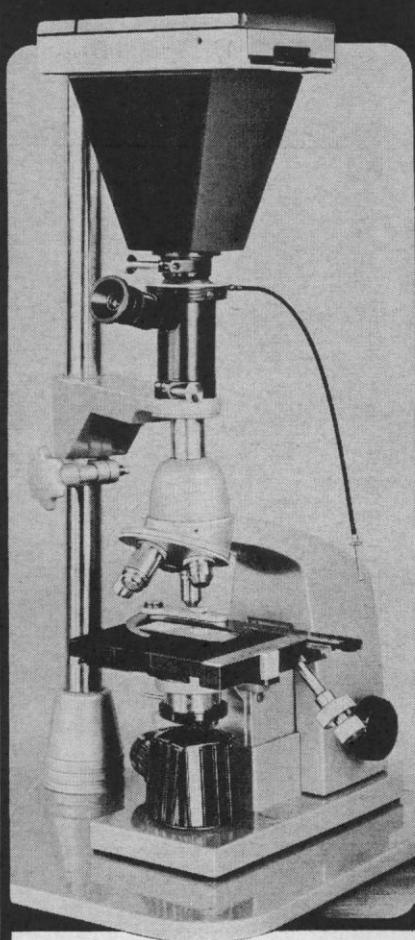
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Denis J. Prager (D.J.P.), Laboratory of Technical Development, National Heart Institute, Bethesda 14, Md. (medical electronics and biomedical laboratory equipment).

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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**Astronautics and Aeronautics, 1963.** Chronology on science, technology, and policy. Prepared by the NASA Historical Staff. Natl. Aeronautics and Space Administration, Washington, D.C., 1964 (order from Superintendent of Documents, Washington, D.C.). 618 pp. Paper, \$2.

**Astronomy for the Layman.** Arthur T. Adams. Vantage Press, New York, 1964. 217 pp. Illus. \$3.95.

**BSCS Biology-Implementation in the Schools** (Bulletin No. 3). Arnold B. Grobman, Paul DeH. Hurd, Paul Klinge, Margaret McKibben Lawler, and Elra Palmer. Hulda Grobman, Ed. Biological Sciences Curriculum Study, Boulder, Colo., 1964. 102 pp. Illus. Paper, \$3.50; cloth, \$5.

**Bird Art in Science: The Growth of a Tradition.** R. L. Scheffel. State Education Department, Univ. of the State of New York, Albany, 1964. 36 pp. Illus. Paper, 50¢ (order from New York State Museum and Science Service, Albany). A supplement to the New York State Museum's permanent exhibit, Bird Art in Science.

**Byron's Journal of His Circumnavigation 1764-1766.** Robert E. Gallagher, Ed. Published for the Hakluyt Society by Cambridge Univ. Press, New York, 1964. 312 pp. Illus. \$7.50.

**Catalogue of Data in World Data Center A: Oceanography.** Data received during the period 1 July 1957 to 31 December 1963. Compiled by W. C. Jacobs. World Data Center A: Oceanography, Washington, D.C., 1964. Unpaged.

**A Cheyenne Sketchbook: Cohoe.** Commentary by E. Adamson Hoebel and Karen Daniels Petersen. Univ. of Oklahoma Press, Norman, 1964. 112 pp. Illus. \$5.95.

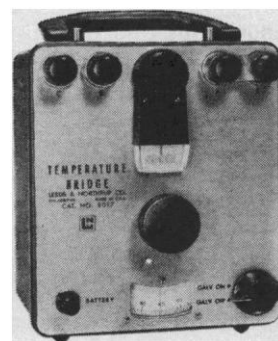
**Computers: Theory and Uses.** Vincent S. Darnowski. Hugh Allen, Jr., Ed. Natl. Science Teachers Assoc., Washington, D.C. 116 pp. Illus. Paper, \$1.

**The Concept of Nature.** The Tarner lectures delivered in Trinity College, November 1919. Alfred North Whitehead. Cambridge Univ. Press, New York, 1964. 212 pp. Paper, \$1.95; cloth, \$5 (reprint of the 1920 edition).

**Disaster Handbook.** Solomon Garb and Evelyn Eng. Springer, New York, 1964. 256 pp. Illus. Paper, \$3.50; cloth, \$4.75.

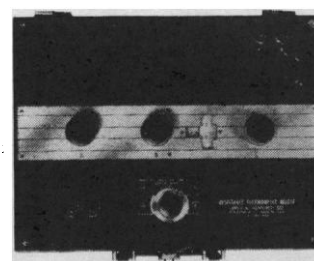
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**Elementary Teacher's Classroom Science Demonstrations and Activities.** David E. Hennessy. Prentice-Hall, Englewood Cliffs, N.J., 1964. 320 pp. Illus. \$7.95.

**Exploration of the Universe.** H. C. King. New American Library, New York, 1964. 335 pp. Illus. Paper, 75¢.

**Willard Gibbs.** Muriel Rukeyser. Dutton, New York, 1964. 475 pp. Illus. Paper, \$1.95 (reprint of the 1942 edition).

**International Yearbook of Education.** vol. 25. International Bureau of Education, Geneva; UNESCO, Paris, 1963 (order from Columbia Univ. Press, New York). 557 pp. Paper, \$6.50. Contains individual reports of 98 countries and an analysis of the educational trends that have influenced the progress of education in these countries in 1962 and 1963.

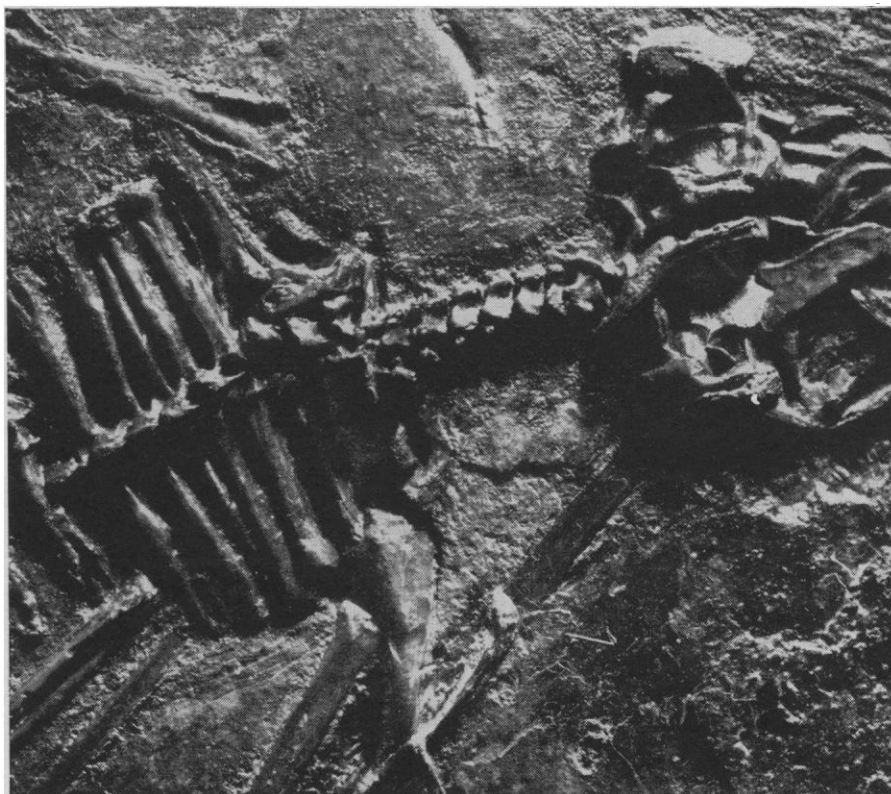
**Laboratory Animals.** vol. 2, *Animals for Research.* A directory of sources of laboratory animals, equipment, and materials. Natl. Acad. Sciences-Natl. Research Council, Washington, D.C., ed. 5, 1964. 95 pp. Paper, \$2.

**Law, Science, and Technology: A Symposium.** (*George Washington Law Rev.* 33, No. 1). George Washington Univ., Washington, D.C., 1964. 458 pp. Paper, \$4.95. Twelve papers concerned with the impact of science and technology on legal processes. The contributors are Thomas A. Cowan; Arthur Selwyn Miller; Robert G. Dixon, Jr.; W. Wallace Kirkpatrick; Harold P. Green; Samuel D. Estep; Spencer M. Beresford; J. Forrester Davison; Donald B. King; Donald N. Michael; Irving Kayton; and Louis H. Mayo and Ernest M. Jones.

**Lightning in His Hand: The Life Story of Nikola Tesla.** Inez Hunt and Wanetta W. Draper. Sage Books and Swallow, Denver, Colo., 1964. 269 pp. Illus. \$5.

**Listen to Leaders in Engineering.** Albert Love and James Saxon Childers, Eds. Tupper and Love, Atlanta, Ga.; McKay, New York, 1965. 350 pp. \$5.95. Twenty-two chapters written by Vannevar Bush, Gordon Stanley Brown, Frederick Emmons Terman, Andrew S. Schultz, Jr., George E. Holbrook, Nathan M. Newmark, Rolf Eliassen, George S. Schairer, Wernher von Braun, Manson Benedict, Simon Ramo, Oscar T. Marzke, Philip Sporn, Bernard M. Oliver, John R. Pierce, Edward E. David, Jr., Charles Stark Draper, Walter A. Rosenblith, Newman A. Hall, William O. Baker, James R. Killian, Jr., and Jerome B. Wiesner.

**Listen to Leaders in Science.** Albert Love and James Saxon Childers, Eds. Tupper and Love, Atlanta; McKay, New York, 1965. 288 pp. \$5.50. Eighteen chapters contributed by George W. Beadle, Lee A. DuBridge, Glenn T. Seaborg, Robert Oppenheimer, Donald H. Menzel, M. King Hubbert, Frank Press, George Wald, Jackson W. Foster, George Gaylord Simpson, James Bonner, James F. Crow, David G. Mandelbaum, George A. Miller, John W. Tukey, Roger Revelle, Henry G. Houghton, and Warren Weaver.



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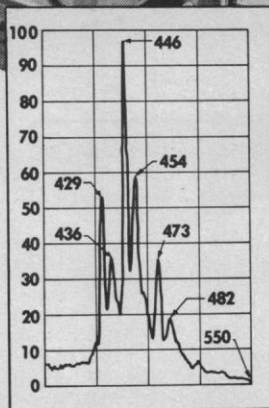
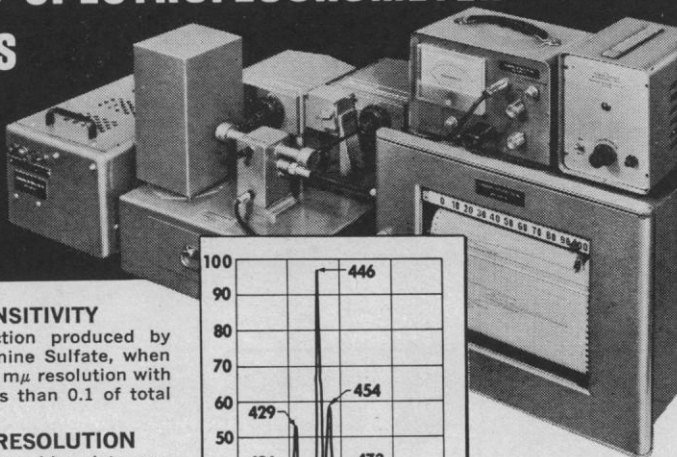




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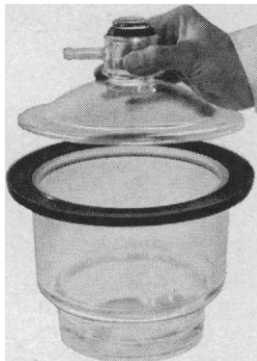
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**Public Papers of the Presidents of the United States: Harry S. Truman, 1949.** General Services Administration, Washington, D.C., 1964 (order from Superintendent of Documents, Washington, D.C.). 707 pp. \$6.75. Contains the public messages, speeches, and statements of the president.

**Radiation Preservation of Foodstuffs.** Second Scandinavian Meeting on Food Preservation by Ionizing Radiation (Stockholm), September 1963; arranged by the Committee for Technical Applications of Ionizing Radiation, Royal Swedish Academy of Engineering Sciences. Per-Olof Kinell and Vera Runnström-Reio, Eds. Johanssons, Karlshamn, Sweden, 1964. 87 pp. Illus. Paper, Kr. 25. Eighteen papers on experimental techniques, application to special foodstuffs, and the fundamental problems involved. The contributors are K. Abrahamsson, A. Brynjolfsson, P.-I. E. Hansen, J. B. Henriksen, B. Henricson, N. W. Holm, M. Jaarma, N. Molin, T. Nilsson, C. G. Österlundh, E. F. Reber, D. N. Rhodes, K. Sehested, J. P. Skou, E. von Sydow, G. Thaarup, and T. A. Truelsen.

**The Reconstruction of Past Environments.** Proceedings, Fort Burgwin Conference on Paleoecology, 1962. Assembled by James J. Hester and James Schoenwetter. Fort Burgwin Research Center, Ranches of Taos, N.M., 1964. 95 pp. Illus. Paper, \$3. Sixteen papers given at the conference.

**Religion and the State University.** Erich A. Walter, Ed. Univ. of Michigan Press, Ann Arbor, 1964 (reprint, 1958 edition). 320 pp. Paper, \$2.25.

**The Research State: A History of Science in New Jersey.** John R. Pierce and Arthur G. Tressler. Van Nostrand, Princeton, N.J., 1964. 183 pp. Illus. \$3.95.

**David Rittenhouse.** Brooke Hindle. Princeton Univ. Press, Princeton, N.J., 1964. 408 pp. Illus. \$8.50.

**Rocket and Missile Technology.** Gene Gurney, Ed. Watts, New York, 1964. 414 pp. Illus. \$5.95. A compilation of some 40 selections, reprints from various sources, covering the spectrum of rocket and missile technology. Among the contributors are Walter Sullivan, John K. O'Doherty, William A. Kinney, and Sir Bernard Lovell.

**Russia in the Thaw.** Alberto Ronchey. Translated from the Italian edition (1963) by Raymond Rosenthal. Norton, New York, 1964. 249 pp. Illus. \$5.

**Science and Cancer.** Michael B. Shinkin. U.S. Department of Health, Education, and Welfare, Washington, D.C., 1964. 143 pp. Illus. Paper, 60¢ (order from Superintendent of Documents, Washington, D.C.).

**The Science Book of Meteorology.** An introduction to the atmosphere and its phenomena. With a special section on the World Meteorological Organization. David C. Knight. Watts, New York, 1965. 215 pp. Illus. \$4.95 (juvenile book).

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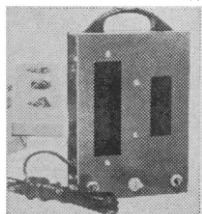
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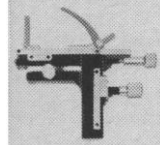
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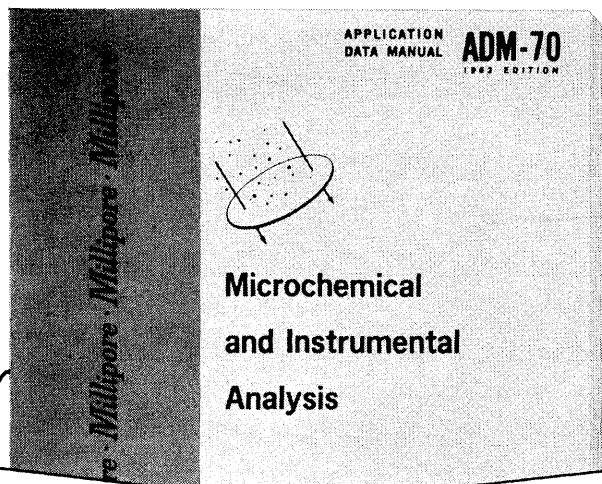
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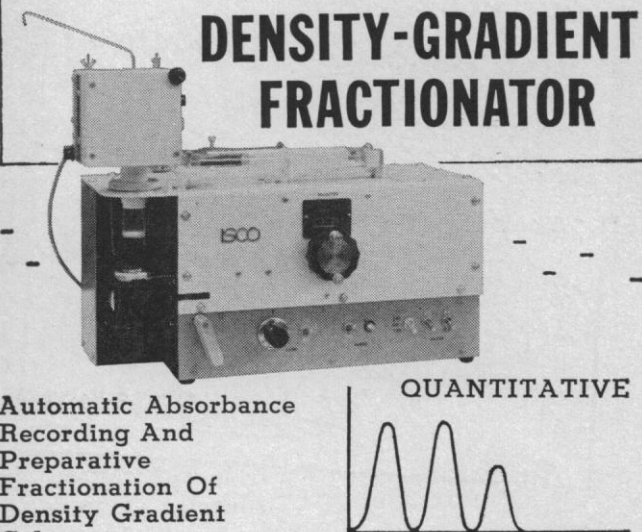
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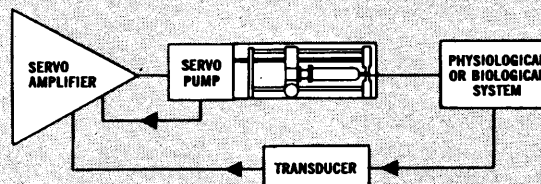
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**Scientific Research Films Made at U.S. Universities: A 1960-1961 Survey.** Office of Scientific Personnel, Natl. Research Council-Natl. Acad. of Sciences: American Science Film Assoc., Washington, D.C., 1964. 50 pp. Paper.

**Secondary School Science Teaching Practices.** H. Seymour Fowler. Center for Applied Research in Education, New York, 1964. 127 pp. \$3.95.

**So You Want to Be a Chemist.** Alan E. Nourse. Harper and Row, New York, 1964. 182 pp. \$3.50 (juvenile book).

**Strawberry Diseases.** A. G. Plakidas. Louisiana State Univ. Press, Baton Rouge, 1964. 207 pp. Illus. \$5.

**Style Manual for Biological Journals.** Prepared by the Committee on Form and Style of the Conference of Biological Editors. Published for the Conference by the American Inst. of Biological Sciences, Washington, D.C., ed. 2, 1964. 127 pp. Illus. \$3.

**Supply and Costs in the U.S. Petroleum Industry.** Franklin M. Fisher. Published for Resources for the Future by Johns Hopkins Press, Baltimore, Md., 1964. 191 pp. Illus. Paper, \$5.

**Transistor Manual.** J. F. Cleary, Ed. General Electric Co., Syracuse, N.Y., ed. 7, 1964. 662 pp. Illus. Paper, \$2.

**The Treasury of Mathematics.** A collection of source material in mathematics, edited and presented with introductory biographical and historical sketches. Henrietta O. Midonick, Ed. Philosophical Library, New York, 1965. 844 pp. Illus. \$15. 54 papers.

**United Kingdom Postgraduate Awards 1964-66.** Association of Commonwealth Universities, London, ed. 12, 1964. 168 pp. Paper, \$1. Summarized information about fellowships, scholarships, and grants, available at universities in the United Kingdom and a short list of awards offered outside the UK.

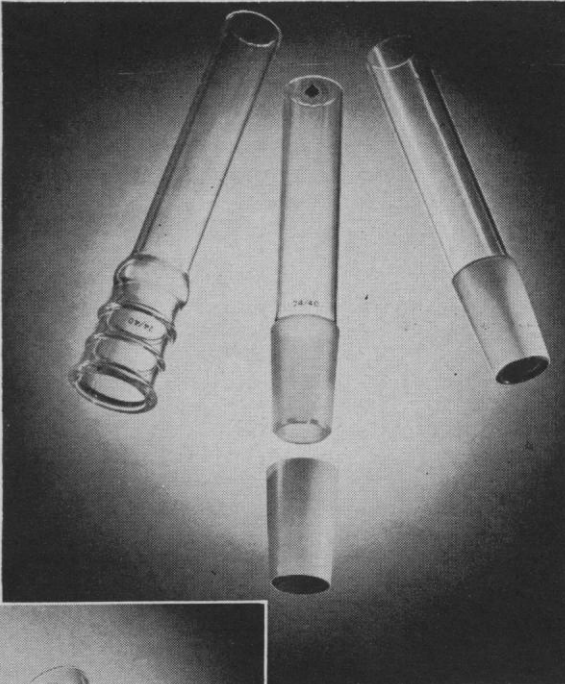
**Visual Perception: The Nineteenth Century.** William N. Dember. Wiley, New York, 1964. 234 pp. Illus. \$4.95.

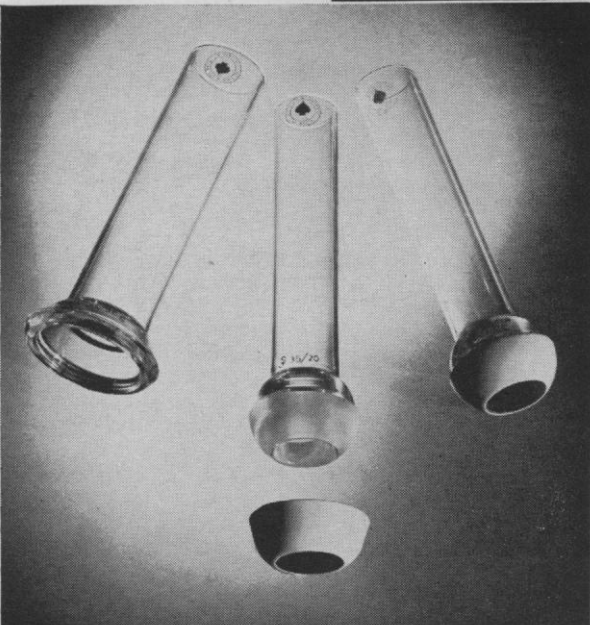
**World Prospects for Natural Resources.** Some projections of demand and indicators of supply to the year 2000. Joseph L. Fisher and Neal Potter. Published for Resources for the Future by Johns Hopkins Press, Baltimore, Md., 1964. 79 pp. Illus. Paper, \$1.50.

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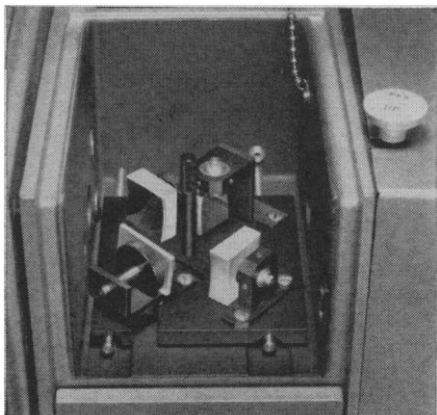
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**Advances in Hydrosience.** vol. 1. Ven Te Chow, Ed. Academic Press, New York, 1964. 452 pp. Illus. \$15. Five papers: "Sonar" by Bradford A. Becken; "Hydroelasticity" by S. R. Heller, Jr.; "Statistical hydrodynamics in porous media" by Adrian E. Scheidegger; "New contributions to hydroballistics" by F. S. Burt; and "Hydraulics of wells" by Mahdi S. Hantush.

**Aerodynamics of Turbines and Compressors.** W. R. Hawthorne, Ed. Princeton Univ. Press, Princeton, N.J., 1964. 630 pp. Illus. \$17.50. The papers are: "Theory of two-dimensional flow through cascades" by F. S. Weinig; "Three-dimensional flow in turbomachines" by Frank E. Marble; "Experimental techniques" by John R. Erwin; "Flow in cascades" by A. R. Howell; "The axial compressor stage" by W. D. Rannie; "The supersonic compressor" by John R. Erwin and Antonio Ferri; "Aerodynamic design of axial flow turbines" by E. Duncombe; "The radial turbine" by Werner T. von der Nuell; "The centrifugal compressor" by Edward S. Taylor; and "Blading interaction effects in turbines" by Hans Kraft. There is an introduction by the editor.

**Alkylolation with Olefins.** A. V. Topchiev, S. V. Zavgorodnii, and V. G. Kryuchkova. Elsevier, New York, 1964. 316 pp. Illus. \$16.

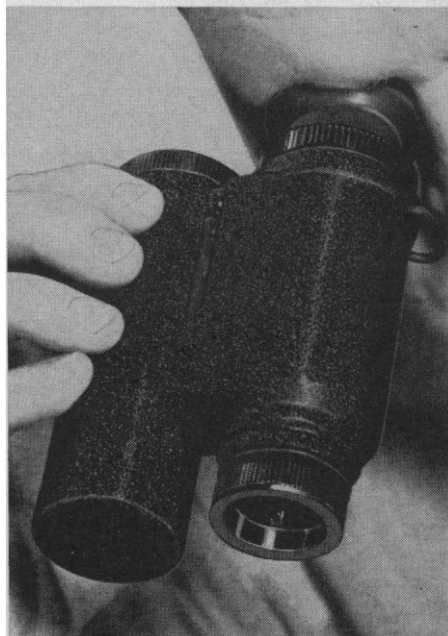
**Analysis Instrumentation, 1964.** Proceedings, 10th National Analysis Instrumentation Symposium (San Francisco, Calif.), 1964. L. Fowler, R. J. Harmon, and D. K. Roe, Eds. Plenum Press, New York, 1964. 350 pp. Illus. \$14.50. Twenty-eight papers.

**Amplifier and Memory Devices: With Films and Diodes.** Noah S. Prywes, Ed. McGraw-Hill, New York, 1965. 472 pp. Illus. \$17.50. Four parts: Tunnel Diodes, by W. F. Chow, A. Chynoweth, and M. Hines; Parametric Amplifiers, by D. Leenov and N. S. Prywes; Magnetic Films, by A. V. Pohm and S. Rubens; and Superconducting Devices, by H. H. Edwards and V. L. Newhouse.

**Analytical Chemistry.** vol. 4, pt. 1, *Solid State Charged Particle Detectors.* Niels J. Hansen, Carl E. Crouthamel, Ed. Pergamon, London; Macmillan, New York, 1964. 78 pp. Illus. Paper, \$4.25.

**Annual Review of Nuclear Science.** vol. 14. Emilio Segrè, Gerhart Friedlander, and H. Pierre Noyes, Eds. Annual Reviews, Palo Alto, Calif., 1964. 518 pp. Illus. \$8.50. Fourteen papers: "Alpha decay" by H. J. Mang; "Recent progress in the theory of nuclear matter" by A. G. Petschek; "Nucleon, two-nucleon reactions above 100 MeV" by J. Robb Grover and A. A. Caretto, Jr.; "Dynamic orientation of nuclei" by Carson D. Jeffries; "Structure of the proton" by Robert R. Wilson and Joseph S. Levinger; "Symmetries among the strongly interacting particles" by R. E. Cutkosky; "Spark chambers" by W. A. Wenzel; "Data systems for multiparameter analysis" by R. J. Spinrad; "Modern techniques used in nuclear design of reactors" by G. D. Joanou and H. B. Stewart; "Breeder reactors" by Lloyd G. Alexander; "Chemistry of the actinide elements" by B. B. Cunningham;

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"Quantitation of cellular radiobiological responses" by G. F. Whitmore and J. E. Till; "Analysis of experiments in particle physics" by Frank T. Solmitz; "Electromagnetic moments of excited nuclear states" by K. Alder and R. M. Steffen.

**Applications of Nuclear Physics.** J. H. Fremlin. English Universities Press, London, 1964. 352 pp. Illus. 25s.

**Applied Combinatorial Mathematics.** Edwin F. Beckenbach, Ed. Wiley, New York, 1964. 630 pp. Illus. \$13.50. A statewide lecture series offered by the University Extension, Engineering and Physical Sciences Divisions, University of California in 1962. Eighteen papers were contributed by George Pólya, Derrick H. Lehmer, Montgomery Phister, Jr., John Riordan, Elliott W. Montroll, N. G. de Bruijn, Frank Harary, Richard Bellman, Robert Kalaba, Edwin L. Peterson, Leo Breiman, Albert W. Tucker, Edwin F. Beckenbach, Marshall Hall, Jr., Jacob Wolfowitz, Charles B. Tompkins, Kenneth N. Trueblood, George Gamow, and Hermann Weyl.

**Aspects Théoriques et Industriels de la Lyophilisation.** Louis Rey, Ed. Hermann, Paris, 1964. 653 pp. Illus. F.84.

**Atlas and Glossary of Primary Sedimentary Structures.** F. J. Pettijohn and Paul Edwin Potter. Translations into Spanish, French, and German by Juan Carlos Riggi, Marie-Hélène Sachet, and Hans-Ulrich Schmincke. Springer Verlag, New York, 1964. 386 pp. Illus. \$14.75.

**An Atlas of VLF Emission Spectra Observed with the "Hiss Recorder"** (Natl. Bur. Standards Tech. Note 226). Jean A. Koch and V. Christine Edens. Natl. Bur. Standards, Washington, D.C., 1964 (order from Superintendent of Documents, Washington, D.C.). 27 pp. Illus. Paper, 40¢.

**Atoms, Molecules, and Quanta.** vols. 1 and 2. Arthur Edward Ruark and Harold Clayton Urey. Dover, New York, 1964 (revised and corrected reprint of the 1930 edition). vol. 1, 463 pp.; vol. 2, 370 pp. Illus. Paper, \$2.50 per volume.

**Automatic Methods in Volumetric Analysis.** D. C. M. Squirrell. Van Nostrand, Princeton, N.J., 1964. 211 pp. Illus. \$6.75.

**Basic Concepts of Geometry.** Walter Prenowitz and Meyer Jordan. Blaisdell (Ginn), New York, 1965. 372 pp. Illus. \$7.50.

**Biogeochemical Methods of Prospecting.** Dmitrii Petrovich Malyuga. Translated from the Russian edition (Moscow, 1963). Consultants Bureau, New York, 1964. 213 pp. Illus. \$27.50.

**Capacitors, Magnetic Circuits, and Transformers.** Leander W. Matsch. Prentice-Hall, Englewood Cliffs, N.J. 1964. 364 pp. Illus. \$16.

**Celestial Mechanics and Astrodynamics.** Papers presented at the American Institute of Aeronautics and Astronautics Astrodynamics Conference (New Haven, Conn.), 1963. Victor G. Szebehely, Ed. Academic Press, New York, 1964. 764 pp. Illus. \$10.75. Twenty-nine papers.

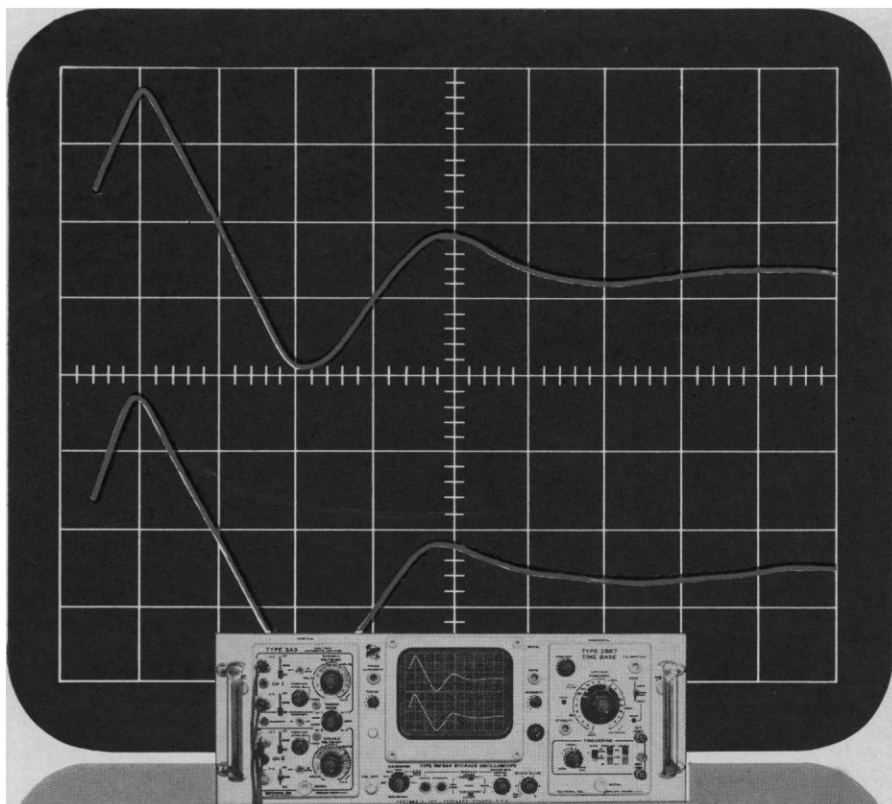
**Chemical Bonding.** Audrey L. Companion. McGraw-Hill, New York, 1964. 167 pp. Illus. \$4.50.

**Chemical Transport Reactions.** Harald Schäfer. Translated from the German edition (Weinheim, 1962) by Hans Frankfort. Academic Press, New York, 1964. 173 pp. Illus. \$6.80.

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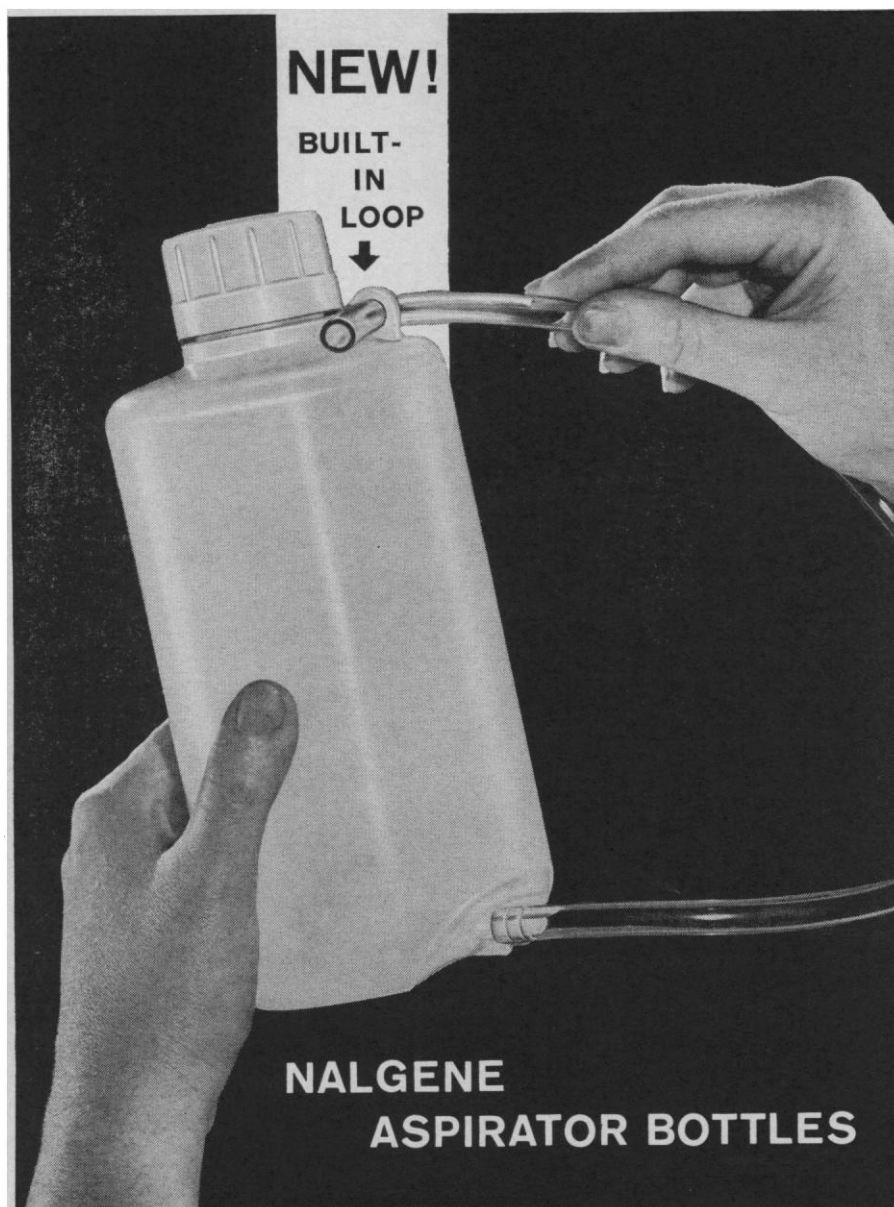
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**The Collision Theory of Chemical Reactions in Liquids.** Alastair M. North. Methuen, London; Wiley, New York, 1964. 153 pp. Illus. \$4.25.

**Colloid Chemistry.** The science of large molecules, small particles, and surfaces. Marjorie J. Vold and Robert D. Vold. Reinhold, New York; Chapman and Hall, London, 1964. 128 pp. Illus. Paper, \$1.95.

**Colloque sur le Paléogène.** Bordeaux, September 1962. Mémoires du Bureau de Recherches Géologiques et Minières, No. 28. vols. 1 and 2. Éditions B.R.G.M., Paris, 1964. vol. 1, 560 pp.; vol. 2, 561 pp. Illus. Paper, F.240.99; cloth, F.270.

**Combustion Chambers for Jet Propulsion Engines.** V. S. Zuyev and L. S. Skubachevskii. Translated from the Russian edition by William E. Jones. B. P. Mullins, Translation Ed. Pergamon, London; Macmillan, New York, 1964. 259 pp. Illus. \$10.

**Communications-Electronics Terminology Handbook.** A manual of definitions, abbreviations, acronyms, and designations. Public Affairs Press, Washington, D.C., 1965. 551 pp. \$7.

**Commutative Normed Rings.** I. Gelfand, D. Raikov, and G. Shilov. Translated from the Russian edition (1960). Chelsea, New York, 1964. 306 pp. Illus. \$6.50.

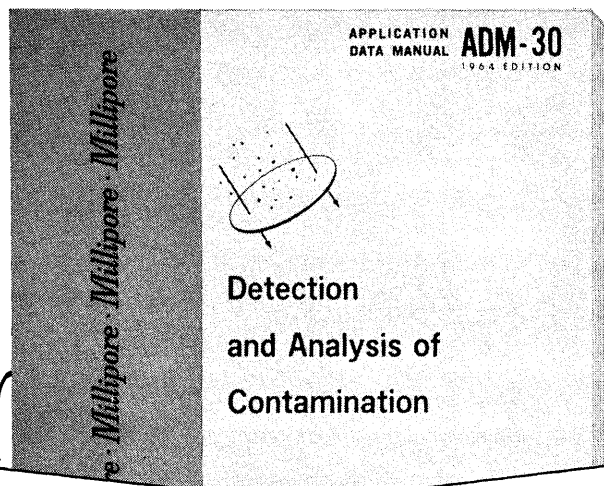
**Conférence internationale sur les théories relativistes de la gravitation.** Proceedings of a conference (Warsaw and Jablonna, Poland), 1962. L. Infeld, Ed. Gauthier-Villars, Paris; PWN-Éditions Scientifiques de Pologne, Warsaw, 1964. 397 pp. Illus. \$7.50. Participants from the U.S. were: J. L. Anderson, R. L. Arnowitt, F. J. Belinfante, P. G. Bergmann, D. R. Brill, B. S. Chandrasekhar, H. Van Dam, S. Deser, B. S. DeWitt, C. DeWitt, R. P. Feynman, D. Finkelstein, J. G. Fletcher, J. N. Goldberg, P. Havas, B. Hoffmann, A. I. Janis, R. P. Kerr, A. Komar, L. Markus, C. W. Misner, E. T. Newman, I. Robinson, R. K. Sachs, L. I. Schiff, A. Schild, R. Schiller, J. Stachel, A. H. Taub, L. H. Thomas, J. Weber, and J. A. Wheeler.

**Continuous Measurement of Unsteady Flow.** G. P. Katys. Translated from the Russian by D. P. Barrett. G. E. Walker, Translation Ed. Pergamon, London; Macmillan, New York, 1964. 225 pp. Illus. \$9.

**Determination of Molecular Weights and Polydispersity of High Polymers.** S. R. Rafikov, S. A. Pavlova, and I. I. Tverdokhlebova. Translated from the Russian edition (Moscow, 1963) by J. Eliassaf. J. Schmorak, Translation Ed. Israel Program for Scientific Translations, Jerusalem; Davey, New York, 1964. 365 pp. Illus. \$14.

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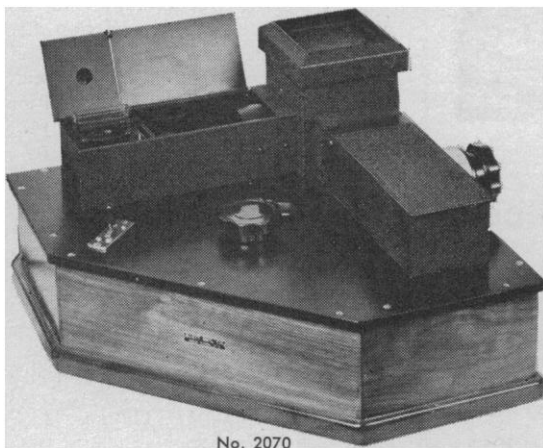
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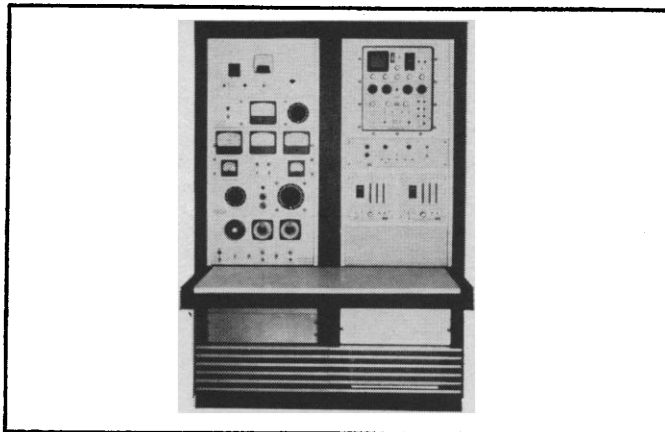
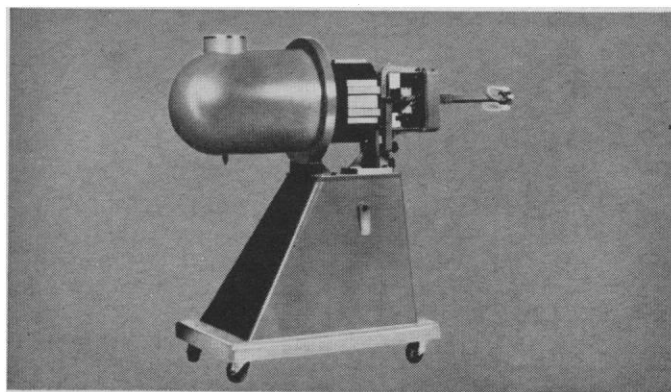
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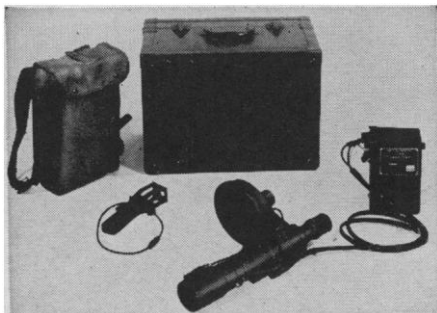
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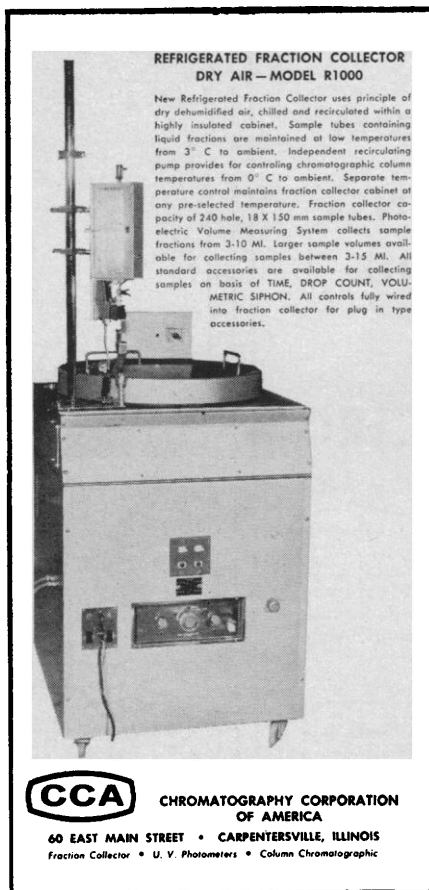
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**The Direct Observation of Dislocations.** S. Amelinckx. Academic Press, New York, 1964. 497 pp. Illus. \$17.

**Disciplines and Techniques of Systems Control.** John Peschon, Ed. Blaisdell (Ginn), New York, 1964. 559 pp. Illus. \$12.50. Ten papers contributed by Roy C. Amara, Alexander A. Feldbaum, Eugene W. Henry, Alexander M. Letov, Connie L. McClure, Stanford K. Mitter, John Peschon, Lucas Pun, Leonard G. Shaw, and H. B. Smets.

**The Dynamic Stability of Elastic Systems.** V. V. Bolotin. Translated from the Russian edition (Moscow, 1956) by V. I. Weingarten, L. B. Greszczuk, K. N. Trirogoff, and K. D. Gallegos. Holden-Day, San Francisco, Calif., 1964. 463 pp. Illus. \$12.95.

**The Eightfold Way.** Murray Gell-Mann and Yuval Ne'eman. Benjamin, New York, 1964. 329 pp. Illus. Paper, \$3.95; cloth, \$8.

**Electrical Correcting Elements in Automatic Control and Regulation Circuits.** G. K. Krug and Ye. K. Krug. Translated from the Russian edition by Andrew J. T. Colin. R. C. Glass, Translation Ed. Pergamon, London; Macmillan, New York, 1964. 96 pp. Illus. \$5.

**Electrical Engineering.** Julius T. Franklin. Macmillan, New York, 1964. 399 pp. Illus. \$9.

**Electronic Structure and Chemical Bonding.** Donald K. Sebera. Blaisdell (Ginn), New York, 1964. 310 pp. Illus. Paper, \$3.50.

**Electron-Stream Interaction with Plasmas.** Richard J. Briggs. M.I.T. Press, Cambridge, Mass., 1964. 199 pp. Illus. \$7.50.

**Elementary Circuit Properties of Transistors.** Campbell L. Searle, A. R. Boothroyd, E. J. Angelo, Jr., Paul E. Gray, and Donald O. Pederson. Wiley, New York, 1964. 328 pp. Illus. \$4.50.

**Elements of Quantum Electrodynamics.** A. I. Akhiezer and V. B. Berestetskii. Translated from the Russian edition by A. Sen and R. N. Sen. Israel Program for Scientific Translations, Jerusalem; Davey, New York, 1964. 309 pp. Illus. \$15.25. A translation of selected parts from *Kvantovaya Elektrodinamika* (ed. 2, 1959).

**Ellipsometry in the Measurement of Surfaces and Thin Films.** A symposium (Washington, D.C.), 1963. E. Passaglia, R. R. Stromberg, and J. Kruger, Eds. Natl. Bur. of Standards, Washington, D.C., 1964. 365 pp. Illus. \$2.25 (order from Superintendent of Documents, Washington, D.C.). *Natl. Bur. Standards Publ.* 256; 19 papers.

**Engineering Units and Physical Quantities.** H. S. Hvistendahl. Macmillan, London; St. Martin's Press, New York, 1965. 140 pp. Illus. \$5.

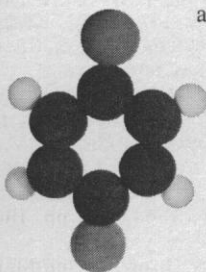
**Envelopes** (vol. 12, Popular Lectures in Mathematics). V. G. Boltyanskii. Translated and adapted from the Russian edition (Moscow, 1961) by Robert B. Brown. Pergamon, London; Macmillan, New York, 1964. 86 pp. Illus. \$2.25.

**Exploding Wires.** Proceedings of a conference (Boston), 1964. vol. 3. William G. Chace and Howard K. Moore, Eds. Plenum Press, New York, 1964. 420 pp. Illus. \$17.50. Twenty-seven papers given



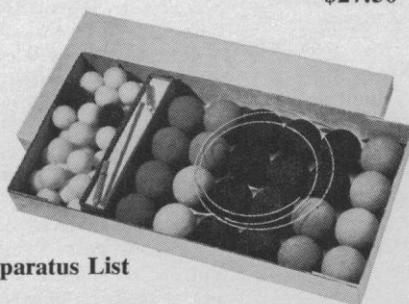
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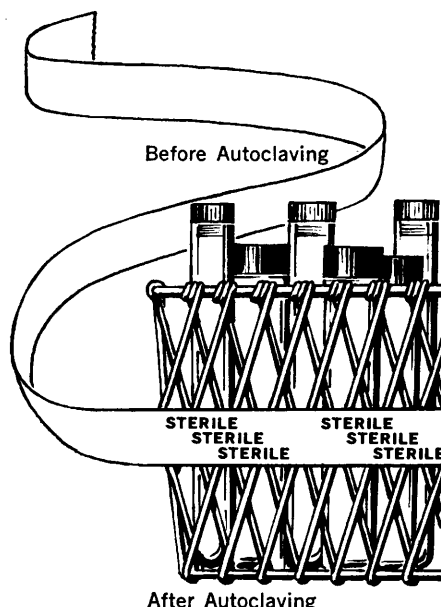
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**Foundations of Physics.** Robert L. Lehrman and Clifford Swartz. Holt, Rinehart, and Winston, New York, 1965. 702 pp. Illus.

**Fracture Processes in Polymeric Solids: Phenomena and Theory.** Bernard Rosen, Ed. Interscience (Wiley), New York, 1964. 849 pp. Illus. \$27.50. Contributors: J. P. Berry, A. Charlesby, R. F. Fedors, P. H. Geil, J. J. Gilvarry, J. W. S. Hearle, C. C. Hsiao, H. H. G. Jellinek, S. Katz, A. Kobayashi, R. F. Landel, E. J. Mercado, S. B. Newman, J. R. M. Radok, M. Reiner, B. Rosen, K. Saito, A. V. Tobolsky, and I. Wolock.

**Free-Electron Theory of Conjugated Molecules: A Source Book.** Papers of the Chicago Group, 1949–1961. J. R. Platt and others. Wiley, New York, 1964. Unpagged. Illus. Paper, \$2.95; cloth, \$4.95. A collection of original papers by N. S. Ham, H. Labhart, W. Lichten, J. R. Platt, K. Ruedenberg, and C. W. Scherr.

**Friedel-Crafts and Related Reactions.** vol. 3, *Acylation and Related Reactions*. pts. 1 and 2. George A. Olah, Ed. Interscience (Wiley), New York, 1964. pt. 1, 936 pp.; pt. 2, 718 pp. Illus. \$60. Contributors: A. T. Balaban, Hans P. Braendlin, A. Gerecs, Gordon Goldman, Peter H. Gore, C. E. Inman, Frederick R. Jensen, Peter Kovacic, Stephen J. Kuhn, Earl T. McBee, K. LeRoi Nelson, C. D. Nenitzescu, R. E. Oesterling, George A. Olah, Judith A. Olah, Andrew G. Peto, Walter Ruske, F. L. Scott, and Suresh Sethna.

**Fuels and New Propellants.** Proceedings of a conference (Milan, Italy), 1963. Corrado Casci, Ed. Pergamon, London; Macmillan, New York, 1964. 379 pp. Illus. \$15.

**The Geochemistry of Oil and Oil Deposits.** L. A. Gulyaeva, Ed. Translated from the Russian edition (Moscow, 1962) by S. Caspari. Israel Program for Scientific Translations, Jerusalem; Davey, New York, 1964. 224 pp. Illus. \$7.50 Eleven papers.

**Geology of Chautauqua County, New York.** pts. 1 and 2. pt. 1, *Stratigraphy and Paleontology (Upper Devonian)* by Irving H. Tesmer (71 pp., \$4.25); pt. 2, *Pleistocene Geology* by Ernest H. Muller (66 pp., \$3.25). New York State Museum, Albany, 1963. Illus. Maps. Paper.

**Geometry and Analysis of Projective Spaces.** C. E. Springer. Freeman, San Francisco, 1964. 311 pp. Illus. \$7.50.

**Glass-Ceramics.** P. W. McMillan. Academic Press, New York, 1964. 237 pp. Illus. \$7.50.

**Guide to Gas Chromatography Literature.** Austin V. Signeur. Plenum Press, New York, 1964. 359 pp. \$12.50. More than 7500 references to published literature and to papers presented at scientific meetings in the field, with complete pagination; coverage through 1963. Author and subject indexes.

**Handbook of Analytical Design for Wear.** C. W. MacGregor, Ed. Plenum Press, New York, 1964. 105 pp. Illus. \$12.50. Revised version of the *Handbook of Metal Wear Properties*.

**Handbook of Applied Hydrology.** A compendium of water-resources technology. Ven Te Chow, Ed. McGraw-Hill, New York, 1964. 1418 pp. Illus. \$39.50.

**Handbook of Electron Beam Welding.** R. Bakish and S. S. White. Wiley, New York, 1964. 279 pp. Illus. \$11.50.

**Handbook of Mathematical Tables and Formulas.** Richard Stevens Burington. McGraw-Hill, New York, ed. 4, 1965. 435 pp. Illus. \$4.50.

**Hard Metals Production Technology and Research in the U.S.S.R.** S. I. Bashkurov, Ed. Translated from the Russian edition (Moscow, 1959) by O. M. Blunn. J. H. Woodhead, Translation Ed. Pergamon, London; Macmillan, New York, 1964. 359 pp. Illus. \$20. Twenty-eight papers dealing with hard alloy technology, structure and properties, and x-ray, chemical, and spectrographic analysis of hard metals. The first of a number of planned publications of scientific works of the All-Union Scientific Research Institute of Hard Metals.

**High Temperature Materials, Plenum Press Handbooks.** vol. 3, *Thermal Radiative Properties.* W. D. Wood, H. W. Deem, and C. F. Lucks. Plenum Press, New York, 1964. 476 pp. Illus. \$17.50.

**Hydraulics and Fluid Mechanics.** Proceedings of the First Australasian Conference (University of Western Australia, Nedlands), 1962. Richard Silvester, Ed. Pergamon, London; Macmillan, New York, 1964. 513 pp. Illus. \$14. Twenty-nine papers submitted at the conference plus the inaugural address by Hunter Rouse. Those attending the conference included applied mathematicians, physicists, and engineers.

**Influence Lines for Statically Indeterminate Plane Structures.** W. J. Larnach. Macmillan, London; St. Martin's Press, New York, 1965. 268 pp. Illus. \$18.

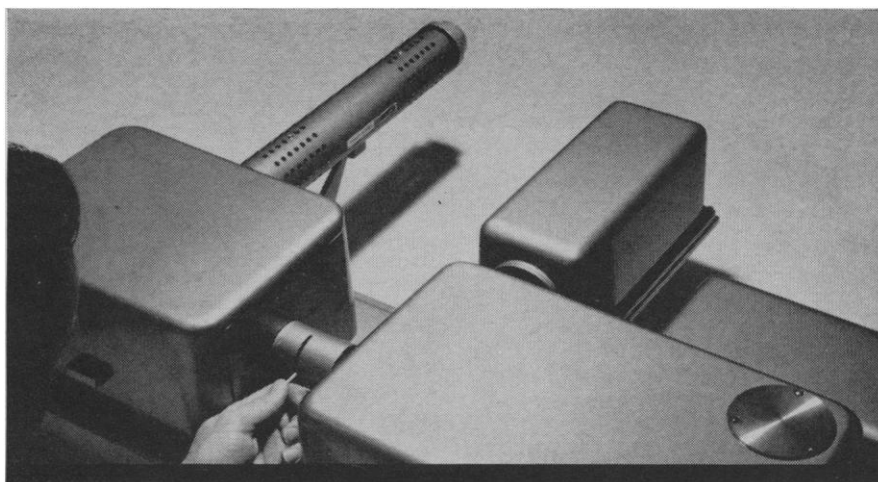
**Instrumentation in the Chemical and Petroleum Industries, 1964.** Proceedings of a symposium (Wilmington, Del.), 1964. George H. Robinson, Ed. Plenum Press, New York, 1964. 150 pp. Illus. \$9.50. Sixteen papers presented at the 5th National Chemical and Petroleum Instrumentation symposium sponsored by the Instrument Society of America. Contributors: W. C. Schall; E. R. Bullock; R. W. Sonnenfeldt; F. G. Willard, G. J. Kirk, Jr, P. S. Radcliffe, and J. R. Scohy; W. H. Vander Heyden; D. Gertz; R. O. Clark; T. A. Gray and J. Imber; E. F. Holben; R. K. Madsen and A. E. Stone; C. L. Mamzic; R. N. Auger; P. S. Buckley; H. C. Clark; S. E. Roth; and R. H. Lockett.

**Intensity Theory for Infrared Spectra of Polyatomic Molecules.** Lev Aleksandrovich Gribov. Authorized translation from the Russian edition (Moscow, 1963) by Paul Porter Sutton. Consultants Bureau, New York, 1964. 119 pp. Illus. Paper, \$15.

**Interpreted Infrared Spectra.** vol. 1. Herman A. Szymanski. Plenum Press, New York, 1964. 301 pp. Illus. \$10.75.

**Introduction to Number Theory.** Trygve Nagell. Chelsea, New York, ed. 2, 1964. 309 pp. Illus. \$5.50.

**Das Kohlenstoffrätzel.** Rudolph Weckering. Buchdruckerei Camille Hermann, Luxemburg, 1964. 140 pp. Illus. Paper, DM. 18.



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