SCIENCE

25 September 1964

Vol. 145, No. 3639

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

CLOVIS PROJECTILE POINTS

Index Issue

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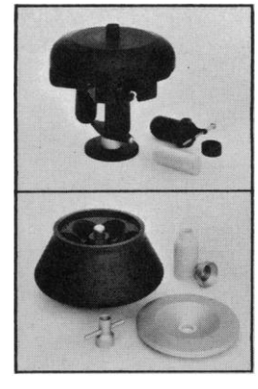

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The problem of finding an accurate method for bilirubin determination has occupied clinical chemists for 50 years. For determinations of new-born plasma, the most useful procedure is the Lathe and Rutheven (2) modification of the Malloy-Evelyn method (3). Stoner and Weisberg have recently reported an excellent micro-method for bilirubin (4).

For accurate determinations of low values of bilirubin, methods of choice are those of Bruckner (5) and Jendrassik and Grof (6). The methods of Meites and Hogg (7), and Powell (8) have the advantage of rapidity and involve few manipulative steps for the laboratory that does not have access to specialized equipment.

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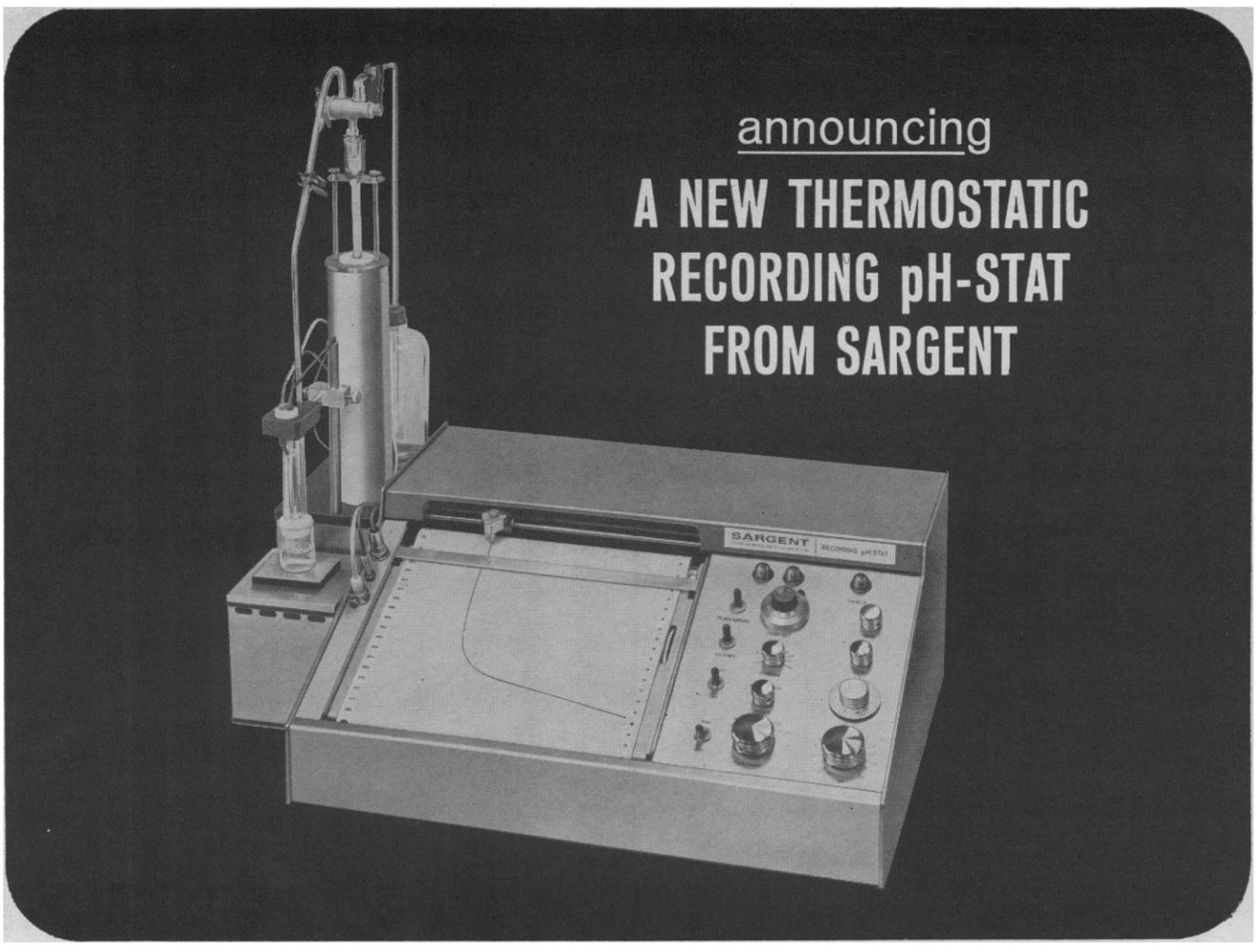
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Two Clovis projectile points recovered during the 1962–63 excavations at Blackwater Draw, New Mexico. Typically found with mammoth remains, these points demonstrate the extremes in size (11.3 versus 2.7 cm in overall length) and the technique of multiple fluting used to thin the base. See page 1408.



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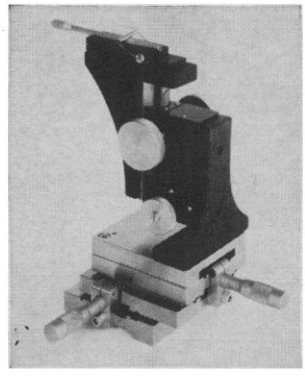

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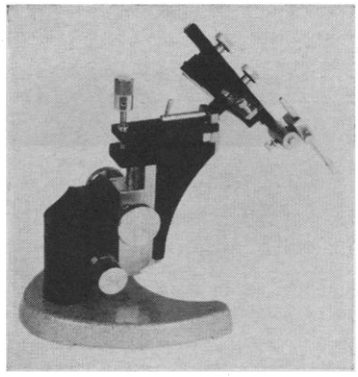

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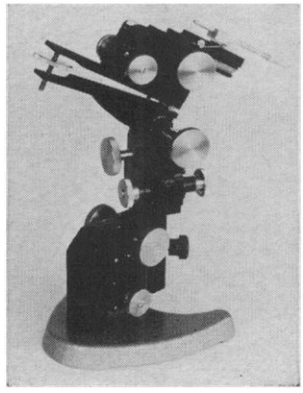

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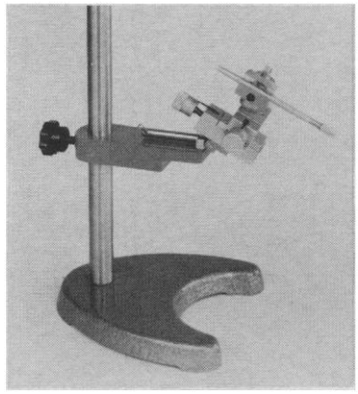

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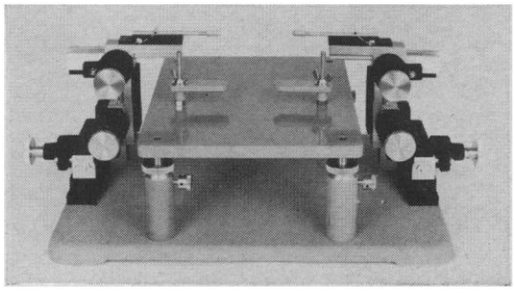

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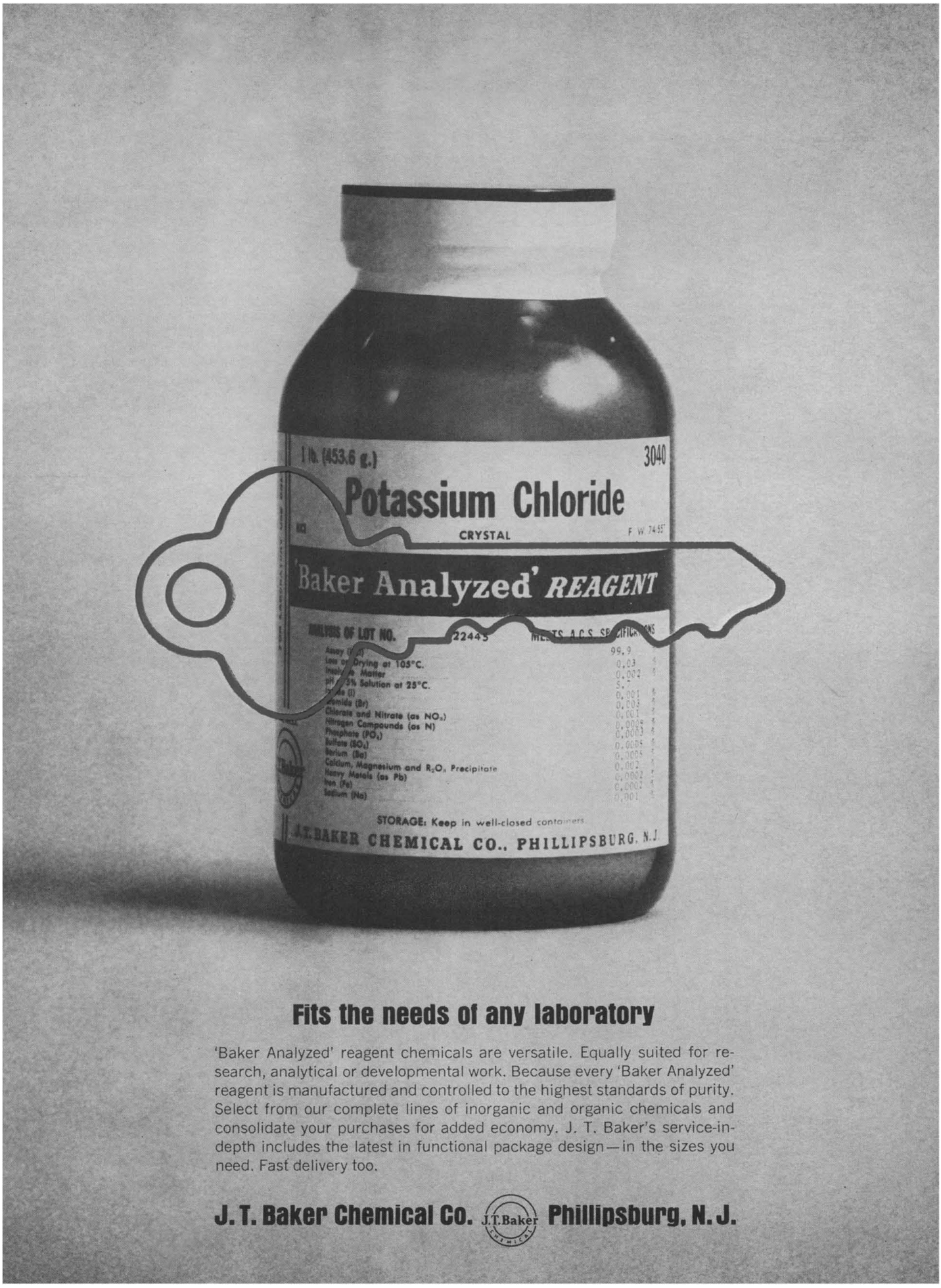

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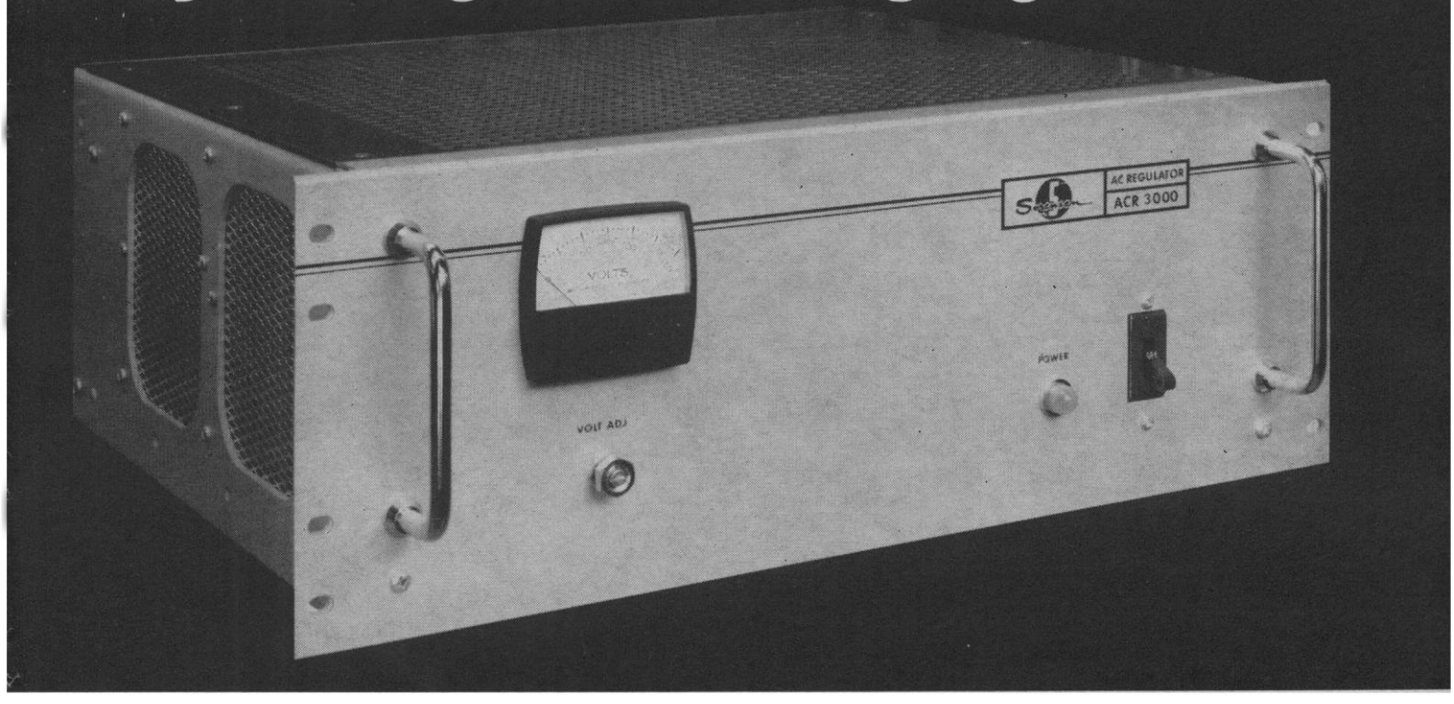

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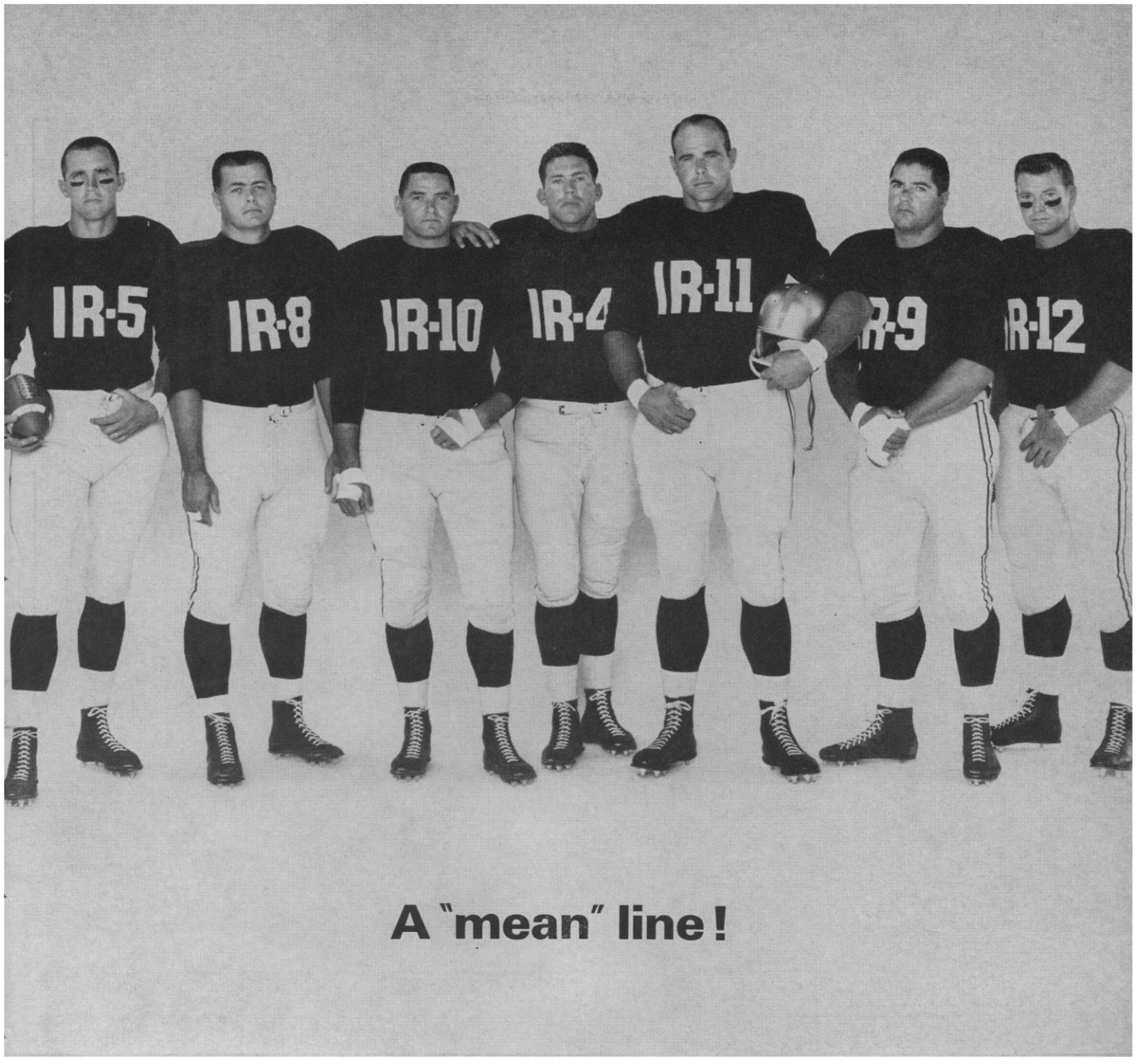

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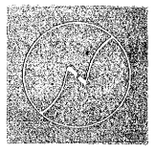

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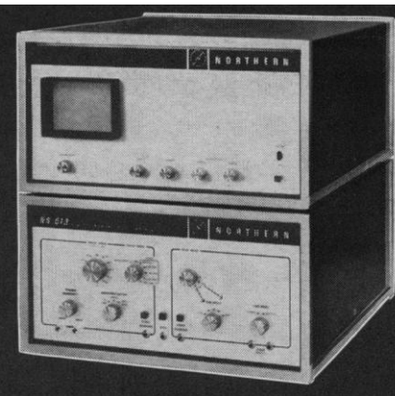

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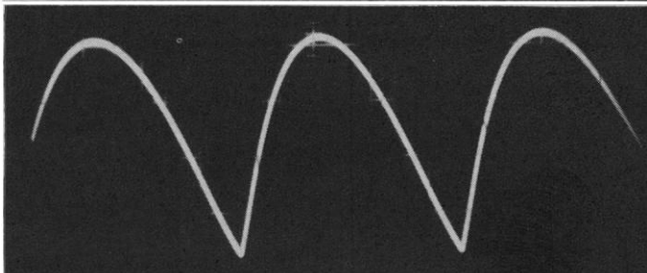
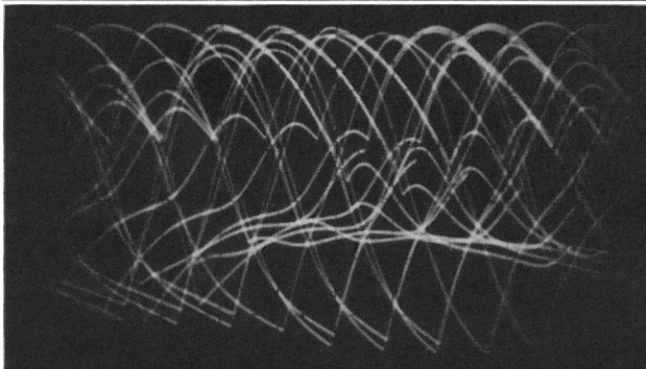
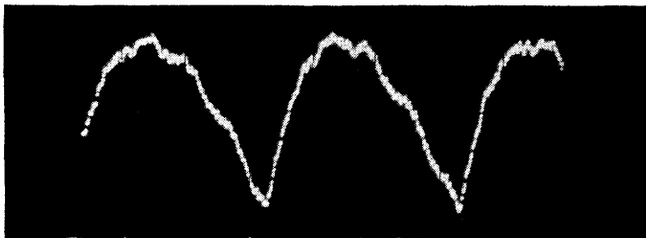


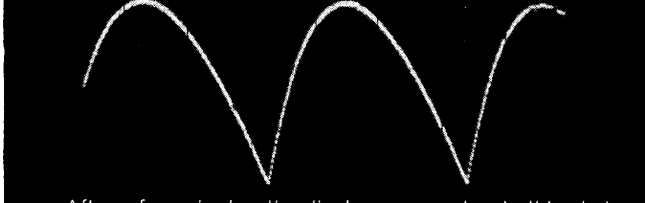
A periodic input signal, 150 cps, 660 millivolts peak to peak, as seen by use of a conventional oscilloscope, before mixing with noise.



The appearance of the signal when mixed with approximately five volts of noise (a distorted 60 cps sine wave).

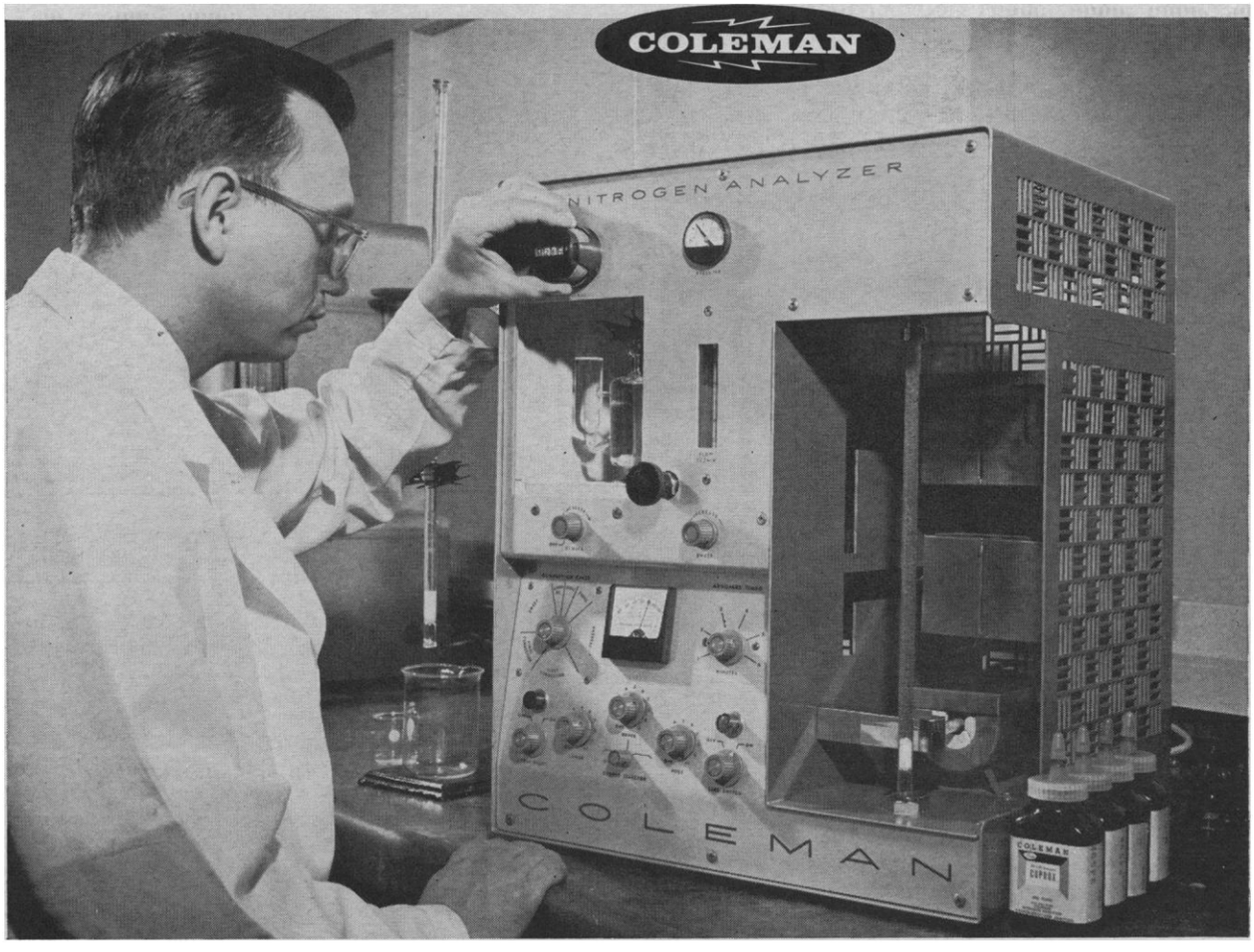


The appearance of the model NS-513 cathode ray tube display after a short measurement. Most of the noise has been averaged out.



After a few minutes, the display appeared as in this photograph. No alteration in the instrument controls was made for this final photograph; the signal doesn't "grow" with time; it merely shapes itself to conform with the true signal of interest.

*PATENTS PENDING



Scope of Coleman Nitrogen Analyzer extended to 20 ppm in trace studies by California Research Corporation*

** California Research Corporation is the research arm of Standard Oil of California. Results of the work are reported in "Automatic Dumas Nitrogen Analysis of Lubricating Oils and Additives," by Farley, Guffy and Winkler, ANALYTICAL CHEMISTRY, Vol. 36, Page 1061, May 1964. Reprints and product literature are available from Coleman Instruments Corporation.*

With the Coleman Model 29 Nitrogen Analyzer, trace quantities of nitrogen in lubricating oils and additives are determined at Calresearch and in an increasing number of the California Chemical Company** (Oronite) customers' laboratories. With only slight procedure modifications, the instrument is being used with samples containing as little as 0.2% nitrogen.

At lower nitrogen levels—down as far as 20 ppm—a specially-developed concentration technique provides adsorption of the nitrogen compounds on alumina. The trace analyses are then made on this nitrogen-bearing adsorbent.

Expanded use of nitrogen-containing additives in lubricating oils brought increased interest in nitrogen determination, a convenient method for correct preparation of additives and for proper product blending.

Prior to the use of the Coleman Nitrogen Analyzer in this application, California Research employed alternate methods which left much to be desired from standpoints of speed, convenience and economy.

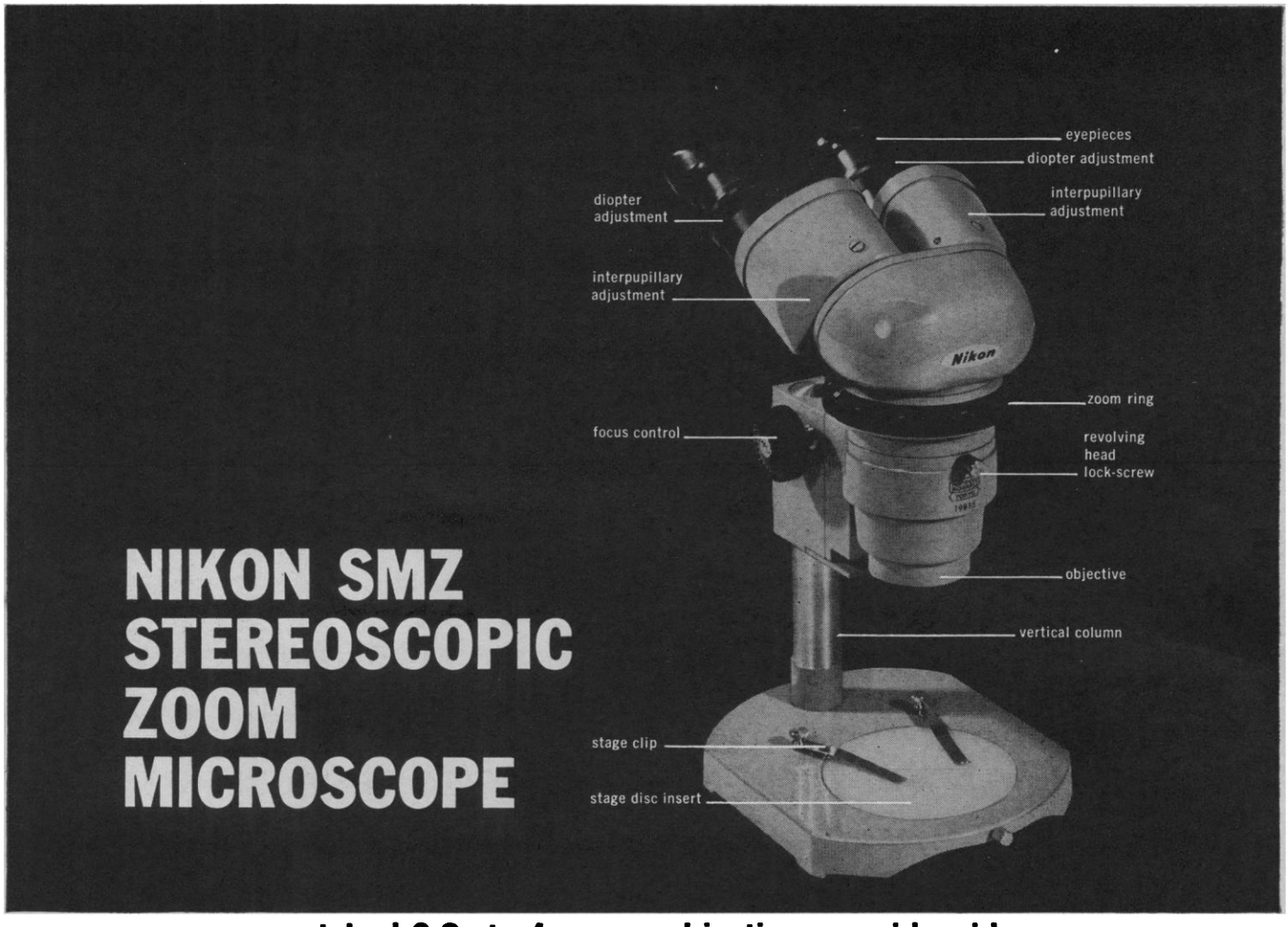
**Chemical marketing company of Standard Oil Company of California.

With sample materials from rose petals to natural fertilizers, from industrial compounds to biological fluids, the unit is proving its versatility in laboratories throughout the world. It is equally valuable in process control and in research, in both the physical and life sciences.

If your work involves any aspect of nitrogen determination, investigate the Coleman Nitrogen Analyzer. Ask your laboratory supply dealer for a demonstration.

CONDENSED SPECIFICATIONS:	
Sample Size	Normally 5 to 50 mg; 1 to 500 mg or more, depending upon nitrogen content of sample.
Speed	Normal operating cycle is 8 minutes; automatically extendable by delay circuit.
Accuracy	±0.2% nitrogen of theoretical nitrogen content at routine levels.
Range	Accepts any sample that combusts at temperatures up to 1000°C.

COLEMAN INSTRUMENTS CORPORATION
42 MADISON STREET • MAYWOOD, ILLINOIS



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 10X mag.	10X field dia.	15X mag.	15X field dia.	20X mag.	20X field dia.	WORKING DISTANCE
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.

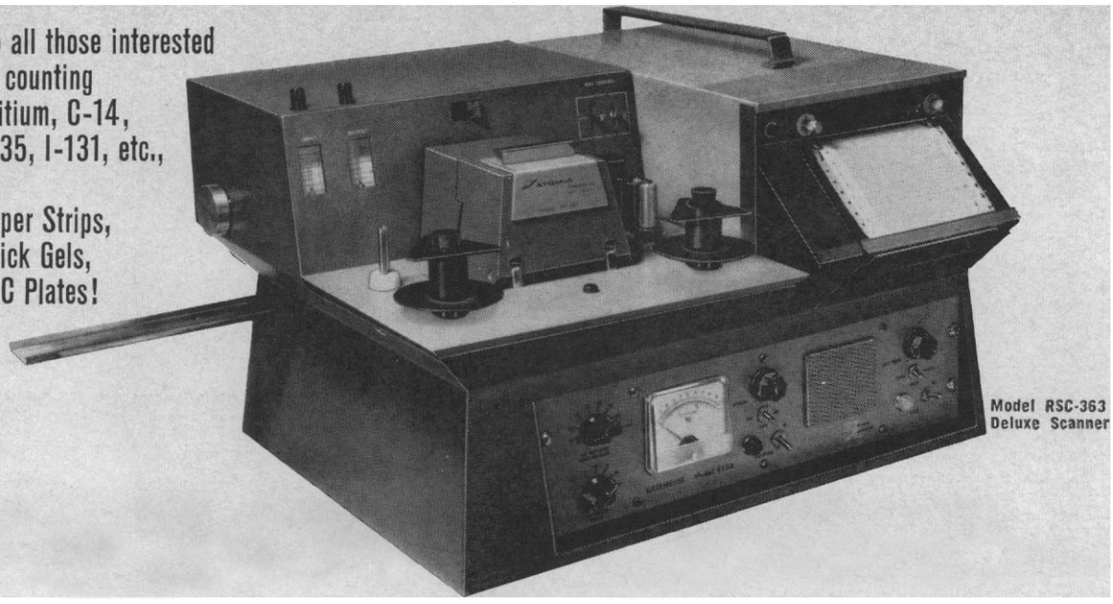
One of the advantages of the SMZ is the precise in-focus tracking of the right and left images over the entire zoom range. This is due to meticulously matched optics, and to the fact that the eyepiece tubes are both adjustable for dioptric power. There is a distinct sense of visual ease and comfort even 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.

Standard equipment supplied with the Nikon SMZ includes stand, base, reversible white-and-black disc insert and clips, as shown in illustration. Optional equipment includes: substage base for transmitted light observation, illuminators, micrometer stages, reticles, polarizing attachment, half-reflecting mirror attachment for on-axis surface illumination, and a variety of other accessories for numerous applications. Free demonstration provided on request. For detailed catalog, write Dept. S-9

NIKON INCORPORATED INSTRUMENT DIVISION 111 FIFTH AVENUE NEW YORK 3, N.Y.
Subsidiary of Ehrenreich Photo-Optical Industries, Inc., In Canada: Anglophoto Ltd. Instrument Division Rexdale, Ontario

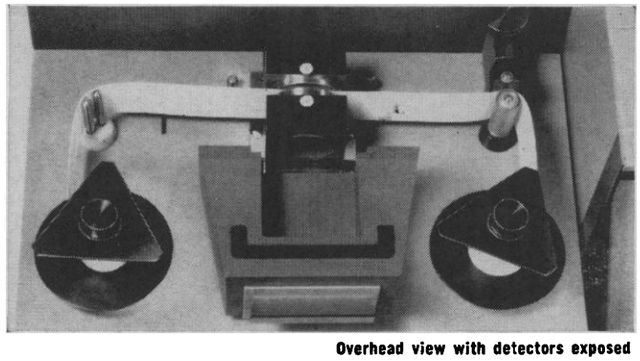
To all those interested in counting Tritium, C-14, S-35, I-131, etc., on Paper Strips, Thick Gels, TLC Plates!



Model RSC-363
Deluxe Scanner

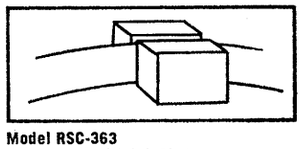
When you're paying over $2000 for a Radiochromatogram Scanner, why buy contamination problems, too?

NOW YOU DON'T HAVE TO. The all-new Model RSC-363 Deluxe Radiochromatogram Scanner eliminates any possibility of contamination because the detectors are located side by side so that the paper strips pass vertically between them.

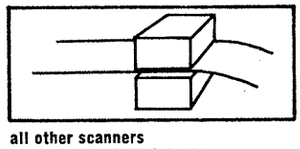


Overhead view with detectors exposed

Thus, fibers and lint do not tend to rub off and fall into the detector chamber and cause contamination problems or higher backgrounds as happens with scanners whose detectors are placed one above the other.



Model RSC-363 with "vertical" detectors



all other scanners with "horizontal" detectors

Proof that decontamination problems exist in other scanners comes directly from their own literature:

Mfr. V—"Snap-out type counting chamber allowing easy removal for cleaning and decontamination."

Mfr. P—"Quickly demountable components for decontamination."

Mfr. T—"Special window position which reduces detector contamination."

Model RSC-363 records the exact location and intensity of separated low-energy beta emitters on paper strips and glass plates used in TLC as well as emitters of higher energy used in thick gel applications. Provision for TLC and thick gel scanning is optional; this feature uses a separate detector so there is no need to disturb the paper strip system.

Other unique features make Model RSC-363 the most versatile automatic 4-pi scanner available today.

Why not send for our FREE descriptive literature?

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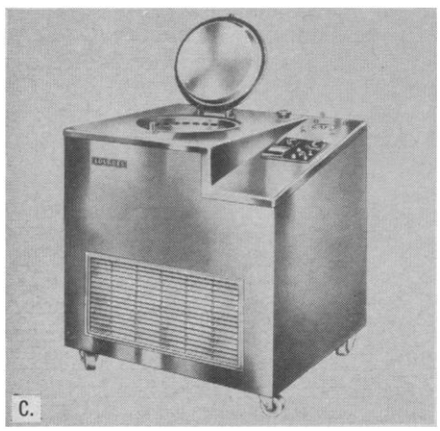
The continents draw closer together every day in this technological era, and communications are swift as sound. But it is still a big, wide world and Lourdes is in every corner of it! From Tokyo to Paris, from Sydney to Reykjavik, Lourdes Instruments are there . . . serving the needs of science and industry with precision.


A.


B.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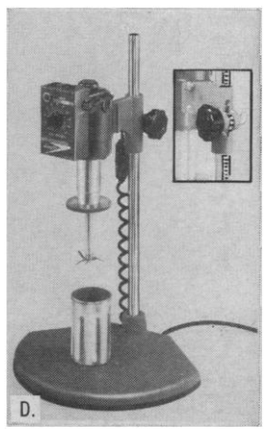
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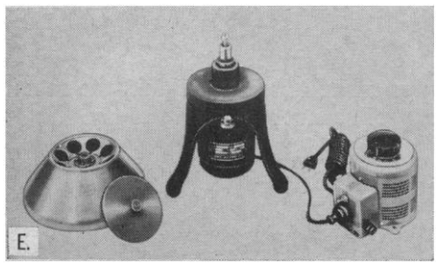
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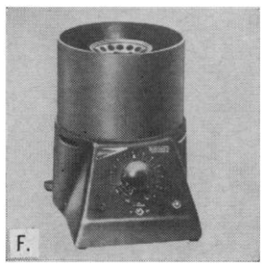
F.

A. Model A "Betafuge", Automatic Superspeed Refrigerated Centrifuge accommodates thirteen interchangeable rotors, including 3300 ml. (6 x 550 ml.) capacity rotor at 14,000 x G; 400 ml. (8 x 50 ml.) rotor at 40,000 x G; temperature control range —20°C to +40°C.

B. Model LCA-2, Non-refrigerated automatic centrifuge, spins 3300 ml. (6 x 550 ml.) capacity rotor at 10,000 x G; 400 ml. (8 x 50 ml.) at 30,000 x G.

C. Model VA-2 "Vacufuge" Automatic Ultraspeed Vacuum Refrigerated centrifuge spins 3300 ml. (6 x 550 ml.) capacity rotor at 33,000 x G; 1500 ml. (6 x 250 ml.) capacity rotor at 65,000 x G. Temperature control range —20°C to +40°C.

D. Model MM-1, Multi-Mix featuring solid state speed control and a rachet and gear mechanism. Sealed homogenizing within stainless steel containers, mason jars, centrifuge bottles, and tubes.

E. Model AX super-speed centrifuge; forces to 34,800 x G; separate RPM-RCF calibrated transformer.

F. Model AA-C "Versa-fuge" table model superspeed centrifuge; spins 400 ml. (8 x 50 ml.) capacity rotor at 34,800 x G; built-in transformer and steel safety guard.

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VANGUARD

NEW MODEL 885 GLASS PLATE SCANNER FOR THIN LAYER CHROMATOGRAPHY

The Model 885 Glass Plate Scanner now extends the range and versatility of the Model 880 Low Background Autoscanner for applications involving the assay of thin layer chromatograms. Designed as an accessory system to operate in conjunction with the Autoscanner, the Model 885 provides a convenient, low cost system for assaying TLC glass plates with unequalled accuracy and sensitivity. The compact design of Model 885 allows it to be operated atop the Model 880 Autoscanner so that no additional bench space is required.

Utilizing the electronics of the Model 880 Autoscanner, the Model 885 provides 2 pi windowless detection for tritium, carbon-14, sulphur-35 and other beta-emitting radioisotopes. A pushbutton transmission provides 10 scanning speeds identical to those available on the Model 880 Autoscanner, assuring absolute correlation between the glass slides and recorder chart paper. An automatic marking system places a distinctive "pip" on the chart record to denote the beginning and end of each TLC plate. This assures accurate location of radioactive zones.

Model 885 is furnished with three interchangeable stainless steel collimators of ½ cm., ¼ cm., and ⅛ cm. width to meet varying requirements of chromatogram resolution while maintaining maximum detection sensitivity. Standard glass plates from ½"—2½" wide and up to 12" in length may be scanned.

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

VANGUARD INSTRUMENT CORPORATION

Designers and Manufacturers of Precision Instrumentation for Research • P. O. Box 244, LaGrange, Illinois 60526, FL 2-1600

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New grades of filter paper! Whatman continues to keep ahead of ever increasing laboratory needs by consistent development of the most complete and specific line of laboratory filter papers available. Here are five new grades, each designed for a specific purpose.

6 — A *smooth surface* version of Whatman #5 which retains the properties of very high retention and slow filtration speed.

90 — This grade filters at an *unbelievably rapid speed* compared with other laboratory filter papers but still has a good retention value and is therefore suitable for the filtration of coarse and gelatinous precipitates. It is designed as a qualitative paper for fast filtrations or as a semi-industrial grade for use in situations where the most rapid filtration is required.

111 — This is a high wet strength paper with medium retention and medium filter speed. It is similar in filtration characteristics to, but *less expensive* than, Whatman #2, and Whatman #52.

114 — This is a *high wet strength* rapid filtering paper suitable for the filtration of coarse and gelatinous precipitates and for use in Buchner funnels and other devices that would tend to break an ordinary filter paper. It is similar in filtration characteristics to Whatman #4, and Whatman #54.

115 — This is a *high wet strength* paper with very high retention, slow filtering speed and semi-glazed surface to prevent fiber shedding. It is similar in filtration characteristics to Whatman #5, and Whatman #50.

Available through your laboratory supply dealer.

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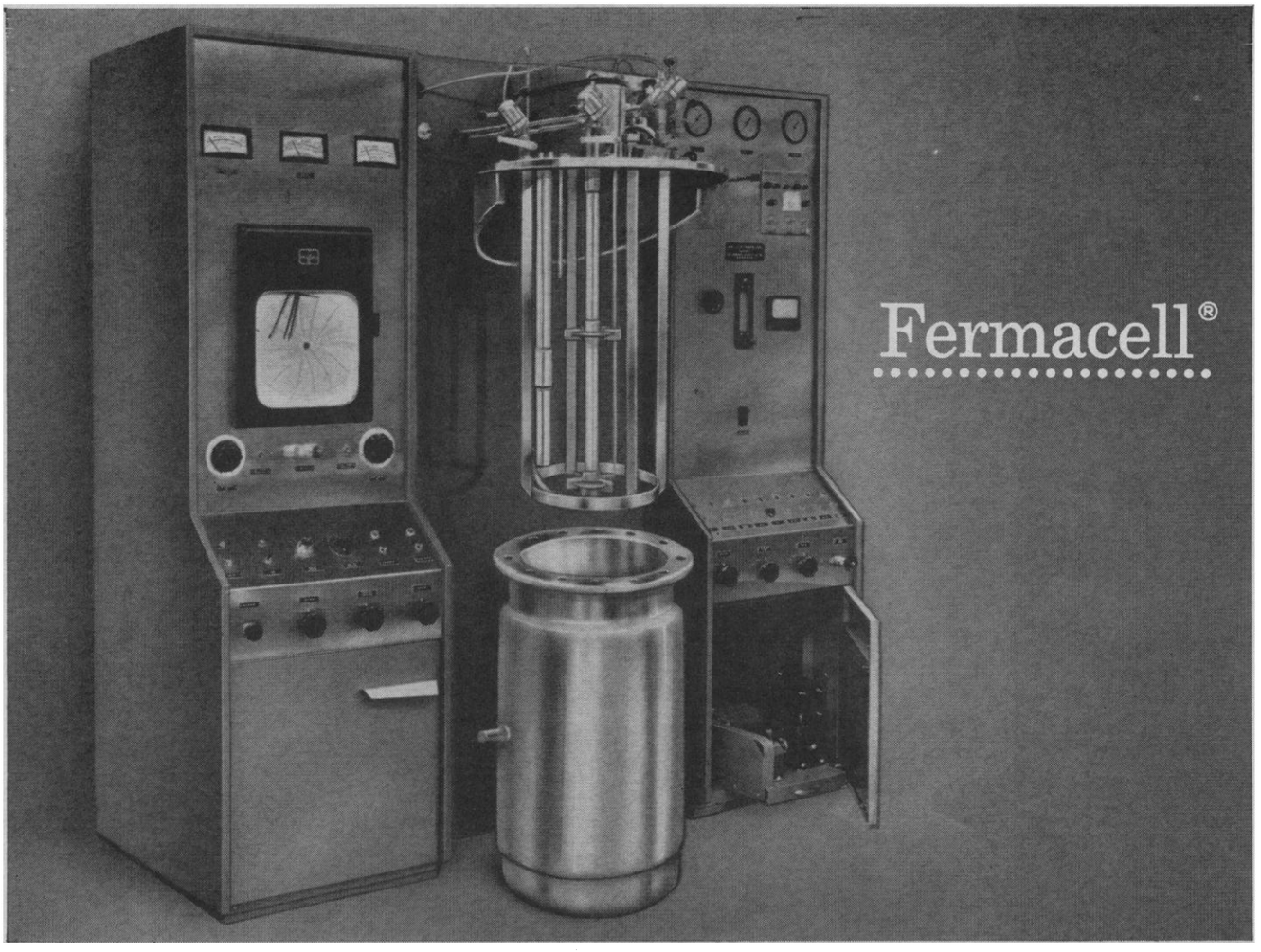


The Fermentor with the Removable Vessel

For laboratory, pilot-plant and small-scale production of microbial cells

The Fermacell is a general purpose fermentor used for basic laboratory research as well as pilot-plant and small-scale production of microbial cells. It is available in two sizes for working volumes up to 40 or 100 liters and is designed for batch production and continuous culture.

Rigid Control. This culturing apparatus is a completely steam-sterilizable system, fully integrated for rigid control of agitation, aeration, temperature, pressure, foam and pH. It is used for growing aerobic and anaerobic bacteria, streptomycetes, molds and yeasts, as well as mammalian and plant tissue cultures.

Easy to Handle and Easy to Use. The Fermacell's fermentor vessel can be removed quickly by one person in less than three minutes for cleaning as well as emptying and refilling. This design permits complete access to process lines, ports, and electrodes mounted in the stationary fermentor head plate.

FERMACELL FEATURES

Removable Fermentor Vessel is easy to handle, easy to clean; provides complete access to the fermentor interior.

Replaceable Shaft Seal Assembly is designed for repeated steam sterilization and a long life of positive sealing without danger of contamination. Seals are contained in a removable cartridge to facilitate inspection and replacement.

Rigid Temperature Control is maintained within ±0.5°C from 5°C above water supply temperature to 60°C.

Integral Recirculating Water Conditioning System circulates cold or heated water to fermentor jacket on control demand.

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.

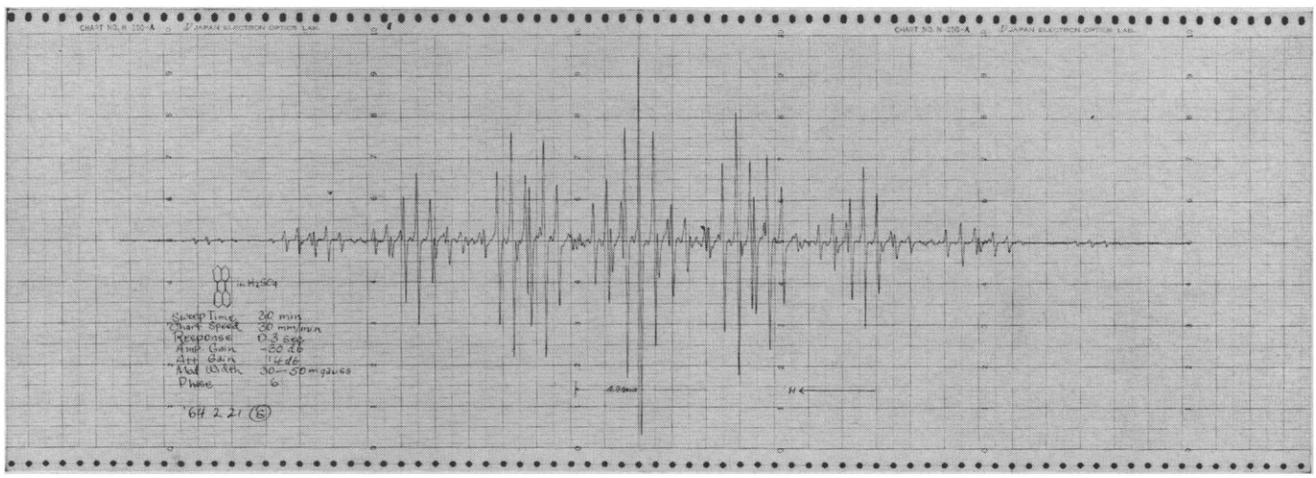
Broad Range of Accessories include Automatic pH Control, Photosynthetic and Ultraviolet Illuminators, Air Incineration System, Air Humidifier, Air Compressor and other equipment.

Easy to Operate—all controls are conveniently mounted on the front of the apparatus.

Send for 12-page Illustrated Catalog No. FMS/9254

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

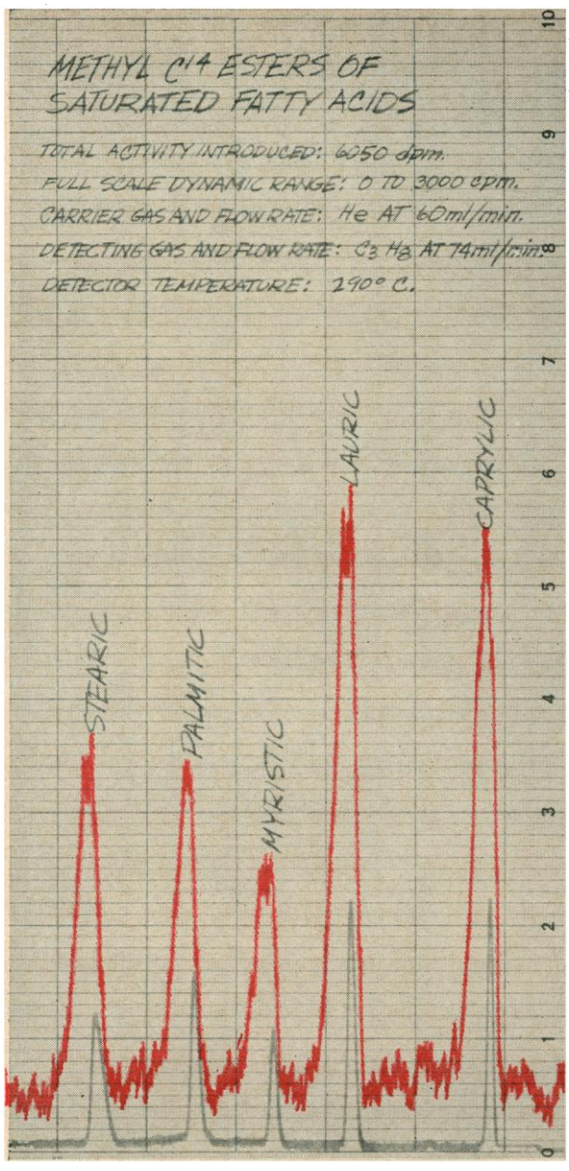
ESR

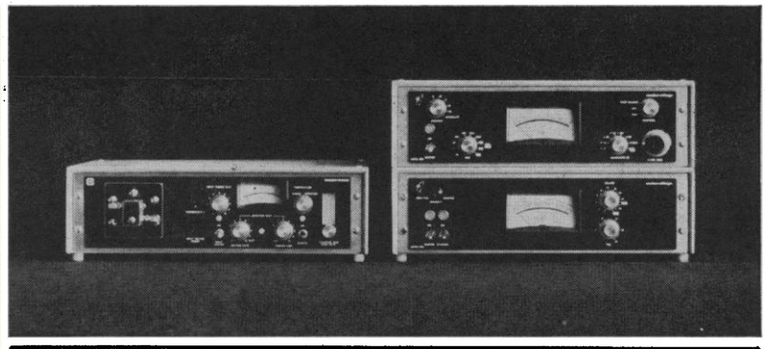


ESR spectrum of perylene positive ion in sulphuric acid showing highly resolved hyperfine structure due to interaction with proton spins.

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

A complete line of versatile Electron Spin Resonance equipment and accessories is now available from Japan Electron Optics Laboratory Co., Ltd. Unusually high sensitivity to 1×10^{11} spins/gauss and 1×10^{-5} resolution with broad operational flexibility make them important research tools for a wide variety of applications. Units for K and Q-band operation with sensitivity of 1×10^{10} spins/gauss are also available. ■ Feeble ESR spectra produced by free radicals of organic compounds and aqueous solution samples used in biochemical research can be clearly recorded and analyzed. Unlike conventional instruments, JEOL's equipment can record second derivative curves for more precise analysis. Samples can be measured under varying conditions of mixture, temperature and rotation as well as under UV radiation. ■ Japan Electron Optics Laboratory Co., Ltd. has established a complete domestic servicing network to provide technical assistance and assure continuous trouble-free service. Complete technical data and sales information on ESR equipment can be obtained by contacting JEOLCO (U.S.A.), Inc., 461 Riverside Avenue, Medford 55, Mass., telephone 396-6241, area code 617.





THE BIOSPAN™ MODEL 4998 GAS RADIOCHROMATOGRAPHY SYSTEM:

Will operate with any gas chromatograph.

Is supplied with separate temperature control systems for the detector and the chromatograph connecting line to eliminate sample condensation.

Uses a flow-through proportional detector to deliver better than 60% detection efficiency for both C^{14} and H^3.

Operates at the high temperatures—up to 300°C—required for good chromatographic separation.

Eliminates sample combustion and time-consuming analysis of individual fractions.

Offers interchangeable 20 ml and 85 ml detectors so that you can select the best sensitivity or resolution to fit your specific application.

Affords precise control of sensitivity and resolution through gas-flow adjustment.

Exhibits less than 2 cpm background per ml of detector volume.

Chart shows the simultaneous recording of the composition of the effluent (black trace) as measured by thermal-conductivity detector and of the component radioactivity (red trace) as measured by the BIOSPAN Model 4998.

MAKE DIRECT ANALYSIS OF THE RADIOACTIVE COMPONENTS IN THE EFFLUENT FROM YOUR GAS CHROMATOGRAPH

Now, with Nuclear-Chicago's BIOSPAN Model 4998, you can reliably and accurately apply radioisotope techniques to dynamic gas chromatography. This new counting system continuously detects and measures the soft beta activity in the gas phase. Sample combustion and lengthy preparatory processes such as fraction collection are no longer necessary. With this nondestructive counting technique, your sample is available for further analysis. These operating advantages permit maximum data-collection efficiency in minimum time and make your gas chromatograph an even more useful analytical tool.

The Model 4998 uses a highly efficient proportional radiation detector housed in a shielded enclosure. Both the enclosure and the connecting lines are temperature-controlled. A stable, well-regulated high-voltage supply furnishes the detector operating voltage.

The flow-through detector has sufficient volume to ensure adequate statistical accuracy for sample fractions of low activity, yet it can distinguish between closely spaced radioactive peaks. The detector's long voltage plateau gives good long-term counting stability.

Data readout for the Model 4998 consists of a precision laboratory ratemeter that is compatible with any Nuclear-Chicago graphic recorder. The ratemeter can also be connected to a dual-channel recorder for simultaneous recording of effluent composition and component radioactivity on a single chart. A high-speed digital integrator is available for continuous presentation of quantitative data.

For more information on the BIOSPAN Model 4998, contact your Nuclear-Chicago sales engineer, or write directly to us. NUC: B-4-225

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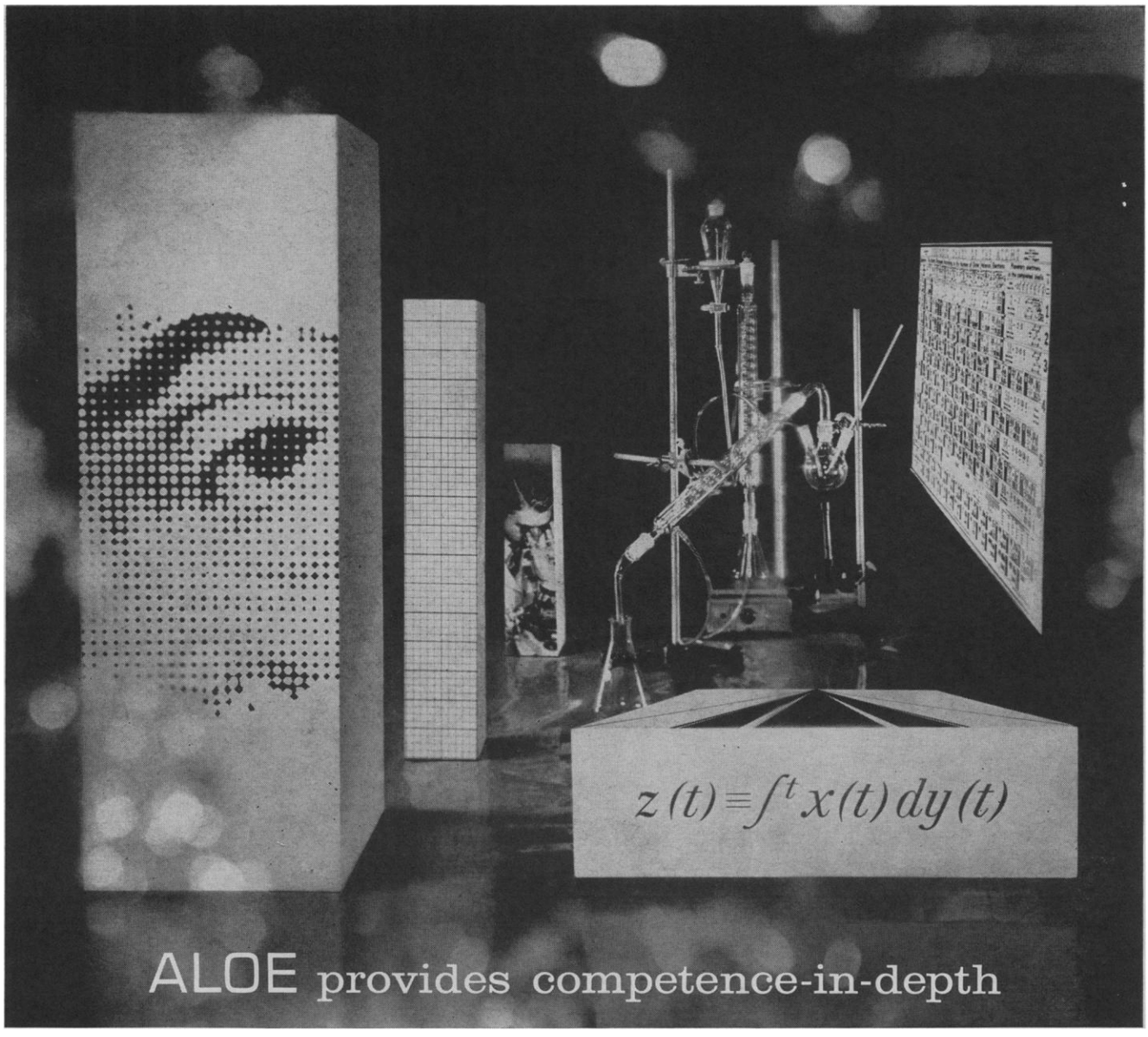

Aloe people work very much as scientists do when searching for an answer—they combine insight and creative imagination with research, knowledge and experience.

This makes for the competence-in-depth you expect from the men at Aloe Scientific when you need the solution to a laboratory equipment problem, or wish equipment advice.

You can ask no better informed men. Each has a background in one or more of the scientific disciplines—has been thoroughly trained by Aloe—regularly attends instrumentation seminars and supplier briefings. Each devotes many hours to scientific reading weekly.

Creative minds, solid backgrounds, know-how that parallels the need—all these are at your service when you contact Aloe Scientific ℬ Division of Brunswick, St. Louis 3, Mo.

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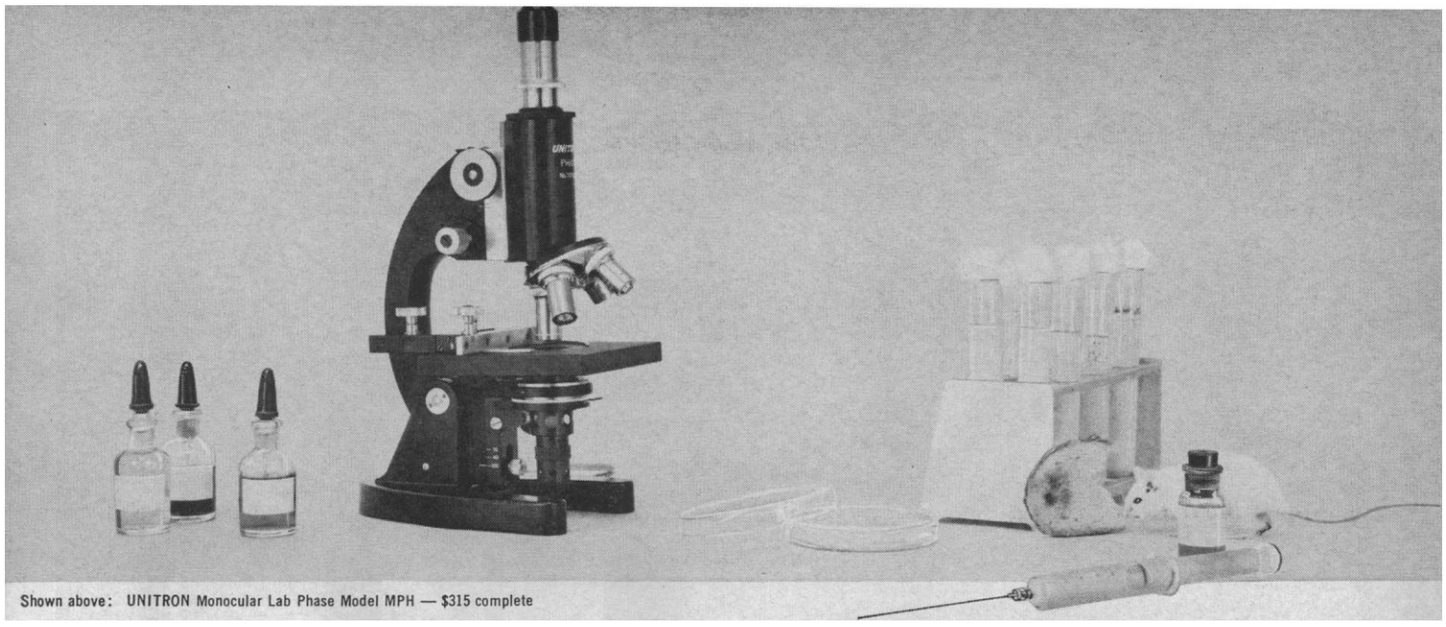

Shown above: UNITRON Monocular Lab Phase Model MPH — $315 complete

There are 3 microscopes in this picture

...at a distinctly singular UNITRON price

Most lab microscopes are used for ordinary *brightfield* studies.

So is UNITRON's MPH.

Some lab microscopes can also be used for *darkfield.*

So can UNITRON's MPH.

Still other lab microscopes offer *phase contrast* to aid in the study of *living, unstained* material.

So does UNITRON's MPH.

Until now, no lab microscope has provided all 3 for the price of 1.

UNITRON's MPH does. The 3 most important techniques of microscopy are built-in, yet the MPH costs less than many single-purpose microscopes.

That's not all. UNITRON's MPH gives you more than just the advantages of 3 specialized microscopes. It unites them in "Continuous-Transition Microscopy." With a turn of the condenser knob, you change from *brightfield* to *darkfield* to *phase contrast,* all in rapid succession. Operation is so easy, it's almost automatic. There are no accessories to attach and no time-consuming adjustments to make. Everything has been factory-centered for you. Even the light source is built-in and permanently aligned

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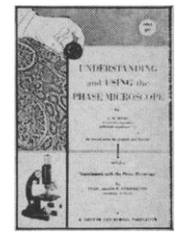

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complacency in behavioral science of which Bixenstine speaks. In the special field of the experimental analysis of behavior I do see a new kind of confidence. It springs not from "a release from preoccupation with theory" but from success. Important problems are being attacked and solved. Methods are available which are effective with respect to behavior as a subject matter, but this does not mean that they should be emulated in every other field of science.

B. F. SKINNER
Psychological Laboratories, Harvard University, Cambridge, Massachusetts

Melman Controversy

The tone of D. S. Greenberg's article on Seymour Melman (News and Comment, 17 Apr., p. 27), as well as that of his reply to Melman's letter (Letters, 17 July, p. 233), seems out of place in your pages. What Greenberg says, what he leaves unsaid, and the phrases he employs all seem to suggest a political argument rather than a presentation of factual material. Contributions of this sort do not seem well designed to add luster to your excellent journal.

ALBERT KAPLAN
4385 Maryland, St. Louis 8, Missouri

Italy: Science and Politics

The article on research in Italy by V. K. McElheny (14 Aug., p. 690) was of more than casual interest to me, as I spent the period from October 1960 to June 1961 at the Instituto Superiore di Sanità under a Fulbright grant. I worked with G. Gualandi in E. B. Chain's group. Even at that time distinct political interference could be noted in the workings of that research institution. Members of political parties of extreme left and right (especially those affiliated with the Movimiento Sociale Italiano) continually alluded to "foreign" elements in the Instituto which should be eliminated. I am sorry that McElheny did not delve further into these political involvements, as I think that the recent unfortunate happenings in Italy are only the legalistic culmination of a long series of parliamentary proceedings, both official and otherwise. Even 3 years ago many persons warned of what would follow if the situation continued to deteriorate.

I believe that the obvious lesson to be learned—if, indeed, it is not already clear to all—is that partisan politics can only have an insidious influence on the administration of any research organization, large or small. Of the wealth of scientific ability and achievement in Italy both in the past and future I have no doubt; one can only hope that members of the Italian Parliament share this view and will cease the harassment and interference which has resulted in the unhappy and unnecessary events described.

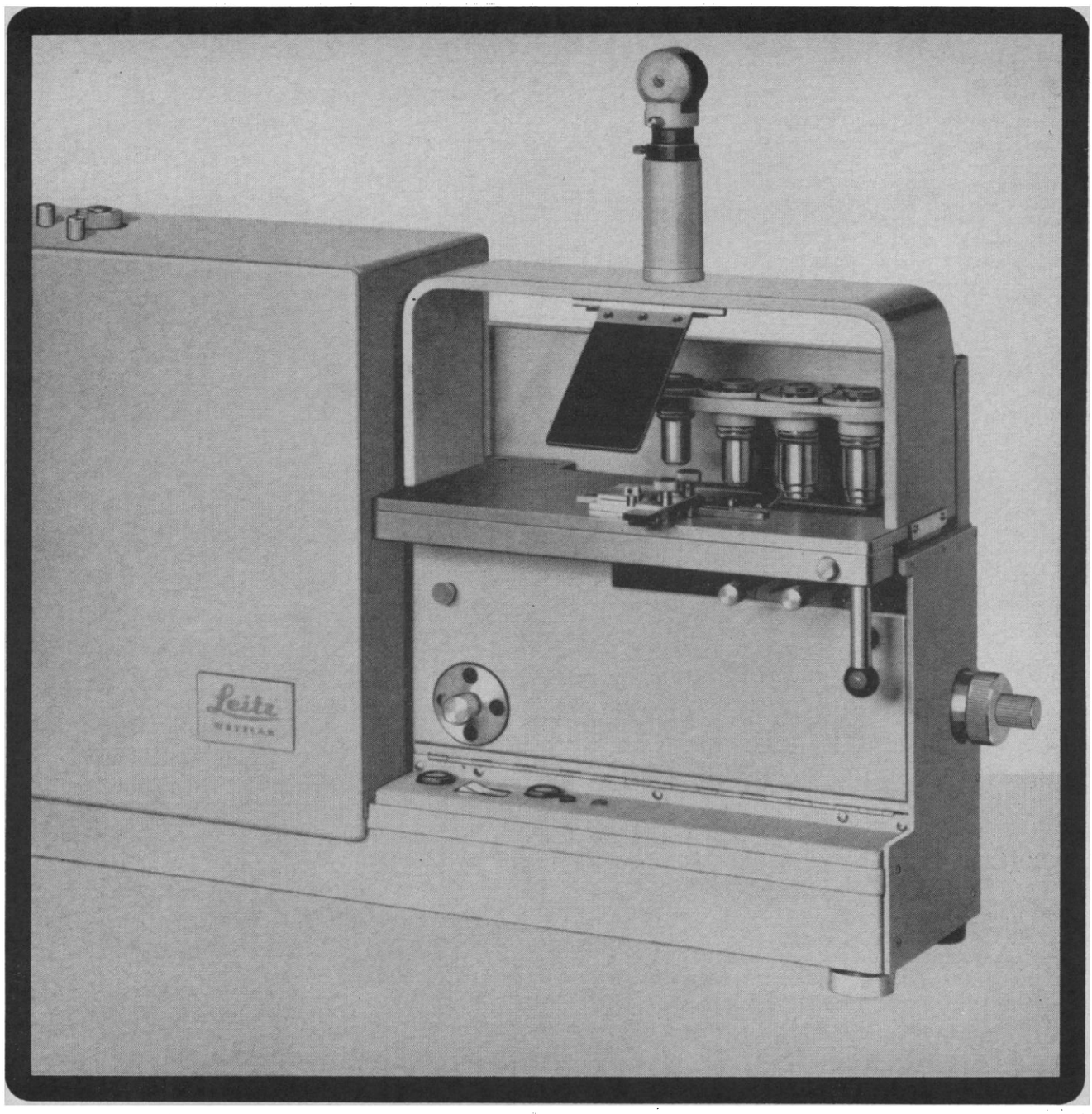
HAROLD B. REISMAN
108 Huntington Avenue, Danville, Pennsylvania

"Science" ≠ Sciences

I should like to comment on the recent discussion of the science training in a liberal arts curriculum (Letters, 21 Aug., p. 767).

While the average science major of my acquaintance is knowledgeable in humanistic and sociological fields, few nonscience majors are capable of contributing to a conversation in scientific areas. These students generally attempt to fulfill their science requirements by taking the easiest possible courses, "easiest" usually meaning a minimum of lab or problem work and a maximum of studying "science," instead of biology, physics, or chemistry. If these courses do succeed in teaching "science," it is a subject which I believe few scientists would recognize. The quality of teaching of the subjects themselves generally suffers from shared emphasis with the more general topic. In contrast, basic courses which aim primarily at exposing the student to the basic facts, methods, problems, and ideas of a particular scientific discipline give him both currency in that field and experience in "science." To imagine that this experience can be supplanted by formal teaching of the philosophical view is to credit philosophy with a scheme sufficiently well developed and defined to enable the student to "appreciate" science. I personally doubt the existence of such a scheme and question the advisability of teaching any subject by teaching about the study of that subject.

STEPHEN MARK SCHWARTZ
Boston University School of Medicine, Boston, Massachusetts



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25 September 1964, Volume 145, Number 3639

SCIENCE

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Women in Science and Engineering

Every 10 years the Bureau of the Census supplies a wealth of new information about the population of the U.S., and each time the information is collected and reported in greater detail than before. A recent report, *Characteristics of Professional Workers,* furnishes, among much else, a variety of statistical information concerning women in science and engineering.

Like all data of the most recent census, the information is as of 1960, or in some cases 1959, and was supplied by the individual or some other member of the household. These inevitable limitations should be kept in mind in an evaluation of the data. The statistics show that in 1960 there were 7714 women engineers (less than 1 percent of all engineers), 14,616 women natural scientists (about 10 percent of natural scientists), and 13,773 women social scientists (about 25 percent of that group). Their median annual earnings from professional work were approximately $5600 in engineering, $5000 in natural sciences, and $4600 in social sciences. The corresponding medians for men were some $2500 to $3000 higher.

In such comparisons men are taken as the standard, and it is not clear that this is the proper standard for all of the women involved. Well over half the women in all three professional groups were or had been married. At least partly as a result of the choices they must make in playing their dual role, women averaged a slightly shorter work week than men, worked fewer weeks during the year, and, except in the natural sciences, had less formal education. Each of these differences may well account for part of the difference in income. But only for education do the census data allow a partial analysis. It turns out that the difference in earnings is about as great for men and women of equivalent education as it is for the total groups.

It is also of interest to compare the 1960 figures with those for 1950. In 1950 women constituted 1.2 percent of all employed engineers; in 1960, 0.9 percent. In 1950 women made up almost 12 percent of the group of natural scientists; in 1960, only 10 percent. In the social sciences the proportion of women dropped from 32 percent in 1950 to 25 percent in 1960.

These decreases reversed the rapid increases of the 1940–50 decade and have run counter to the general increase in professionally employed women between 1950 and 1960. They have done so during a period in which university administrators, government offices, and professional associations have given a considerable amount of attention to efforts to improve opportunities for women. These efforts have not been limited to science and engineering, but those fields have been prominent. Why then should the relative participation of women in science and engineering have decreased? Census data do not answer this question, but their essentially complete coverage of the entire population indicates that a good deal remains to be done in the way of providing opportunities for the reeducation of scientifically and technically trained women who wish to return to their professions when family responsibilities lighten, and that we have not yet developed the employment practices and social policies that encourage the fullest use of capable women who want professional careers.

—DAEL WOLFLE

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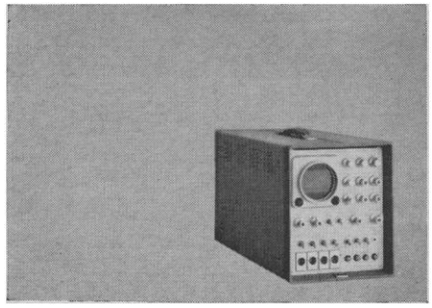
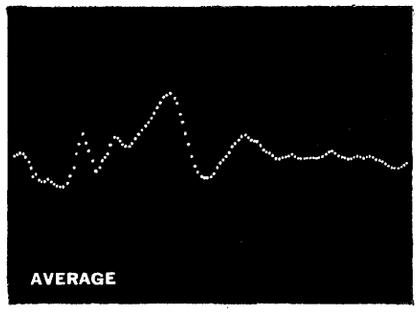
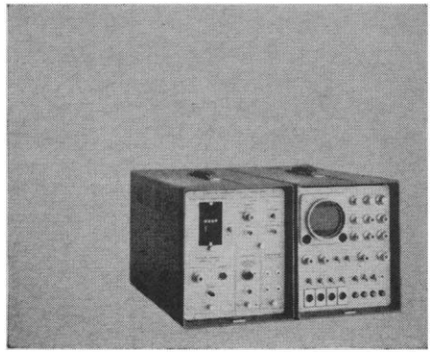


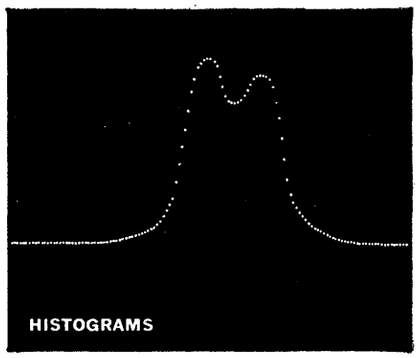
Four years of successful application of the Mnemotron 400B CAT (Computer of Average Transients) in neurophysiology, cardiology, ophthalmology and other biology research laboratories has established the versatility and reliability of this multi-purpose digital computer. Its circuitry derives and accumulates data from a succession of responses masked by random activity or background, and provides CRT display or output in analog or digital form for permanent record or further processing by general purpose computers.



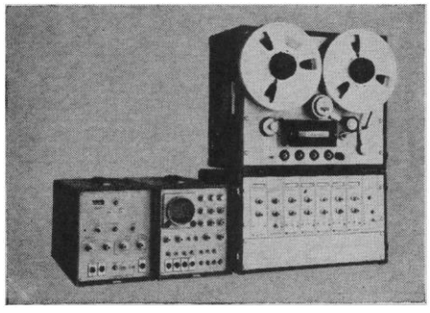
Add on units as statistical needs develop . . .



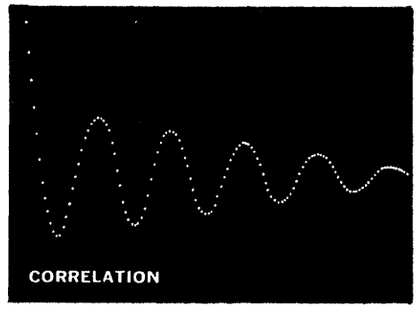
Automatically processing quantities of data gives fresh insights into evoked potentials in neurophysiological studies, electrocardiography, pupillography and numerous other biological investigations. Such increased understanding suggests new approaches, thus requiring further statistical analysis of the data. The 522 Resolver/Integrator and 600 Series units can be added to expand CAT capabilities to compute Histograms of wide variety. Interspike intervals, action potential firing rates, P-R-T amplitude distributions, reaction time distributions, spontaneous firing rates — suggest a few of the studies implemented by these added capabilities.



Add further data handling capability . . .



Occasionally, experimental conditions indicate information could be gained from autocorrelation of successive signals or cross-correlation of two related signals. Addition of the COR 256 makes these capabilities available. Further, recording the experimental data on magnetic tape can add several dimensions to the data reduction system. The TMC 700/1400 Magnetic Tape Recorder Systems can record up to 14 channels of experimental data for subsequent processing by the CAT, or for storage of data accumulated in the CAT memory.



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with consequent formation of triplet states in high yield. Much of the variation in behavior is understandable on the basis of the variation in the electronic structures of the lowest-lying triplet states of different molecules. The general picture was extended by George Porter (Sheffield) who added consideration of low-lying "charge transfer" states to the usual n, π^* and π, π^* states. Although it appears to the reviewer that charge-transfer states are π, π^* states having large dipole moments, the generalization will be of great value because compounds having such low-lying states are exceptionally unreactive and easily characterized by spectroscopy. However, the developing harmony of thought was jolted in the last lecture by N. C. Yang (Chicago) who presented strong evidence that 9–anthraldehyde (and perhaps other compounds) reacts by way of a triplet state that is not the lowest available to the molecule. Evidently solution photochemists will have to recognize the possibility, well known from vapor-phase studies, that decay to the lowest excited state of a given multiplicity will not always be fast compared with bimolecular reactions.

Howard Zimmerman (Wisconsin), Oskar Jeger (Zurich E. T. H.), and Gerhardt Quinkert (Braunschweig) also discussed rearrangement and fragmentation of ketones. No absolute mechanistic-type reaction has yet emerged. For example, reactions in which carbonyl groups are lost as carbon monoxide obviously involve free radicals in some instances, but in other cases show stereoselectivity which indicates that the lifetimes of any such intermediates must be vanishingly short. The well-known Zimmerman hypotheses concerning the rearrangements of unsaturated ketones were presented, discussed, expanded, and contracted. The writer is left with the feeling that he understands the various mechanisms but does not yet quite understand the compounds.

Discussions of photoaddition reactions by Richard Cookson (Southampton) and de Mayo served to remind participants that study of the mechanisms of photoreactions can often be blended with development of extraordinary new synthetic methods. One of the attractions of photochemistry is use of the reactions for synthesis of exotic compounds. Those who study reaction mechanisms seem to feel that they will shortly provide a systematic understanding to guide synthetic work. However, synthetic chemists feel such urg-

ency that they forge ahead and develop spectacular synthetic procedures without waiting for the final word from chemical dynamics. Fortunately, the two approaches enjoy a symbiotic relationship, frequently within a single laboratory.

Various aspects of the chemistry of conjugated dienes and polyenes were expounded by Madame Mousseron (Montpellier), William Dauben (Berkeley), and Klaus Gollnick (Müllheim). These versatile molecules undergo ring-closure, ring-opening, rearrangement by hydrogen transfer, cyclodimerization, and internal cycloaddition to give fantastically distorted molecules and enter into a large number of reactions with other reactants—all under the influence of light. With this group of substrates there is often good evidence that triplet and singlet paths do not cross in many cases. Consequently, reactions effected by direct irradiation and by sensitization frequently give entirely different products.

Refreshing novelty was provided by Orville Chapman (Iowa State) and Mendel Cohen (Weizmann Institute). Chapman presented an entirely new group of photorearrangements of aromatic nitro compounds. Cohen discussed phototropism and photodimerization in crystals. The work complements studies of crystal structures by x-ray diffraction. At least within the two series of materials studied, it is possible to make unequivocal predictions concerning photochemical reactivity on the basis of intermolecular relationships within the crystals.

The symposium was sponsored by the Organic Division of the International Union of Pure and Applied Chemistry and the principal lectures will be published in a special issue of *Pure and Applied Chemistry*. The symposium and the accompanying course were supported by a grant from NATO. Financial aid from the latter organization was largely responsible for the presence of many young investigators.

GEORGE S. HAMMOND
California Institute of Technology, Pasadena

Surface Physics

Investigations of chemical and physical interactions occurring at solid surfaces were reported at the second annual Surface Physics Symposium held at Washington State University, Pull-

man, 8–9 May 1964. Most of the reported work was done under ultrahigh vacuum conditions so that a variety of spurious effects could be eliminated.

The surface ionization that takes place when a solid is evaporated from a heated metal surface has been widely used for some time in sources of charged particles and in molecular beam detectors; the efficiency of this process is predicted by the Saha-Langmuir equation. This equation, which agrees with experimental results for alkaline metal evaporation, predicts that the ratio of ions to neutrals is greatest when a material with low ionization potential is evaporated from a high work function surface.

J. F. Truhlar (Washington State University) described an experiment in which heated filament-grade tungsten was found to be a source of ions of most of the alkaline metals, alkaline earths, and other substances. Previous work has shown that the ion current is a good indicator of the rate at which the surface of a filament is etched or chemically sputtered in reactive gases.

In a report on work recently completed at the Ames Laboratory of the Atomic Energy Commission, Miles J. Dresser (Washington State University) found that the Saha-Langmuir equation is grossly inadequate to predict the surface ionization efficiency for the electronically complicated rare earth atoms. The predicted ionization efficiency is incorrect both in its absolute value and in its temperature dependence. Apparently part of the problem results from the difficulty of assigning the proper statistical weights to complex atoms.

G. A. Antypas (Washington State University) is using the positive ion currents from a high purity Fe filament to study metal defects. Even with low impurity levels, easily measured ion currents are obtained and it is found that phase transformation and plastic deformation increase the positive ion current. It appears that these positive ion currents are a much more sensitive indicator of metal structure than is electron emission and that they will yield valuable information about metal defects and impurity diffusion.

E. W. Mueller (Pennsylvania State University) outlined recent advances in field ion microscopy and described a photoelectronic image intensifier which has reduced photographic exposure time by four orders of magnitude. The improved intensity permits the ultimate flickering of the atomic images to be

observed. This flickering appears to be caused by the statistical variation in the ion current which originates at a single atomic point (about 10^{-14} amperes).

E. V. Kornelsen (National Research Council of Canada) has found that when high energy, rare gas ions impinge upon tungsten monocrystals with velocities along certain preferred directions, their penetration is much greater than when a polycrystalline tungsten target is used. One can explain this by the fact that certain directions in the crystals are more open than others or that elastic vibrations can be more easily excited by particles traveling in a preferred direction. In addition to this, a fraction of a percent of the ions exhibit unusually long paths in monocrystals. These ions do not seem to be governed by normal stopping power laws; the mechanism of penetration is unknown.

Several conjectures were made to explain this unexpected result. One possibility is that the ions create phonon waves which then carry the ions for great distances with no energy loss. Another suggestion is that the projectile ions are channeled so that they tend not to lose energy to the lattice but interact only with free electrons. When the energy of the ion has been decreased to less than 15 ev, the ion may be neutralized and energetically cannot again become charged. When the energy of the atom has further decreased to several ev, the neutral atom may then exhibit a Ramsauer interaction in which it appears almost transparent to the free electrons of the metal and travels a great distance with no further energy loss.

Investigation of the adsorption of activated gases is beginning to yield information on the activated states responsible for adsorption or pumping. Some studies have already been completed on the adsorption of gases activated by bombardment with low energy electrons. Whenever a heated filament is used as a source of bombarding electrons, an additional thermally activated absorption process, called chemical pumping, must also occur.

C. M. Bliven (General Telephone Company) has used the omegatron partial pressure analyzer to study the chemical pumping of nitrogen. Both the sticking probability and the number of molecules adsorbed depend upon the pressure. Disagreement on the measured values of these variables, which have previously been attributed to crys-

tallographic orientation, impurities, and surface preparation, may also be ascribed in part to pressure differences.

S. B. Nornes (Washington State University) was concerned with the mechanism of chemical pumping in N_2. On the basis of the measured pressure dependence, it is possible that N_2 which strikes the filament is dissociated and that the atomic nitrogen leaving the filament is adsorbed on the glass walls. Atomic nitrogen has already been found to be the important activated species when N_2 is bombarded by low energy electrons. If the precision and sensitivity of such adsorption studies can be increased, these measurements may be capable of producing fundamental data on activated states not otherwise observed.

In a public lecture Mueller described his work developing the field ionization microscope and presented a film showing electronically intensified field ion images in which the atoms of a number of metals could be seen to evaporate under the influence of high electric fields.

E. E. DONALDSON
Department of Physics,
Washington State University, Pullman

Forthcoming Events

September

29–2. American **Roentgen Ray** Soc., 65th annual, Minneapolis, Minn. (C. A. Good, Mayo Clinic, Rochester, Minn.)

30–2. **American Council on Education**, 47th annual, San Francisco, Calif. (L. Wilson, ACE, 1785 Massachusetts Ave., NW, Washington, D.C. 20006)

30–2. **Earth Sciences**, intern. conf., Cambridge, Mass. (H. G. Houghton, Dept. of Meteorology, Massachusetts Inst. of Technology, Cambridge)

30–2. **Standards Engineers** Soc., 13th annual, New York, N.Y. (SES, 170 Livingston Ave., New Providence, N.J.)

30–2. **Vacuum**, 11th natl. symp., Chicago, Ill. (G. H. Bancroft, Bendix-Balzers Vacuum, Inc., 1645 St. Paul St., Rochester, N.Y. 14621)

30–4. **Spectroscopy**, 11th intern. conf., Belgrad, Yugoslavia. (Sekretarijat, Prorodno-matematicki fukultet, Fizickochemijsky zavod Belgrad, Studeniski trg., 16, Bloc C, Yugoslavia)

October

1–2. Emission of **Electrons** from Solids, conf., Univ. of Keele, Keele, England. (Inst. of Physics and the Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

1–3. American Assoc. for **Surgery of Trauma**, Chicago, Ill. (S. R. Gaston, 18 Fort Washington Ave., New York 10022)

2–3. Council for International **Organi-**

zations of Medical Societies, 6th general assembly, Brussels, Belgium. (P. A. Messerli, 6 rue Franklin, Paris 16e, France)

2–3. **Psychotherapy of the Family,** symp., Milwaukee, Wis. (B. C. Burris, Milwaukee Psychiatric Hospital, Milwaukee 53213)

2–9. **Radiology,** 8th inter-American congr., Caracas, Venezuela. (R. Merenfeld, Apartado Postal 9362 Candelaria, Caracas)

3–4. New England Intercollegiate **Geological** Conf., Yale Univ., New Haven, Conn. (J. Rodgers, Dept. of Geology, Yale Univ., New Haven 06520)

3–4. **Medical Radiobiology,** 7th natl. congr., Pisa, Italy. (Segreteria, Inst. di Radiologia dell'Università, Spedali Riuniti de "S. Chiara," Pisa)

3–13. **Weights and Measures,** 12th conf., Paris, France. (Intern. Bureau of Weights and Measures, Pavillon de Breteuil, Sèvres, Seine-et-Oise. France)

4–9. American College of **Surgeons,** clinical congr., Chicago, Ill. (American College of Surgeons, 55 East Erie St., Chicago 60611)

5–6. **Enzyme Regulation,** 3rd intern. symp., Indianapolis, Ind. (G. Weber, Indiana Univ. School of Medicine, Indianapolis)

5–7. Association of **Medical Illustrators,** annual, Los Angeles, Calif. (C. Bridgman, Dept. of Anatomy, UCLA Center for Health Sciences, Los Angeles)

5–7. **Radiation Effects on Electronics,** natl. meeting, American Nuclear Soc., Syracuse, N.Y. (ANS, 244 East Ogden Ave., Hinsdale, Ill.)

5–8. **Clay Mineral** Soc., Univ. of Wisconsin, Madison. (M. L. Jackson, Univ. of Wisconsin College of Agriculture, Madison 6)

5–8. American **Documentation** Inst., annual, Philadelphia, Pa. (B. F. Cheydleur, Philco Corp., Willow Grove, Pa. 19090)

5–8. Research Methods and **Instrumentation,** 14th symp., Bethesda, Md. (J. B. Davis, Natl. Insts. of Health, Bethesda, Md. 20014)

5–9. **Aeronautics and Space Engineering,** Soc. of Automotive Engineers, Los Angeles, Calif. (E. V. Albert, 399 N. Sepulveda Blvd., El Segundo, Calif. 90245)

5–9. American **Public Health** Assoc., New York, N.Y. (B. F. Mattison, 1790 Broadway, New York, N.Y.)

5–10. German **Physical** Soc., Düsseldorf. (GPS, Gänsheidestr. 15a, Stuttgart, Germany)

6–8. **Analytical Chemistry in Nuclear Technology,** 8th conf., Gatlinburg, Tenn. (C. D. Susano, Oak Ridge Natl. Laboratory, P.O. Box X, Oak Ridge, Tenn.)

6–8. **Cornea,** world congr., Washington, D.C. (J. H. King, 1746 K St., NW, Washington, D.C.)

6–9. **Optical** Soc. of America, annual, New York, N.Y. (M. E. Warga, OSA, 1155 16th St., NW, Washington, D.C. 20006)

6–9. **Space Electronics,** symp., Las Vegas, Nev. (C. H. Doersam, Jr., Box 177, Port Washington, N.Y.)

6–10. Clinical and Experimental **Hypnosis,** 16th annual, Pittsburgh, Pa. (Soc. for Clinical and Experimental Hypnosis, 353 W. 57 St., New York, N.Y. 10019)

7. **California** Acad. of Sciences, San Francisco. (G. E. Lindsay, California Academy of Sciences, Golden Gate Park, San Francisco)

7–9. Structure and Functions of **Epidermal Barriers**, intern. symp., Brno, Czechoslovakia. (Zd. Vlašin, Dermatological Clinic, 53, Pekarska, Brno)

7–9. Electronic **Information Handling**, natl. conf., Pittsburgh, Pa. (A. Kent, Univ. of Pittsburgh, Pittsburgh)

7–9. Institute of **Management Sciences** (TIMS)/**Operations Research** Soc. of America (ORSA), joint natl. meeting, Minneapolis, Minn. (G. B. Davis, School of Business Administration, Univ. of Minnesota, Minneapolis)

8–10. **Agricultural Meteorology**, 6th conf., Lincoln, Nebr. (American Meteorological Soc., 45 Beacon St., Boston 8, Mass.)

9–10. **Undergraduate Courses and Curricula**, midwestern regional conf., Univ. of Kansas, Lawrence. (R. E. McNair, Assoc. of Midwest College Biology Teachers, Univ. of Kansas, Lawrence)

10. **Paleontological Research Inst.**, annual, Ithaca, N.Y. (R. S. Harris, 109 Dearborn Pl., Ithaca 14850)

11–14. American **Oil Chemists** Soc., Chicago, Ill. (C. H. Hauber, AOCS, 35 E. Wacker Dr., Chicago 60601)

11–14. International **Scientific Radio Union**/Inst. of **Electrical and Electronics Engineers**, joint meeting, Univ. of Illinois, Urbana. (E. C. Jordan, Dept. of Electrical Engineering, Univ. of Illinois, Urbana)

11–15. **Diseases of the Chest**, 8th intern. congr., Mexico City, D.F. (M. Kornfeld, American College of Chest Physicians, 112 E. Chestnut St., Chicago 11, Ill.)

11–15. **Electrochemical** Soc., Washington, D.C. (ES, 30 E. 42 St., New York, N.Y. 10017)

11–16. **Allergology**, 5th intern. congr., Madrid, Spain. (F. Lahoz, Clínica de la Concepción, Avda. Reyes Católicos 2, Madrid 3)

11–16. American Assoc. of **Medical Record Librarians**, annual, Miami Beach, Fla. (M. J. Waterstraat, RRL, 840 North Lake Shore Dr., Chicago, Ill. 60611)

11–16. Pan American Assoc. of **Ophthalmology**, 7th, Montreal, Canada. (J. W. McKinney, PAAO, 921 Exchange Bldg., Memphis, Tenn.)

11–16. American Soc. of **Plastic and Reconstructive Surgery**, annual, San Francisco, Calif. (P. P. Pickering, 2850 Sixth Ave., Suite B, San Diego, Calif.)

12–14. **Aviation Pathology**, 5th scientific session, Washington, D.C. (Secretary, Joint Committee on Aviation Pathology, Armed Forces Inst. of Pathology, Washington, D.C. 20305)

12–14. **Entry Technology**, American Inst. of Aeronautics and Astronautics conf., Williamsburg, and NASA-Langley Research Center, Va. (S. P. Johnston, AIAA, 1290 Sixth Ave., New York, N.Y.)

12–14. Protection Against **Radiations** in Space, 2nd symp., Gatlinburg, Tenn. (F. C. Maienschein, Oak Ridge Natl. Laboratory, P.O. Box X, Oak Ridge, Tenn.)

12–15. **Instrument** Soc. of America, 19th **Instrument-Automation** conf., New York, N.Y. (ISA, 530 William Penn Pl., Pittsburgh, Pa. 15219)

13–15. Air Force **Science and Engineering**, 11th symp., Brooks Air Force Base, Tex. (G. E. Schafer, Headquarters Aerospace Medical Div., Brooks AFB)

13–16. **Calorimetry**, 19th conf., Washington, D.C. (W. N. Hubbard, Argonne Natl. Laboratory, 9700 S. Cass Ave., Argonne, Ill.)

13–16. **Lubrication**, 1st intern. conf., American Soc. of Mechanical Engineers/ American Soc. of Lubrication Engineers, Washington, D.C. (W. J. Anderson, MS 6-1, NASA-Lewis Research Center, 21000 Brookpark Rd., Cleveland, Ohio)

13–17. **Electron Microscopy** Soc. of America, 22nd annual, Detroit, Mich. (A. R. Taylor, Virus Div., Parke, Davis & Co., Detroit 32)

14–15. American Soc. of **Tool and Manufacturing Engineers**, Minneapolis, Minn. (R. E. Gariss, 6523 El Pulcro St., Long Beach, Calif.)

14–16. **Gaseous Electronics**, 7th conf., Atlantic City, N.J. (S. Schneider, U.S. Army Electronics R&D Laboratories, Fort Monmouth, N.J. 07703)

14–16. **Parenteral Drug** Assoc., annual conv., New York, N.Y. (PDA, Broad and Chestnut Sts., Philadelphia 7, Pa.)

14–16. **Remote Sensing of Environment**, 3rd symp., Ann Arbor, Mich. (D. C. Parker, Univ. of Michigan, Box 618, Ann Arbor 48107)

14–16. **Sonics and Ultrasonics**, symp., Santa Monica, Calif. (A. H. Meitzler, Bell Telephone Labs., Inc., Murray Hill, N.J.)

15–16. **Bioenergetics**, symp., Univ. of Western Ontario, London, Ontario, Canada. (K. P. Strickland, Dept. of Biochemistry, Faculty of Medicine, Univ. of Western Ontario, London)

15–16. **Systems Science**, first annual conf., Inst. of Electrical and Electronics Engineers, Univ. of Pennsylvania, Philadelphia. (H. G. Sparks, Moore School of Engineering, Univ. of Pennsylvania, Philadelphia)

15–17. **Correlation of Particles** Emitted in Nuclear Reactions, intern. conf., Gatlinburg, Tenn. (A. Zucker, Oak Ridge Natl. Laboratory, P.O. Box X, Oak Ridge, Tenn. 37830)

15–17. Central **Neuropsychiatric** Assoc., Denver, Colo. (W. P. Shelton, 8215 Westchester Dr., Dallas 25, Tex.)

15–22. Association of **American Medical Colleges**, 75th annual, Denver, Colo. (P. J. Sanazaro, Div. of Education, Assoc. of American Medical Colleges, 2530 Ridge Ave., Evanston, Ill. 60201)

16–17. Western **Industrial Medical** Assoc., Los Angeles, Calif. (C. Einert, 2151 Berkeley Way, Berkeley 4, Calif.)

16–17. **Systemics**, 11th annual symp., St. Louis, Mo. (H. C. Cutler, Missouri Botanical Garden, St. Louis)

16–20. American **Medical Women's** Assoc., New York, N.Y. (M. A. Sears, Anderson Hospital, Houston 25, Tex.)

16–24. American Soc. of **Clinical Pathologists**, annual, Bal Harbor, Fla. (ASCP, 445 N. Lake Shore Dr., Chicago, Ill.)

17–18. Society for **Psychophysiological Research**, 4th annual, Washington, D.C. (L. A. Gustafson, SPR, 74 Fenwood Rd., Boston, Mass. 02115)

17–20. College of American **Pathologists**, Bal Harbor, Fla. (E. E. Simard, Box 136, Salinas, Calif.)

17–25. International **Aeronautic** Federation, general conf., Tel Aviv, Israel. (M. J. Randleman, Natl. Aeronautic Assoc., 1025 Connecticut Ave., NW, Washington, D.C. 20036)

18–21. Association of **Military Surgeons** of the U.S., Washington, D.C. (Brig. Gen. F. E. Wilson, Suite 132, 1500 Massachusetts Ave., NW, Washington, D.C. 20005)

18–22. **Metallurgical** Soc., fall meeting, Philadelphia, Pa. (D. A. Parks, Inst. of Metals Div., Metallurgical Soc. of AIME, 345 E. 47 St., New York, N.Y. 10017)

18–23. American Acad. of **Ophthalmology and Otolaryngology**, Chicago, Ill. (W. L. Benedict 15 Second St., SW, Rochester, Minn. 55901)

18–24. **Dental Education**, 2nd Latin American seminar, Mexico City. (D. Restrepo, Pan American Sanitary Bureau, 1501 New Hampshire Ave., NW, Washington, D.C. 20036)

19–20. **Unconventional Inertial Sensors**, symp. (secret), Farmingdale, N.Y. (R. E. McIntyre, RMG-8, Bureau of Naval Weapons, Washington 25, D.C.)

19–21. **Mechanisms**, conf., American Soc. of Mechanical Engineers, Lafayette, Ind. (T. P. Goodman, Technological Inst., Northwestern Univ., Evanston, Ill.)

19–21. Academy of **Psychosomatic Medicine**, New York, N.Y. (R. N. Rutherford, 200 Broadway, Seattle, Wash.)

19–21. Technical Assoc. of the **Pulp and Paper Industry**, plastics-paper conf., Washington, D.C. (TAPPI, 360 Lexington Ave., New York 10017)

19–22. Association of Official **Agricultural Chemists**, 78th annual, Washington, D.C. (L. G. Ensminger, AOAC, Box 540, Benjamin Franklin Station, Washington, D.C. 20044)

19–23. American Soc. of **Civil Engineers**, New York, N.Y. (W. H. Wisely, ASCE, 345 E. 47 St., New York, N.Y. 10017)

19–23. American Soc. for **Metals**, Philadelphia, Pa. (A. R. Putnam, ASM, Metals Park, Ohio)

19–23. **Radiochemical Methods of Analysis**, symp., Salzburg, Austria. (Intern. Atomic Energy Agency, 11 Karntnerring, Vienna 1, Austria)

20–30. Nov. **UNESCO**, 13th session, general conf., Paris, France. (UNESCO, Place de Fontenoy, Paris 7°)

21–22. American Heart Assoc., Council on **Arteriosclerosis**, annual, Atlantic City, N.J. (D. M. Smith, AHA, 44 E. 23 St., New York, N.Y. 10010)

21–22. **Industrial Hygiene Foundation**, annual, Pittsburgh, Pa. (R. T. P. deTreville, IHF, 4400 Fifth Ave., Pittsburgh 15213)

21–23. **Aerospace and Navigational Electronics**, 11th East Coast conf., Baltimore, Md. (M. Hastings, Mail No. 1281 A, Baltimore Space and Defense Center, Westinghouse Electric Corp., P.O. Box 1693, Baltimore 21203)

21–23. **Pain**, intern. symp., Detroit, Mich. (R. S. Knighton, 2799 W. Grand Blvd., Detroit)

21–23. **Spectroscopy, Instrumentation and Chemistry**, 3rd Pacific meeting, San Francisco, Calif. (J. G. Conway, Lawrence Radiation Laboratory, Univ. of California, Berkeley 4)

21–24. **Acoustical** Soc. of America,

68th, Austin, Tex. (W. Waterfall, ASA, 335 E. 45 St., New York, N.Y. 10017)

21–25. **Cybernetics**, 4th intern. congr., Namur, Belgium. (Intern. Assoc. for Cybernetics, 13 rue Basse-Marcelle, Namur)

22–23. **New Mexico** Acad. of Science, Albuquerque. (K. S. Bergstresser, 739 42 St., Los Alamos, N.M.)

23–24. **Kentucky** Acad. of Science, Morehead. (G. Levey, College Box 2325, Berea, Ky.)

23–24. American **Physical** Soc., Chicago, Ill. (R. G. Sachs, Argonne National Laboratory, Argonne, Ill. 60440)

23–25. Association of **Clinical Scientists**, Washington, D.C. (R. P. MacFate, 300 N. State St., No. 5422, Chicago, Ill. 60610)

23–25. Experimental **Gerontology**, symp., Basel, Switzerland. (Prof. Verzar, Inst. de Gerontologie Experimentale, Nonnenweg 7, Basel, Switzerland)

24–29. American Acad. of **Pediatrics**, annual, New York, N.Y. (AAP, 1801 Hinman Ave., Evanston, Ill.)

25–31. American Soc. for **Horticultural Science**, Caribbean Region, 12th annual, Maracay, Venezuela. (E. H. Casseres, Londres 40, México 6, D.F.)

26–27. American Inst. of **Aeronautics and Astronautics**/Canadian Aeronautics and Space Inst., joint meeting, Ottawa, Ont., Canada. (P. J. Burr, AIAA, 1290 Sixth Ave., New York, N.Y. 10019)

26–27. **Combustion** Inst., western states section, fall meeting, Univ. of Utah, Salt Lake City. (Secretary, CI, 16902 Bollinger Dr., Pacific Palisades, Calif. 90272)

26–28. **Antimicrobial Agents and Chemotherapy**, 4th conf., American Soc. for Microbiology, New York, N.Y. (ASM, 115 Huron View Blvd., Ann Arbor, Mich.)

26–28. Chemical Inst. of Canada, 14th **Chemical Engineering** meeting, Hamilton, Ont. (CIC, 48 Rideau St., Ottawa 2)

26–28. Society of **Rheology**, 35th annual, Pittsburgh, Pa. (H. Markovitz, Mellon Inst., 4400 Fifth Ave., Pittsburgh 13)

26–14. Pan American **Standards** Committee, textiles seminar, Lima, Peru. (American Standards Assoc., 810 18th St., NW, Washington, D.C.)

27. Oak Ridge Inst. of **Nuclear Studies**, Oak Ridge, Tenn. (W. G. Pollard, Box 117, Oak Ridge)

27–29. Joint **Computer** Conf., San Francisco, Calif. (R. I. Tanaka, c/o Lockheed Missiles and Space Co., 3251 Hanover St., Palo Alto, Calif.)

28–30. Society of **Experimental Stress Analysis**, annual, Cleveland, Ohio. (B. E. Rossi, 21 Bridge Square, Westport, Conn.)

28–30. **Inertial Guidance Test,** 2nd symp., Holloman Air Force Base, N.M. (F. P. Ray, Holloman AFB).

28–30. **Nuclear Science**, 11th symp., Philadelphia, Pa. (U.S. Office of Aerospace Research, 4th and Independence Ave., SW, Washington, D.C.)

28–30. **Rock Mechanics**, 6th symp., Rolla, Mo. (C. Christianson, Dept. of Mining Engineering, School of Mines and Metallurgy, Univ of Missouri, Rolla)

28–30. Southeastern **Library** Assoc., 21st biennial conf., Norfolk, Va. (E. F. Jesse, c/o Armed Forces Staff College Library, Norfolk)

29–31. American Soc. for **Aesthetics**, Chicago, Ill. (J. R. Johnson, Cleveland Museum of Art, Cleveland 6, Ohio)

29–31. **Electron Devices**, Inst. of Electrical and Electronics Engineers, Washington, D.C. (M. Mass, Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.)

29–31. **Gerontological** Soc., 7th annual, Minneapolis, Minn. (GS, 660 South Euclid, St. Louis, Mo. 63110)

29–31. **Indiana** Acad. of Science. Indianapolis. (C. F. Dineen, Biology Dept., St. Mary's College, Notre Dame, Ind.)

29–31. Society of **Photographic Scientists and Engineers**, annual symp., Washington, D.C. (W. S. Dempsey, FMA, Inc., 4925 Fairmont Ave., Washington, D.C.)

29–31. Society for the **Scientific Study of Religion**, Washington, D.C. (S. Z. Klausner, SSSR, 1424 16th St., NW, Washington, D.C.)

30–1. **Meteoritical Soc.**, 27th meeting, Arizona State Univ., Tempe. (C. B. Moore, Dept. of Geochemistry, Arizona State Univ., Tempe)

November

1–7. **Plant Scientists** of Latin America, 6th meeting, Lima, Peru. (M. Paulette, Universidad Agraria, Apartado 456, Lima)

2–4. Society of **Engineering Science**, 2nd technical meeting, Michigan State Univ., East Lansing. (A. C. Eringen, School of Aeronautical and Engineering Sciences, Purdue Univ., West Lafayette, Ind. 47907)

2–6. United Nations, **Drug Supervisory** Body, 62nd session, Geneva, Switzerland. (UN, Palais des Nations, Geneva)

2–9. Natural Gas in Production of **Petrochemicals**, seminar, Teheran. (U.N. Economic Commission for Asia and the Far East, Sala Santitham, Rajadamnern Av., Bangkok, Thailand)

3–5. **Liquification** in Mine Chambers, conf., Ostrava, Czechoslovakia. (Mrs. E. Vergeinerova, Czechoslovak Scientific and Technical Soc., Siroka 5, Prague 1)

4–6. **Diffraction**, 22nd Pittsburgh conf., Pittsburgh, Pa. (W. M. Biagas, Pittsburgh Diffraction Conf., Crucible Steel Co., P.O. Box 7257, Pittsburgh 15213)

4–6. **Design of Experiments**, 10th conf., (by invitation only), Washington, D.C. (F. G. Dressel, Army Research Office-Durham, Box CM, Duke Station, Durham, N.C.)

4–6. Northeast **Electronics Research and Engineering** meeting (NEREM), Boston, Mass. (J. E. Storer, Boston Section, Inst. of Electrical and Electronics Engineers, 313 Washington St., Newton 58, Mass.)

4–6. **Manned Space Flight**, 3rd, American Inst. of Aeronautics and Astronautics, NASA Manned Spacecraft Center, Houston, Tex. (AIAA, 141 E. 44 St., New York 17)

4–7. French Soc. of **Orthopedics and Traumatology**, 39th congr., Paris. (Secretariat, Pavillon Ollier, Hôpital Cochin, 27, rue du Faubourg Saint-Jacques, Paris 14e)

5–6. U.S. Army Materiel Command, Inst. of **Environmental Sciences**, joint meeting, Aberdeen Proving Ground, Md. (A. Armstrong, 104 Bliss Lane, Glen Burnie, Md.)

5–7. **Nutrition Hygiene** Conf., Brno, Czechoslovakia. (K. Halacka, Hygiene

Section, Czechoslovak Medical Soc., Sokolska 31, Prague 2)

6–7. **Biochemistry**, 7th annual West Central States conf., State Univ. of Iowa, Iowa City. (G. F. Lata, Dept. of Biochemistry, State Univ. of Iowa, Iowa City)

7. International Acad. of **Oral Pathology**, 2nd conf., San Francisco, Calif. (J. L. Bernier, Dental School, Georgetown Univ., Washington, D.C. 20007)

7–14. International **Dental** Federation, 52nd meeting, San Francisco, Calif. (G. H. Leatherman, 35 Devonshire Pl., London, W.1)

8–14. **Switching Circuit Theory and Logical Design**, 5th annual symp., Princeton Univ., Princeton, N.J. (T. H. Crowley, Bell Telephone Laboratories, Murray Hill, N.J.)

9–11. Flexural Mechanics of **Reinforced Concrete**, intern. symp., Miami, Fla. (H. A. Sawyer, Dept. of Civil Engineering, Univ. of Florida, Gainesville)

10–11. **Quality Control**, seminar, Cleveland, Ohio. (R. C. Schultz, American Soc. of Tool and Manufacturing Engineers, 10700 Puritan Ave., Detroit 38, Mich.)

11–12. Use of **Plastics in Machine Construction**, conf., Hungary. (Hungarian Soc. of Mechanical Engineers, Szabadsag ter 17, Budapest 5)

11–13. Eastern **Analytical** symp., New York, N.Y. (M. Margoshes, Room 3, Chemistry Bldg., Natl. Bureau of Standards, Washington, D.C. 20234)

11–13. American Soc. for **Cell Biology**, Cleveland, Ohio. (D. E. Green, Inst. for Enzyme Research, 1710 University Ave., Madison 6, Wis.)

11–13. American **Concrete** Inst., fall meeting, Miami, Fla. (W. T. Eefting, 3332 Pan American Dr., Miami, Fla.)

11–14. **Models for the Perception of Speech and Visual Forms**, symp., Boston, Mass. (Symp. Committee, Data Sciences Laboratory, Air Force Cambridge Research Laboratory, Bedford, Mass. 01731)

12–13. American Soc. of **Cytology**, 12th annual, Pittsburgh, Pa. (W. R. Lang, 1012 Walnut St., Philadelphia, Pa. 19107)

12–13. **Nerve as a Tissue**, conf., Lankenau Hospital, Philadelphia, Pa. (K. Rodahl, Lankenau Hospital, Philadelphia 51)

13–15. Association of **Clinical Scientists**, 26th meeting, Washington, D.C. (R. P. MacFate, 300 N. State St., No. 5322, Chicago, Ill. 60610)

15–19. American Soc. of **Agronomy**, Crop Science Soc. of America, Soil Science Soc. of America, annual, Kansas City, Mo. (L. A. Richards, American Soc. of Agronomy, 677 S. Segoe Rd., Madison 11, Wis.)

16–18. **Bioastronautics** and the Exploration of Space, 3rd intern. symp., San Antonio, Tex. (R. Mitchell, U.S. Air Force Aerospace Medical Div., Brooks Air Force Base, Tex.)

16–18. Grain Boundaries and Surfaces in **Ceramics**, conf., Raleigh, N.C. (D. B. Stansel, Box 5125, Raleigh)

16–18. **Engineering in Medicine and Biology**, 17th annual conf., Cleveland, Ohio. (D. G. Fleming, Case Inst. of Technology, 10900 Euclid Ave., Cleveland 44106)

16–18. **Space Simulation Testing**, conf., Pasadena, Calif. (W. R. Howard, Jet Propulsion Laboratory, 4800 Oak Grove Dr., Pasadena 91103)

New Products

Recording *p*H-stat facilitates the study of reaction kinetics and stoichiometry by the precision recording of reaction curves under closely controlled conditions of temperature, mixing, and *p*H. It combines the functions of *p*H control, temperature control, reagent delivery, and mixing and volume recording into one integrated instrument. This instrument controls *p*H with a long term stability of ±0.01 *p*H by the addition of acid or base reagent from an all-glass precision displacement burette. The desired *p*H is dial selected to 0.01 *p*H over the range 0 to 14 *p*H and is maintained at this value by precise measurement and comparison through a chopper-stabilized amplifier sensitive to 0.005 *p*H. All types of electrodes can be accommodated. The temperature of the sample solution is controlled to ±0.05°C over the range 20° to 50°C by a thermoelectric module which is built into the variable-speed magnetic stirring plate. The sample beaker rests on this plate and a unit containing a thermistor probe, the delivery tubes, and the *p*H-measuring electrodes is lowered to the proper level. The thermistor element senses the temperature of the sample solution and forms the input to the temperature controller. The desired temperature is selected on a ten-turn potentiometer. Volume added is recorded with an accuracy of ±0.1 percent of capacity on a chart whose 250-mm axis may be made to represent from 0.05 ml to 10 ml. Burette systems of 0.25, 2.5, or 10 ml may be used and a five-to-one drive reduction selector permits recording of ⅕ burette over full scale. Time is recorded on the other axis of a chart graduated in 1-inch and 0.1-inch divisions. There is a three-speed electrical switching mechanism.—D.J.P. (E. H Sargent & Co., 4647 W. Foster Ave., Chicago, Ill.)

Circle 1 on Readers' Service card

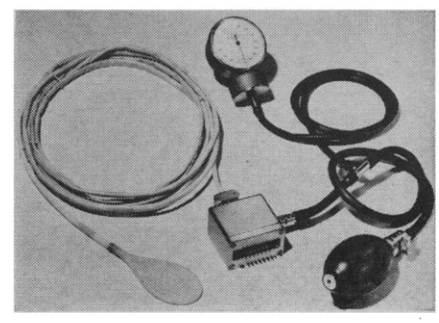
Null balance micromanometer for testing and calibration of laboratory instrument is designed to be a primary standard of high accuracy and sensitivity for the calibration and testing of low-pressure or vacuum gages, draft gages, inclined manometers, and low-pressure diaphragm or bellows controls. The micromanometer operates on the "null balance" principle in which a known pressure value is balanced against the reading to be measured, allowing the reading to be made at a zero reference point. No correction for fluid displacement is required, so that the instrument reads directly to 0.001 inch of water pressure. It may be used to read pressure at below atmospheric as well as differential pressures in systems operating at static pressures up to 20 lb/in.^{2} (gage). Range is 10 or 20 inches and maximum operating pressure is 20 lb/in.^{2} (gage). Scale gradations read inches and tenths on the main scale; hundredths and thousandths on the micrometer dial. The manometer is supplied with a concentrate for making an indicating fluid of low surface tension; a magnifier for reading the indicating-fluid meniscus; and a mercury thermometer.—D.J.P. (Meriam Instrument Co., 10920 Madison Ave., Cleveland, Ohio 44102)

Circle 2 on Readers' Service card

Bench-top centrifuge is designed to provide the capacity and versatility of larger cabinet models in a relatively compact instrument. Measuring 17 inches high by 16½ inches in diameter, and weighing 50 lb, the unit affords a convenient means for performing the Coombs test, chromosome characterization, blood-cell washing, cross matching tests, and other blood grouping procedures. The motor in the model HN International Centrifuge is a 125-watt series type capable of speeds up to 9100 rev/min. It is supported by two bearings: the lower, a sealed ball-bearing type, requires no lubrication; the upper, a sleeve-type, requires periodic lubrication. A stepless dial-controlled auto transformer provides reproducible speed control, and an electric timer can be set to automatically shut the centrifuge off after any time interval between 2 and 120 minutes. A timer cutout is incorporated into the power switch for runs longer than 120 minutes. A dynamic electric brake reduces coast-down time by 75 percent and provides smooth, even braking with no danger of resuspending packed sediments. Typical examples of volumes, speeds, and forces are: 24 × 15 ml, 3700 rev/min, 2000*g*; 8 × 50 ml, 4300 rev/min, 2460*g*; and 4 × 100 ml. 2700 rev/min, 1520*g*. The most notable feature of this unit is its versatility, as it accepts all popular clinical accessories as well as large-volume accessories. Ten horizontal swinging heads, eleven high-speed angle heads, and four micro-hematocrit kits are available. When combined with the numerous shields, trunion rings, and adaptors, literally hundreds of accessory combinations can be assembled for a variety of routine and research applications.—D.J.P. (International Equipment Co., 300 Second Ave., Needham Heights, Mass.)

Circle 3 on Readers' Service card

Miniature GM tube (No. 308T) is used to measure phosphorus-32 tracers for detection of malignant neoplasms of the gastrointestinal tract. The detector is 1.062 inches long and has a 0.20-inch diameter. The wall thickness is 30 mg/cm^2. The manufacturer has also developed a smaller tube (No. 307) which is 0.94 inches long with a

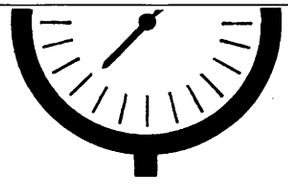


The material in this section is prepared by the following contributing writers:

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).

The information reported here is obtained from manufacturers and from other sources considered to be reliable. Neither *Science* nor the writers assume responsibility for the accuracy of the information. A Readers' Service card for use in mailing inquiries concerning the items listed is included on pages 1369 and 1491. Circle the department number of the items in which you are interested on this card.



0.11-inch diameter, which also has a 30-mg/cm^2 wall thickness. The figure shows a special probe assembly using a string of eight 307's to simultaneously monitor different sections of the gastrointestinal tract. Either the 307 or 308T may be covered with polyvinyl chloride tubing and supplied with 6-ft leads.—R.L.B. (Lionel Electronic Laboratories, Hoffman Place, Hillside, N.J.)

Circle 4 on Readers' Service card

Vacuum evaporator for electron microscope specimen preparation measures 29 by 54 by 15½ inches front-to-back. All operating controls are out in front, for optimum convenience in day-to-day use. Vacuum of 2 by 10^{-5} mm-Hg is achieved in only 10 to 15 minutes. Carbon and metal evaporation can be carried out successively on the same specimen. For shadowing, a strip of suitable metal foil is wound around the tungsten electrodes. The system comes complete with specimen-holder, carbon-rod and tungsten-filament electrodes, cylindrical bell jar, high-vacuum system, and all essential auxiliary equipment, and requires 2.2 kw at 230 volts 50/60-cycles, single-phase. Two accessories available for the evaporator are a specimen-heating furnace, to heat-treat specimens to 800°C in vacuum or inert gas, and a refrigerant reservoir, for making evaporation replicas of biological specimens, low molecular-weight polymers, and other heat-sensitive materials.—R.L.B. (Fisher Scientific Co., 415 Fisher Bldg., Pittsburgh, Pa. 15219)

Circle 5 on Readers' Service card

Laboratory balance with a capacity of 1000 g has a precision of 0.05 g and a linearity of 0.10 g. A direct-reading optical scale has graduations to 100 g and is readable to 0.1 g by means of a vernier. Weighings in excess of 100 g are made by using external weights which are manipulated between a rack and a balance pan. Each of nine 100-g weights can be rolled from the rack onto the pan to obtain the proper reading on the optical scale. This pan is then cleared by merely lifting it up. Net weight of materials in containers, and additive weighings are performed by using the built-in tare control on the front panel. This control provides 200 g of tare capacity with additional capacity available by use of weights on the balance pan. Oscillations are controlled by permanently adjusted magnetic damping. Dimensions are 16½ by 12½ by 7½

inches. A stainless-steel pan, 6 inches in diameter, is standard, but a plate 6 inches in diameter, a 12- by 6-inch stainless-steel scoop, and an aluminum subject box (9 inches in diameter by 5 inches deep) are available as accessories. The balance pan is 5¼ by 4¼ inches.—D.J.P. (Ohaus Scale Corp., 1052 Commerce Ave., Union, N.J.)

Circle 6 on Readers' Service card

Automatic burette (series BH) is an all-glass gravity instrument which permits the performance of rapid and accurate titrations. The burette consists of two parts connected by a standard taper joint. The calibrated upper part is available in 10-, 25-, and 50-ml sizes to meet various requirements. The "H" shaped bottom part contains a Teflon needle valve and three solenoid shut-off valves. The iron cores are fused into the glass poppets so that the titrant contacts only glass. The color-coded coils are epoxy potted and operate on 115 volts a-c. The key to the performance of the burette is the presence of two independently controlled delivery channels, one delivering at a fast rate, the other adjustable down to very slow rates. Fast cycle times are possible with the push-button (semiautomatic) refill and automatic zero.—R.L.B. (Luft Instrument, Inc., Old Winter St., Lincoln, Mass.)

Circle 7 on Readers' Service card

Reflectance accessory for Beckman DB Ultraviolet Spectrophotometers for the complete measurement of color converts the DB into a double-beam recording spectroreflectometer for reflectance determinations, transmittance analyses, and tristimulus measurements of color. The accessory measures color intensity, composition, and the reflectivity of surfaces. When used with a recorder, it permits the running of color measurement curves at low cost. Utilizing an integrating sphere for the measurement of diffuse reflectance, the accessory is effective throughout the visible operating range (380 mμ to 720 mμ). It is extremely useful for minimizing the effects of turbidity and for decreasing the effects of light scattering in the measurement of sample transmission. Industries which have wide applications for spectral color measurements include those involved with the production of food, plastics, leather, paint, tile, textiles, and paper.—R.L.B. (Beckman Instruments, Inc., 2500 Harbor Blvd., Fullerton, Calif.)

Circle 8 on Readers' Service card

NEW BOOKS

(Continued from page 1426)

Communications in Space. From wireless to satellite relay. Orrin E. Dunlap, Jr. Harper and Row, New York, ed. 2, 1964. 272 pp. Illus. $5.95.

The Counter-Revolution of Science. Studies on the abuse of reason. F. A. Hayek. Free Press of Glencoe (Macmillan), New York, (© 1955), 1964. 255 pp. Paper, $1.95.

Creation Still Goes On. F. L. Boschke. Translated from the German, (Wien, 1962) by L. Parks. McGraw-Hill, New York, 1964. 256 pp. Illus. $7.95.

The Crisis in Medical Education. Lester J. Evans. Univ. of Michigan Press, Ann Arbor, 1964. 109 pp. Illus. $4.

Darwin of the Beagle. Bern Dibner. Blaisdell (Ginn), New York, ed. 2, 1964. 155 pp. Illus. Paper, $1.95.

Decimals and Percentage. Betty K. Friel. Doubleday, Garden City, N.Y., 1964. 518 pp. Illus. $5.95.

Educating Tomorrow's Doctors. Milton J. Horowitz. Appleton-Century-Crofts, New York, 1964. 282 pp. $5.50.

Educators Guide to Free Films. Mary Foley Horkheimer and John W. Diffor, Eds. Educators Progress Service, Randolph, Wis., ed. 24, 1964 647 pp. Paper, $9.

Educators Guide to Free Filmstrips. Compiled and edited by Mary Foley Horkheimer and John W. Diffor. Educators Progress Service, Randolph, Wis., ed. 16, 1964. 158 pp. Paper, $6.

Electron Tubes at Work. James B. Owens and Paul Sanborn. Doubleday, Garden City, N.Y., 1964. 571 pp. Illus. $6.95.

Engineers, Inventors, and Workers. P. W. Kingsford. St. Martin's Press, New York, 1964. 272 pp. Illus. $4.95.

The Expectant Father. George Schaefer and Milton L. Zisowitz. Simon and Schuster, New York, 1964. 157 pp. Illus. $3.95.

Experiments and Considerations Touching Colours. Robert Boyle. Marie Boas Hall, Ed. Johnson Reprint, New York, 1964 (facsimile of the 1664 edition). 481 pp. Illus. $12.50.

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