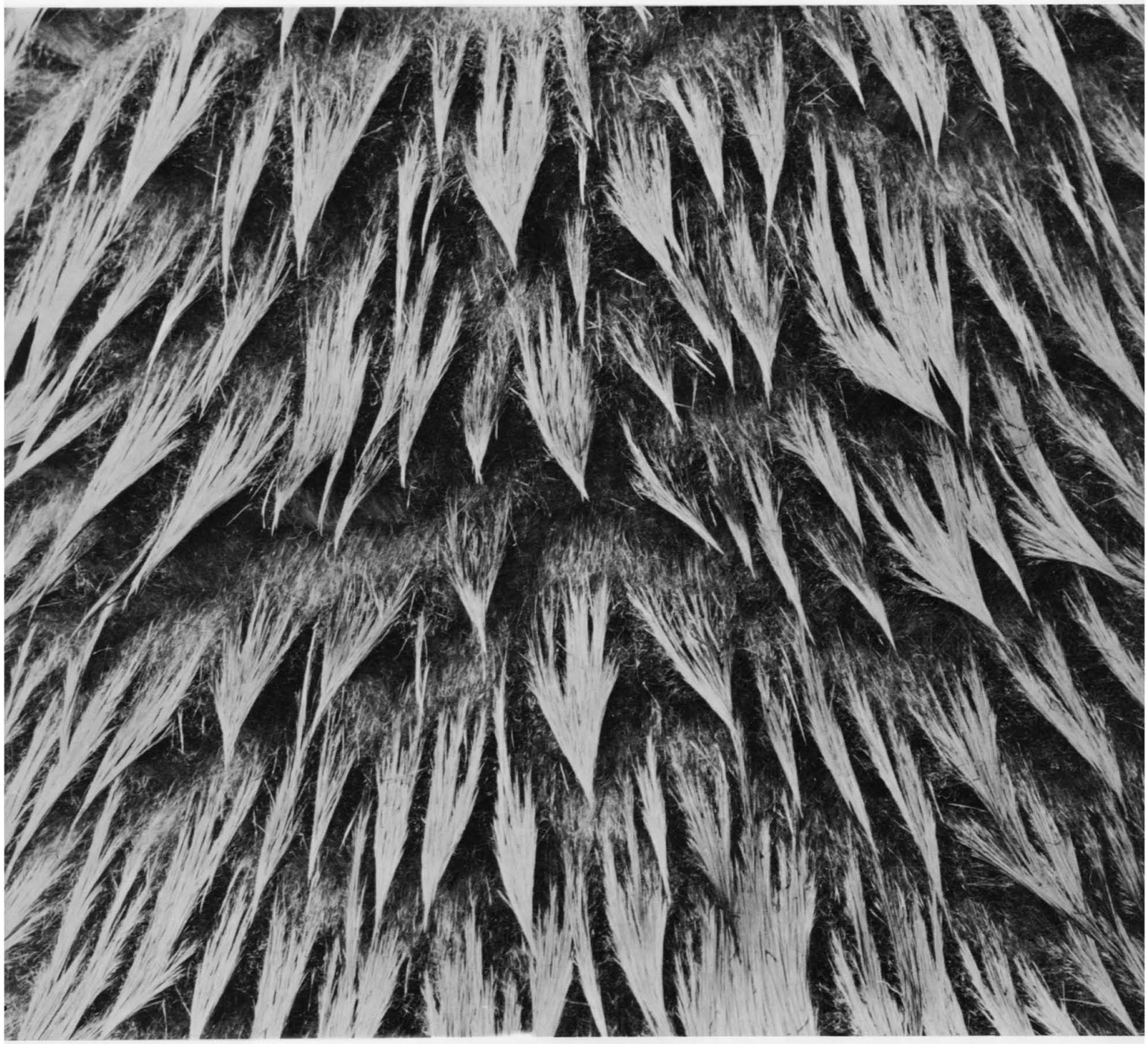
SCIENCE

11 May 1962

Vol. 136, No. 3515

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



Book Issue

A phenomenon of the twentieth century. In every field of science, in every line of business, in every nook and cranny of our society—data is multiplying. Where once an atomic physicist might contend with six variables . . . today he has sixty. Where once a businessman needed a few quick facts to make a decision . . . today he more likely needs thousands. ■ This is the information explosion—a condition arising from the tremendous economic and technical progress since World War II. IBM is finding the means to harness the staggering volumes of information that have resulted. In addition to handling huge calculation tasks, computers have been developed by IBM research to sort, retrieve and communicate information. Their expanding capabilities are being felt today in such fields as automatic language translation, atomic energy, medical research and space exploration. ■ In helping to control the information explosion, IBM is providing businessmen and scientists with new tools for solving many of the complex problems of this changing world.

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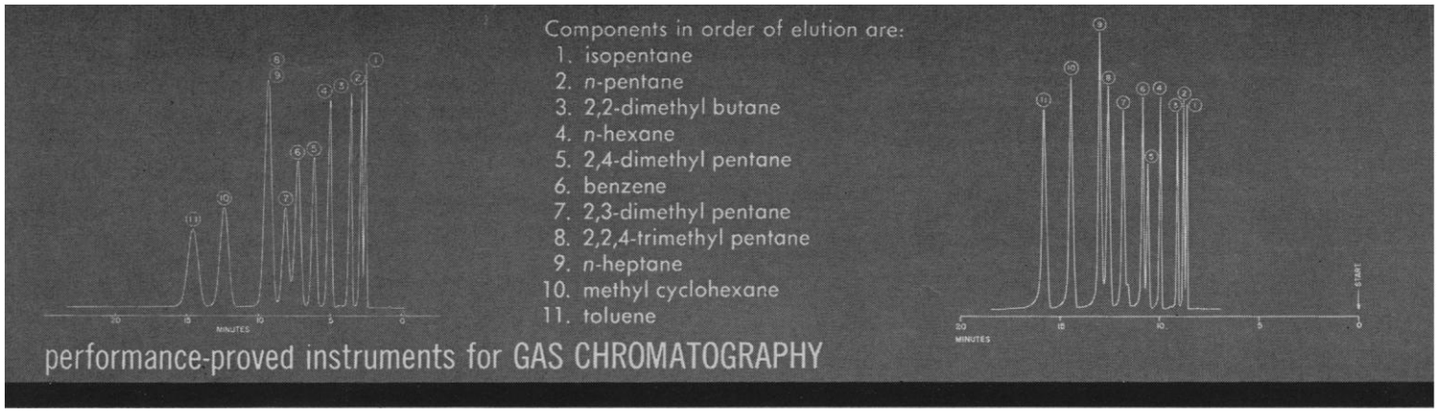

Chromatograms show (left) analysis of hydrocarbon mix on 1/4" packed column, with squalane substrate on Chromosorb-W. At right, the same 11-component mix, run on a 300-foot Large Diameter Golay column, same detector, column temperature 48°C lower. Note improved resolution, particularly on peaks 8 and 9.

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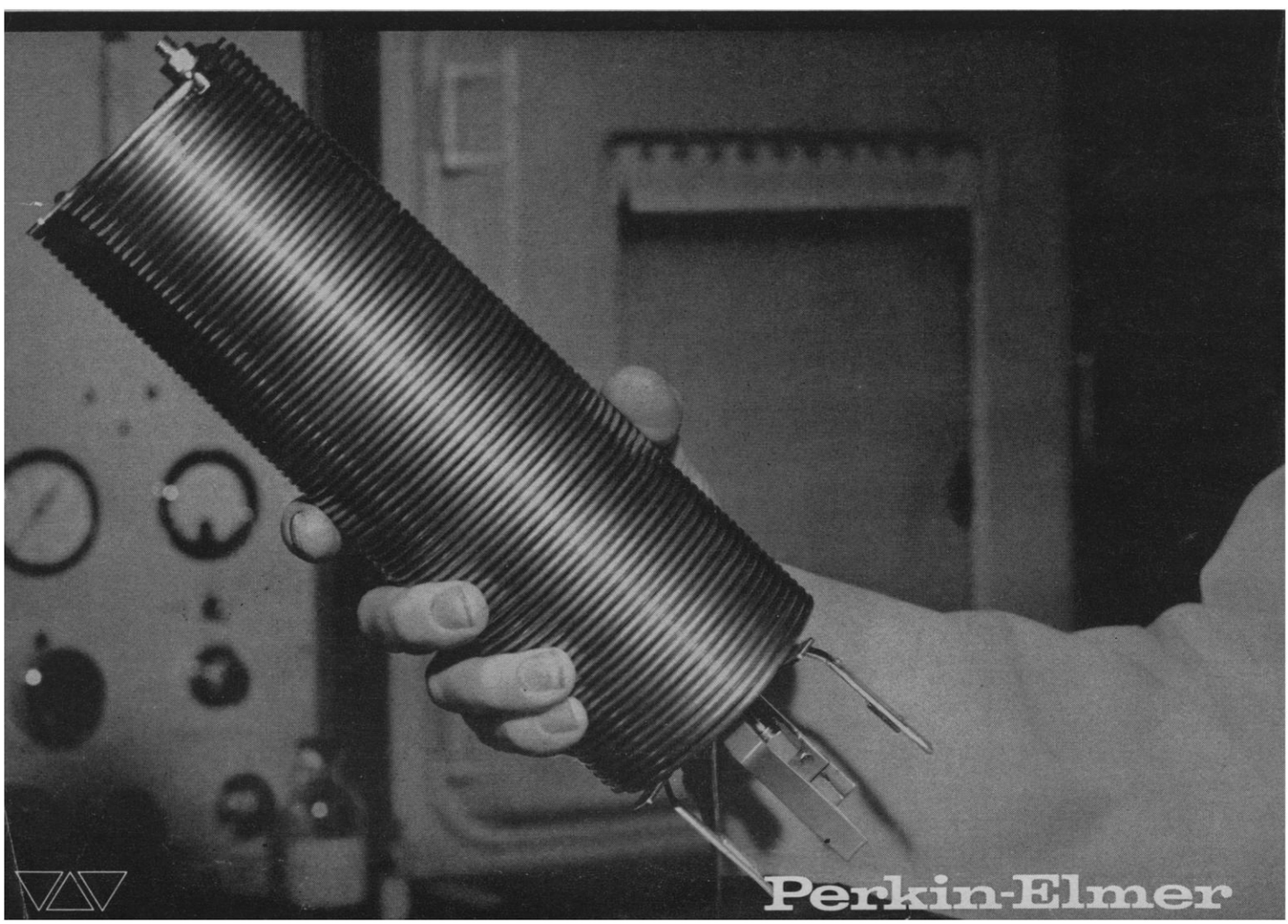

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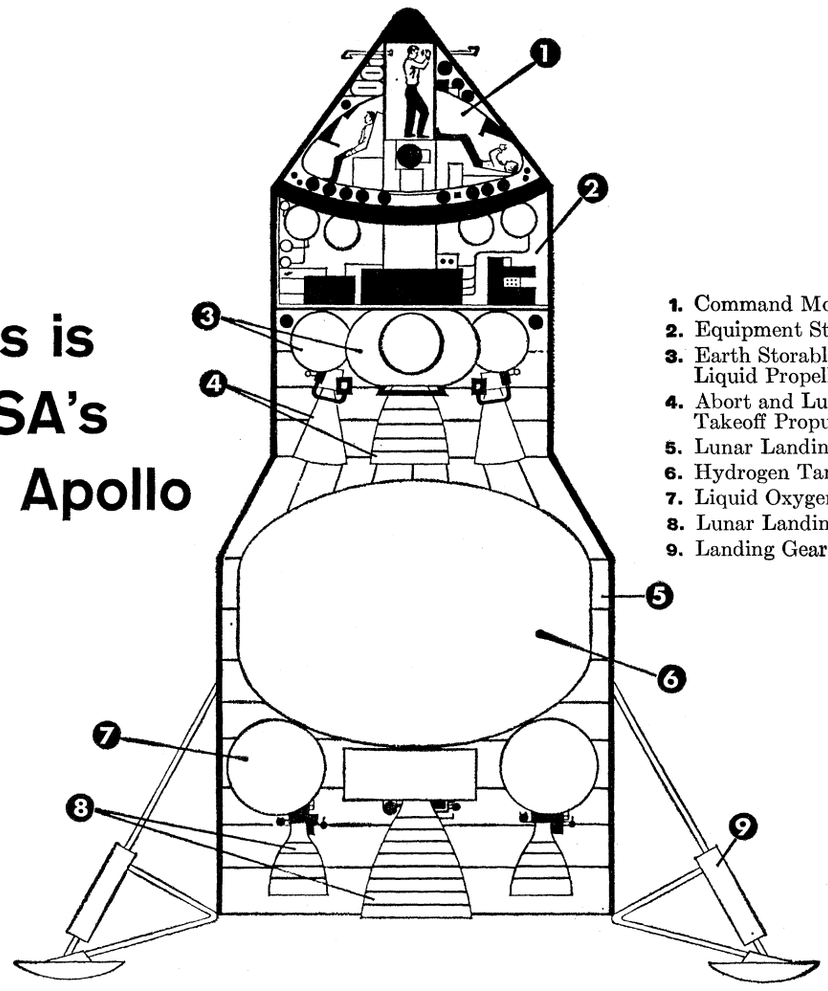
SCIENCE

This is NASA's Project Apollo



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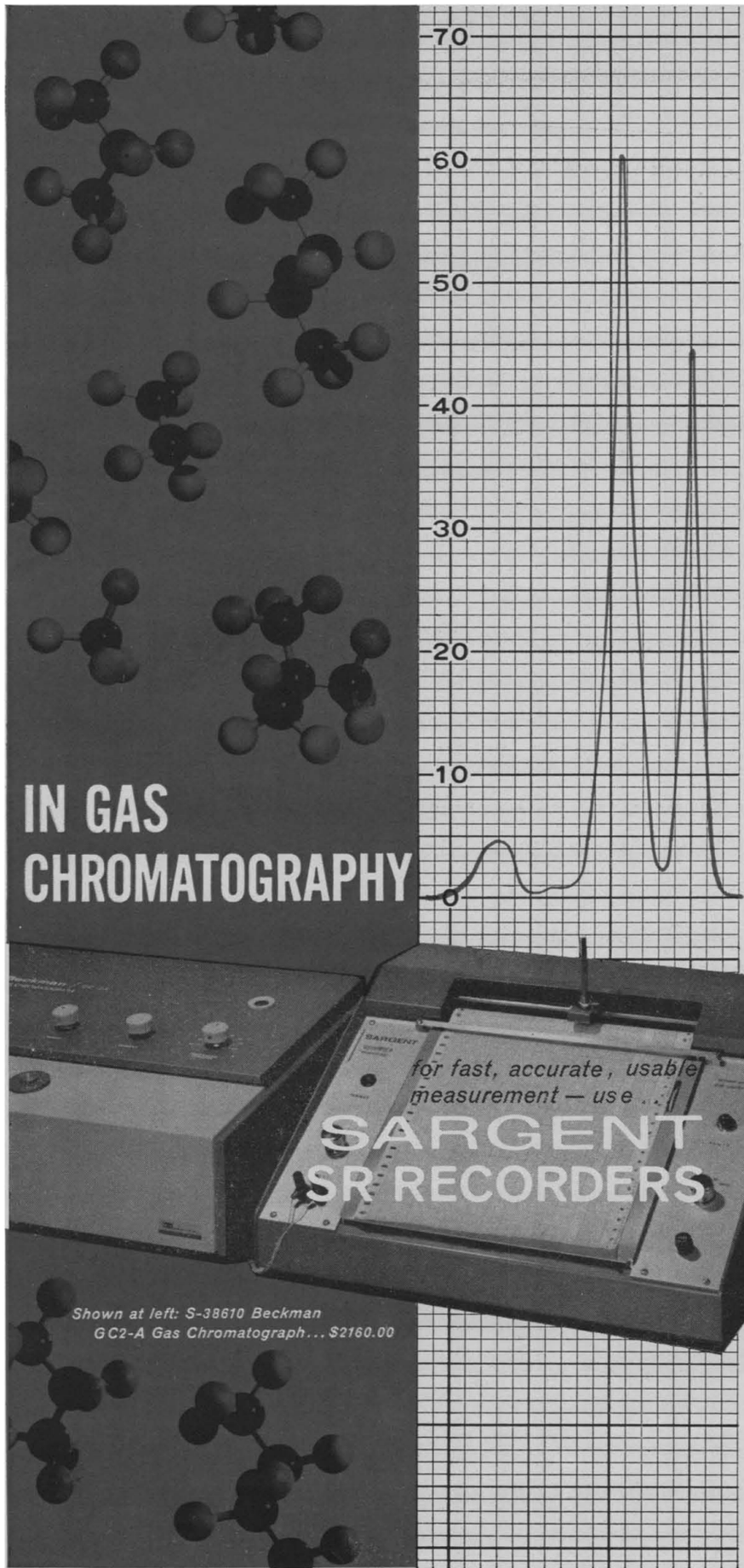

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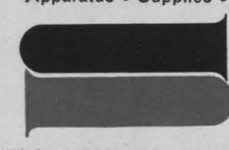

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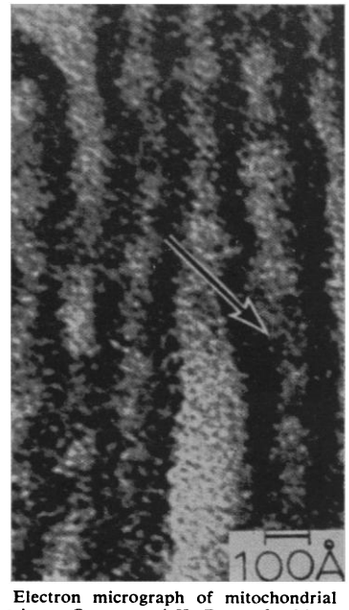

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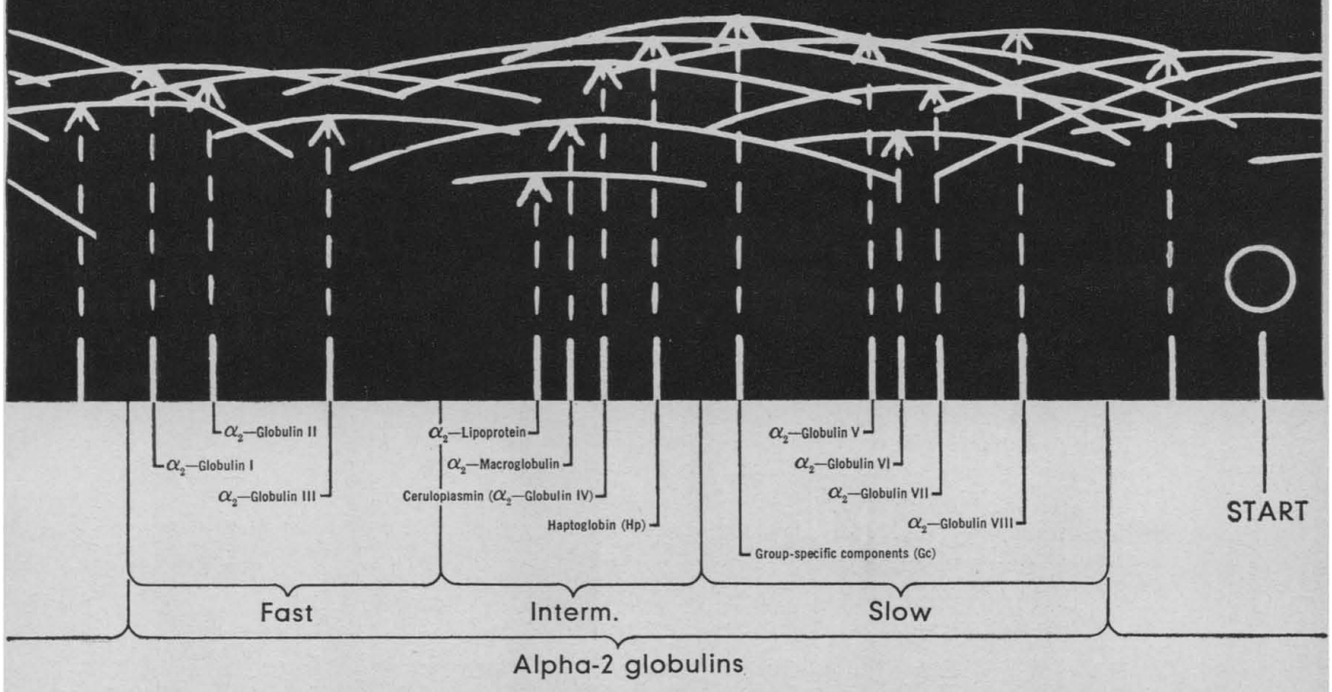

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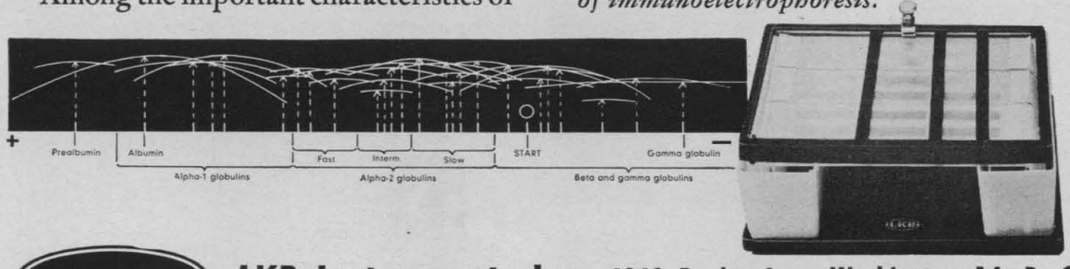

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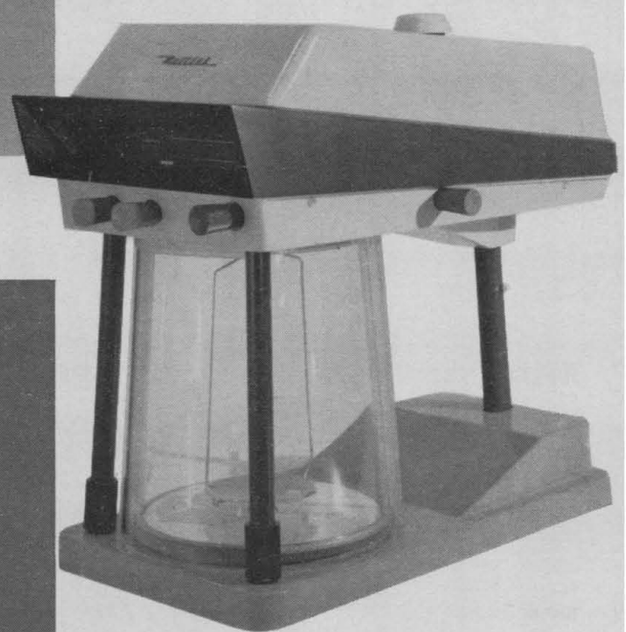

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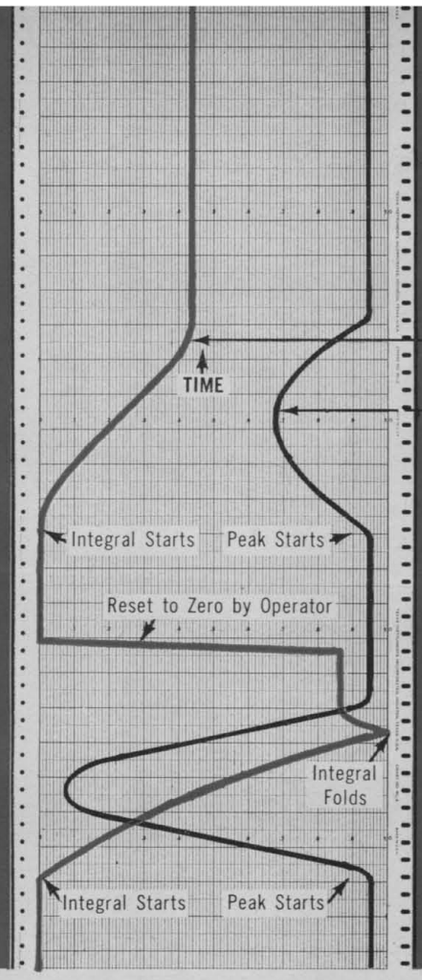

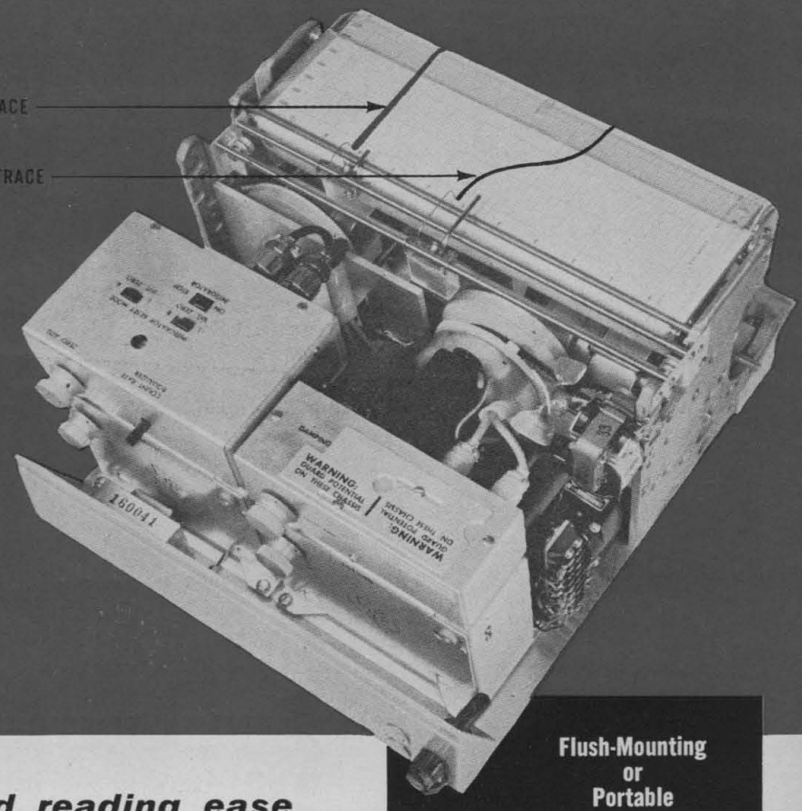

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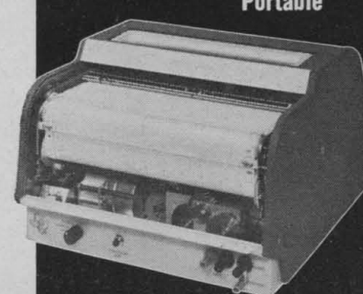

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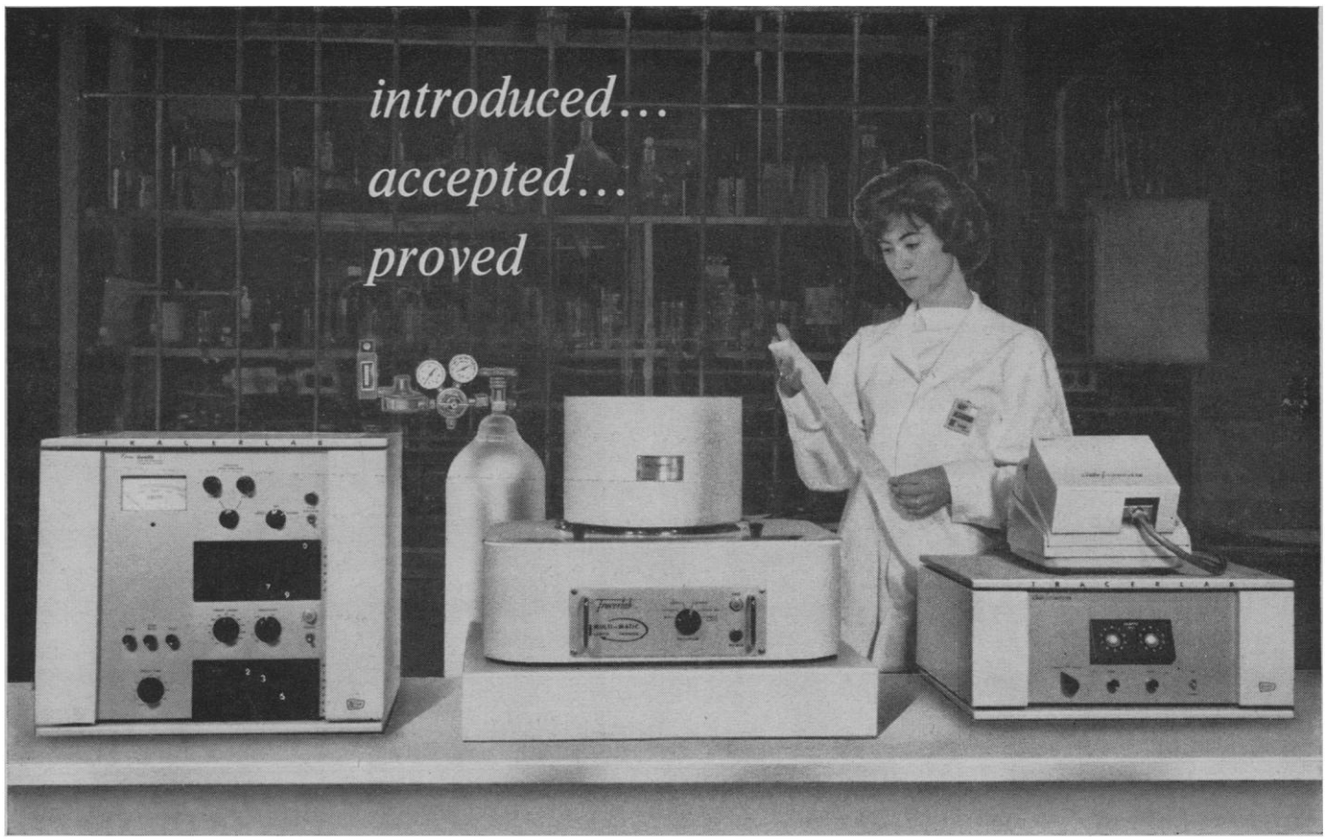

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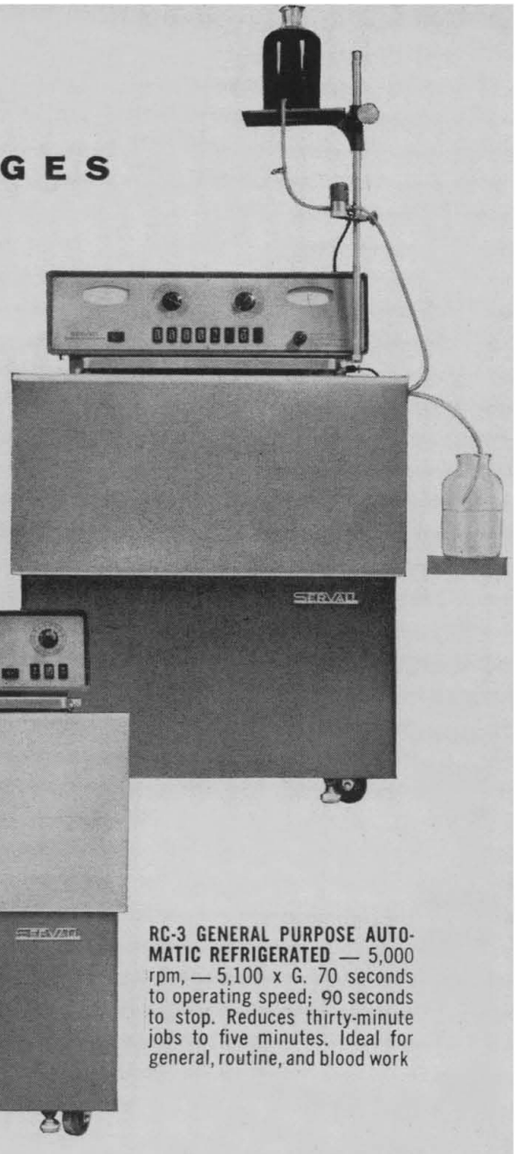

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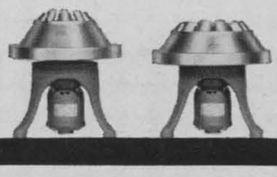

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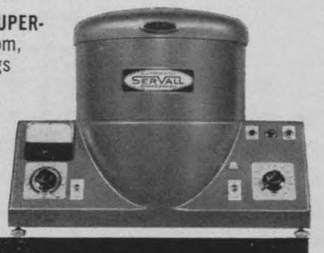

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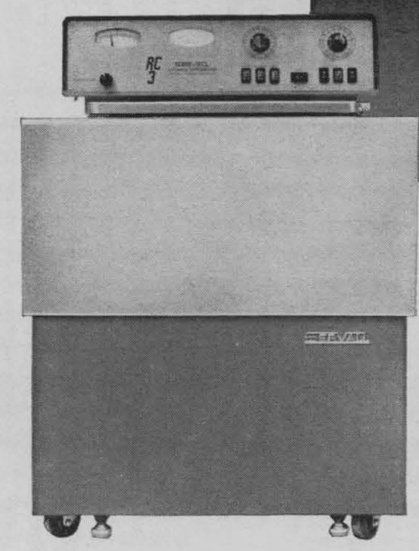

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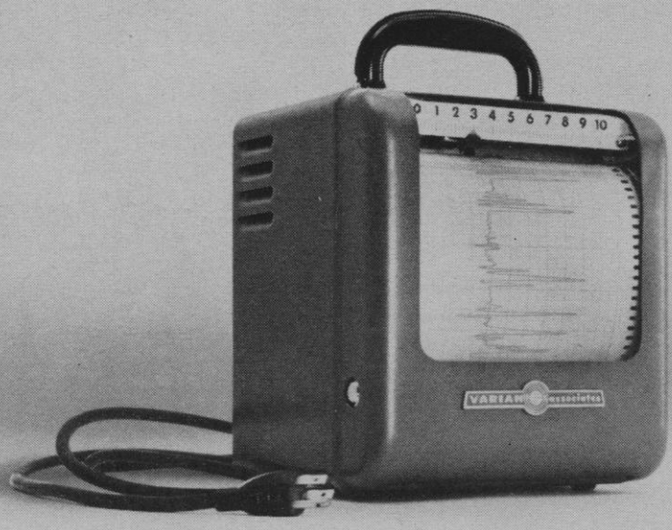

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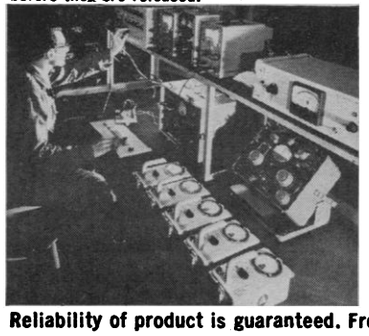

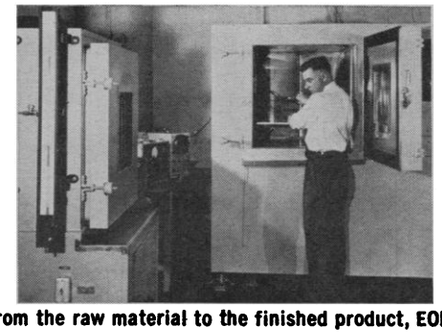

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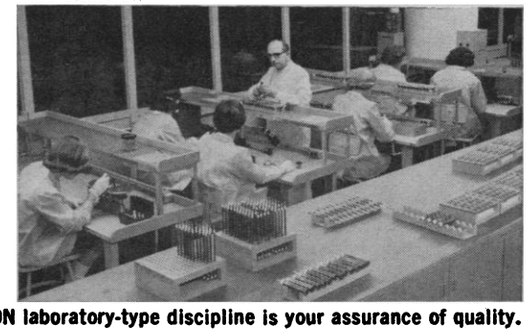

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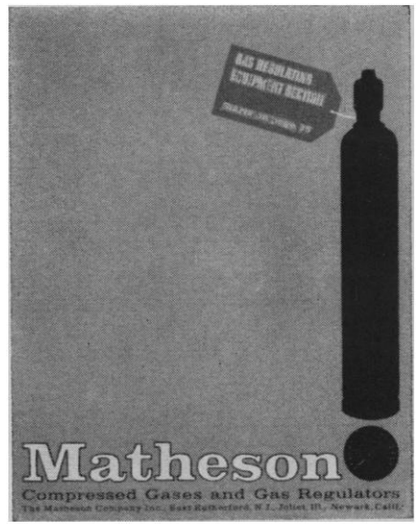

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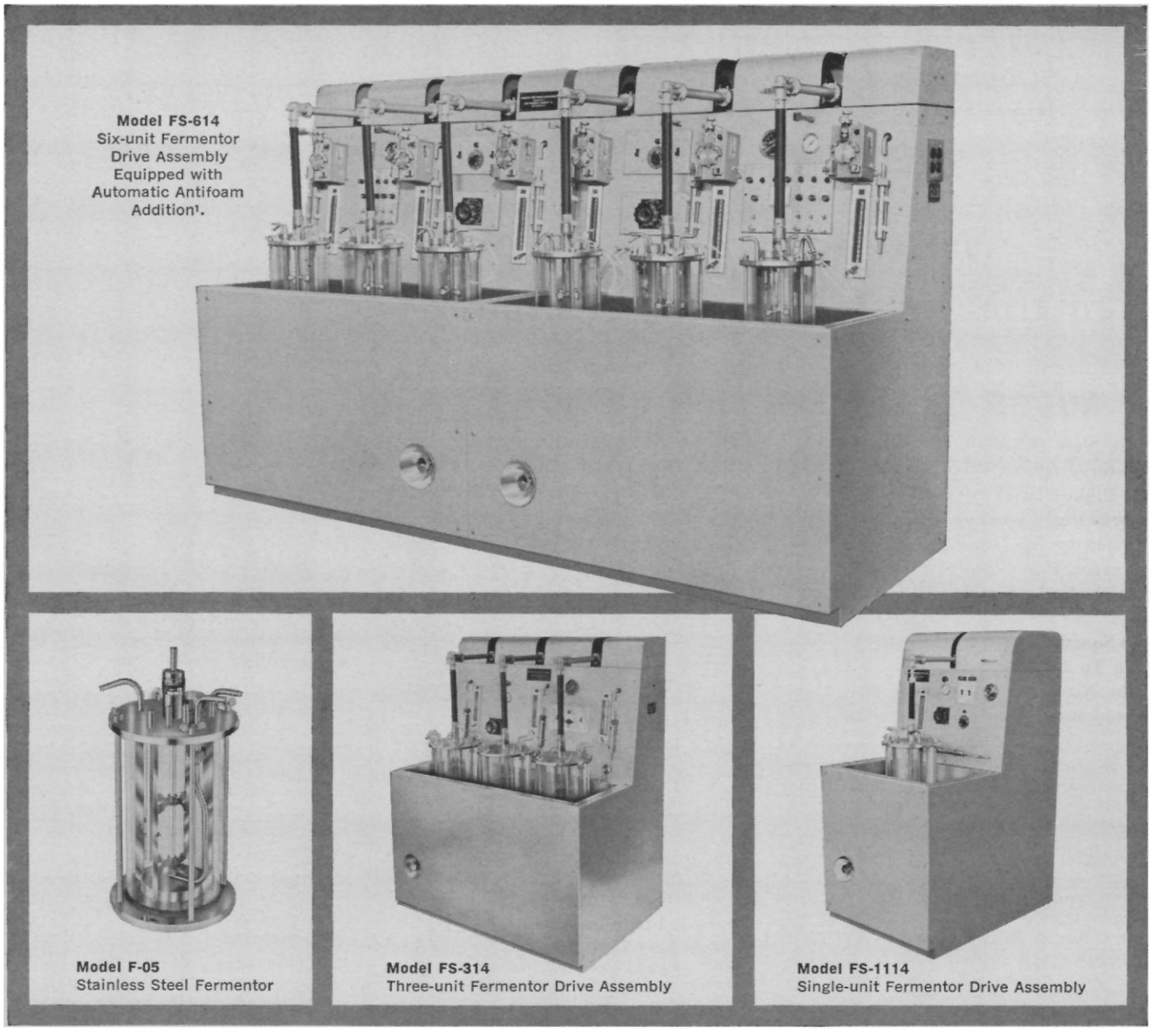

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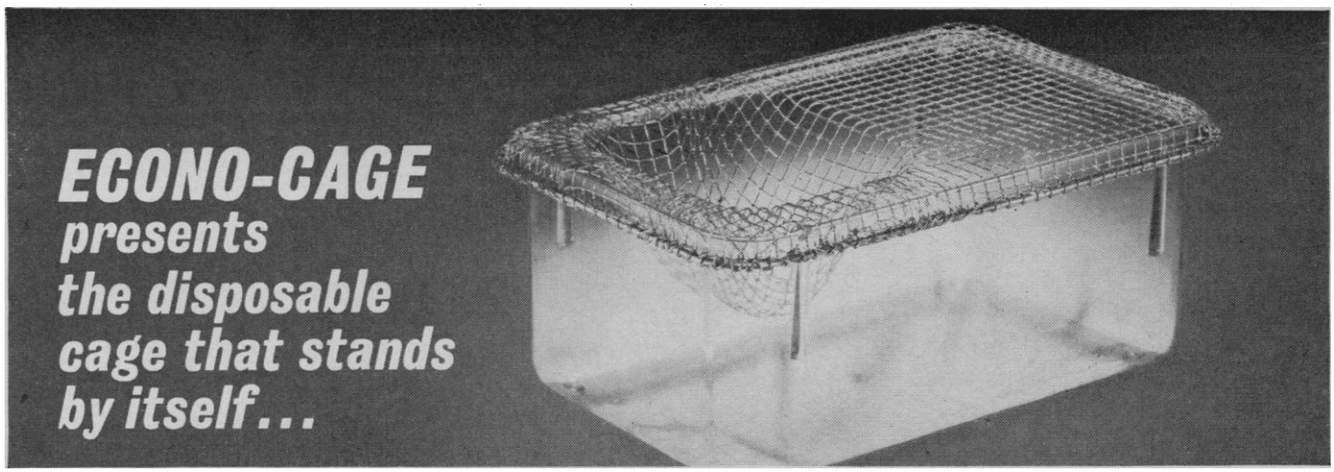

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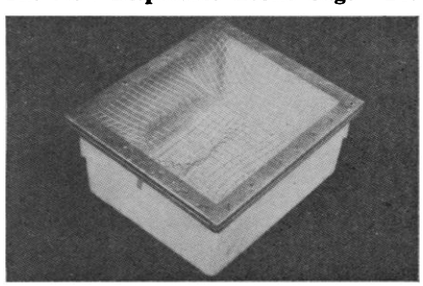

ECONO-CAGE #50 SERIES

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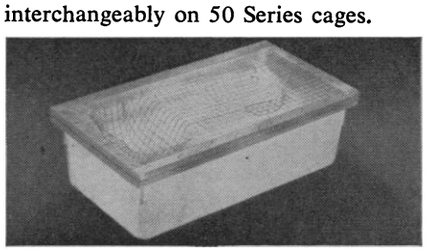
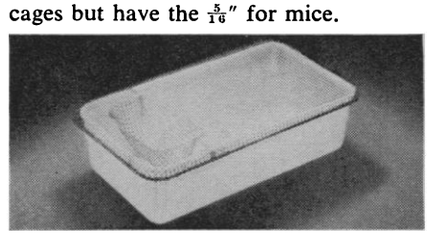


ECONO-CAGE #40 SERIES

Number 40 Series cages can be used interchangeably for Hamsters and/or rats. #43 is made of clear Acrilonitrile-Styrene-Copolymer, #44 of Linear Polyethylene and #45 of translucent Polypropylene. All 40 Series lids are standard ½" mesh designed for rat housing and fit interchangeably on all 40 Series cages. All 30 Series lids also fit all 40 Series cages but have the $\frac{5}{16}$" for mice.



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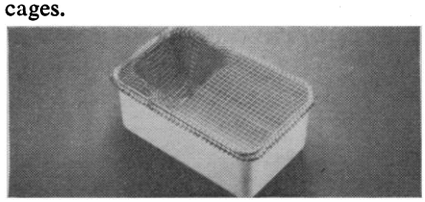
Number 30 Series cages are designed as breeding and holding cages for mice. The over-all dimensions are 19" X 10½" X 5⅛" deep. Cage #32 is made of fiberglass, reinforced by plastic. Cage #33 is made of clear Acrylonitrile-Styrene Copolymer. Cage #34 is made of linear high density Polyethylene. Cage #35 is made of Polypropylene. All 30 Series lids are interchangeable on 30 Series cages.



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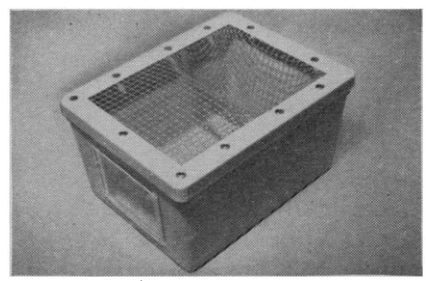
Econo-Cages in the 20 Series are designed primarily for mice. Over-all dimensions of the cages are 11½" X 7½" X 5". This cage is used for housing animals during experimentation and also as a one-to-one and two-to-one breeding cage. The cages are available in Polystyrene — new disposable Econo-Cage #21, Fiberglass, reinforced plastic — Econo-Cage #22, clear Styrene-Acrylonitrile Copolymer — Econo-Cage #23, transculent Linear Polyethylene—Econo-Cage #24, autoclavable Polypropylene—Econo-Cage #25 and Polycarbonate Resin—Econo-Cage #27. All 20 Series lids are interchangeable on 20 Series cages.



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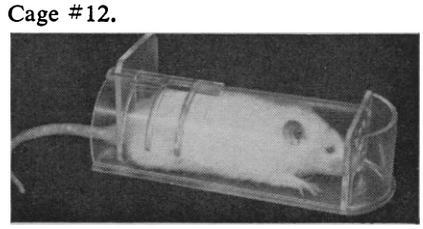
Over-all dimensions of the Econo-Cage general purpose unit are 11½" X 8" X 6" deep. This cage is designed especially for laboratories with changing animal use requirements. It can be used to house mice, Hamsters, rats and guinea pigs. Because of its versatility, it is ideal in teaching situations. The cage is available with or without windows. It is made of fiberglass reinforced polyester plastic. All #12 lids can be used on General Purpose Cage #12.



ECONO-RESTRAINING CAGES #90 SERIES

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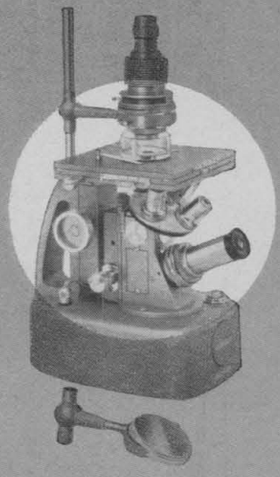

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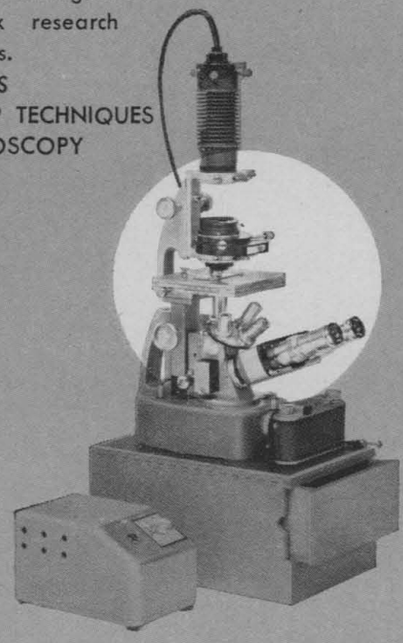

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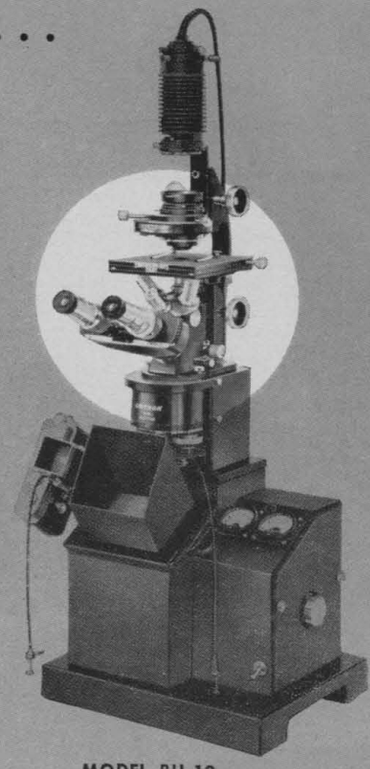

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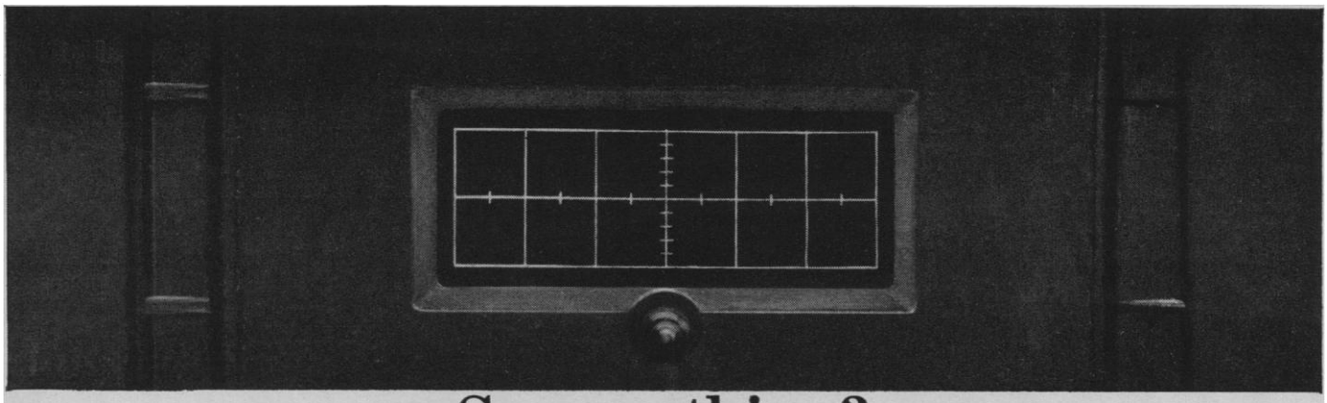

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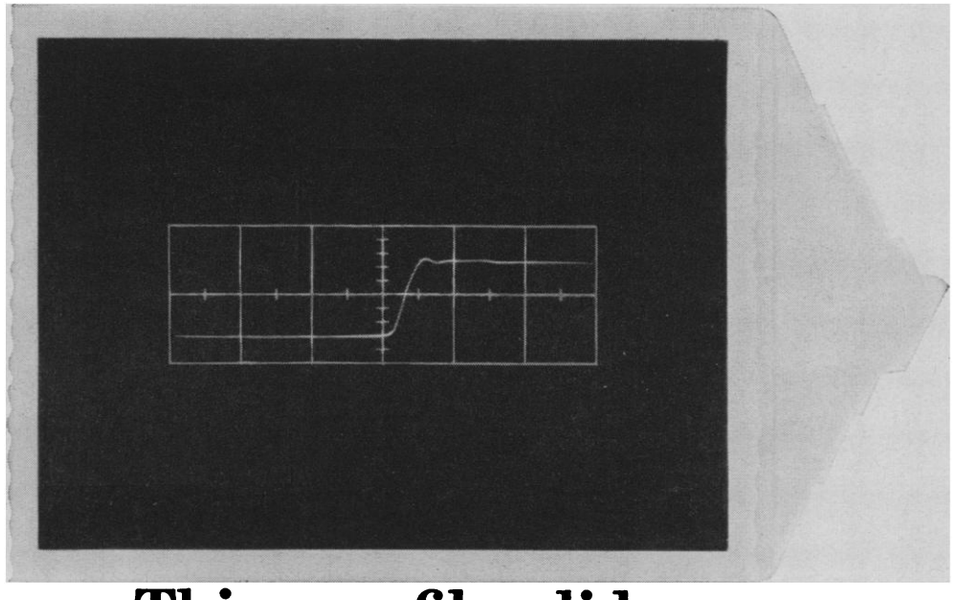

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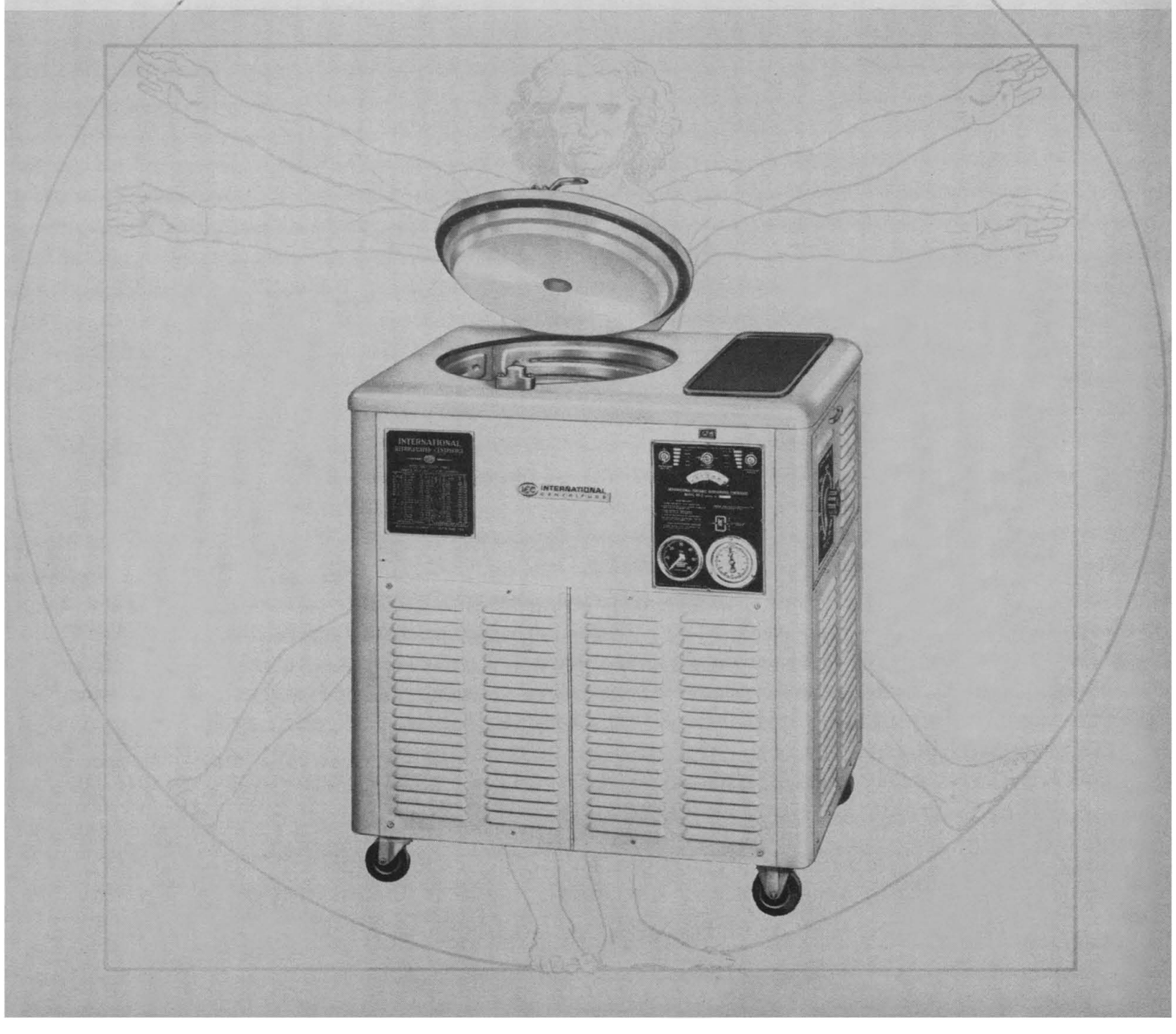

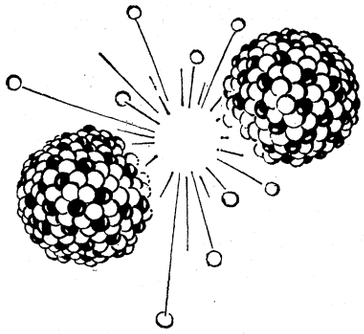

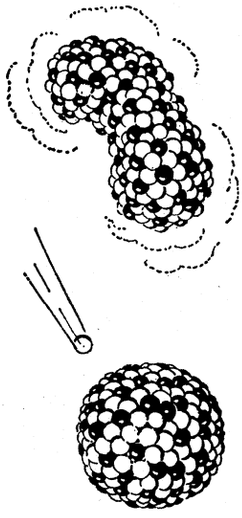

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by EUGENE ACKERMAN, Mayo Clinic, Biophysics Section. March '62, 626pp., Text price: $10.00

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by GEORGE SHORTLEY, Vice-President of Booz-Allen Applied Research, Inc., and DUDLEY WILLIAMS, The University of Ohio. Available in 1 volume: 1961, 928pp., Text price: $10.50. Available in 2 volumes: 1961, 928pp., Text price: $6.00 per vol.

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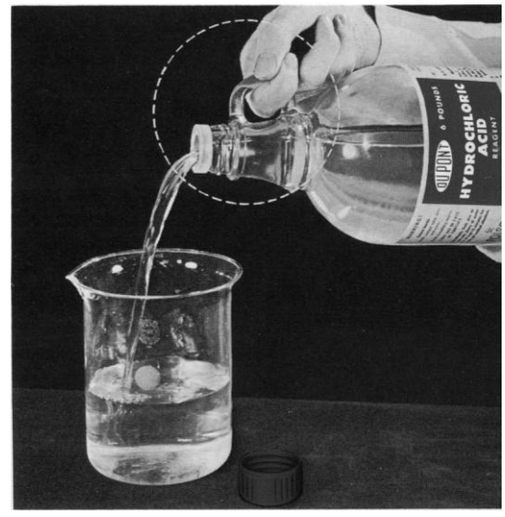

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REAGENT

GLACIAL ACETIC ACID REAGENT

Acetic Acid (CH_3COOH)	Min. 99.7%
Residue after Evaporation	Max. 0.0010%
Chlorides as Cl	Max. 0.00005%
Sulfates as SO_4	Max. 0.00005%
Iron (Fe)	Max. 0.00002%
Heavy Metals as Pb	Max. 0.00005%
Substances reducing $KMnO_4$	Pass ACS Test
Dilution Test	Pass ACS Test

HYDROCHLORIC ACID REAGENT

Hydrochloric Acid (HCl)	Min. 36.5%, Max. 38.0%
Sulfites as SO_3	Max. 0.00008%
Sulfates as SO_4	Max. 0.00008%
Free Chlorine (Cl)	Max. 0.00005%
Heavy Metals as Pb	Max. 0.00005%
Residue after Ignition	Max. 0.0004%
Iron (Fe)	Max. 0.00001%
Arsenic (As)	Max. 0.000001%
Ammonium (NH_4)	Max. 0.0003%

DUPONT
HYDROCHLORIC ACID
REAGENT

DUPONT
NITRIC ACID
REAGENT

NITRIC ACID REAGENT

Nitric Acid (HNO_3)	Min. 69.0%, Max. 71.0%
Chlorides as Cl	Max. 0.00005%
Residue after Ignition	Max. 0.0004%
Heavy Metals as Pb	Max. 0.00002%
Sulfates as SO_4	Max. 0.00008%
Iron (Fe)	Max. 0.00002%
Arsenic (As)	Max. 0.0000005%

SULFURIC ACID REAGENT

Sulfuric Acid (H_2SO_4)	Min. 95.0%, Max. 98.0%
Nitrate (NO_3)	Max. 0.00005%
Chloride as Cl	Max. 0.00002%
Ammonium as NH_4	Max. 0.0001%
Residue after Ignition	Max. 0.0004%
Iron (Fe)	Max. 0.00002%
Heavy Metals as Pb	Max. 0.00005%
Arsenic (As)	Max. 0.0000005%
Substances reducing Permanganate as SO_2	Max. 0.0001%

DUPONT
SULFURIC ACID
REAGENT

DUPONT
AMMONIUM HYDROXIDE
REAGENT

AMMONIUM HYDROXIDE REAGENT

Ammonia (NH_3)	Min. 28.0%, Max. 30.0%
Chlorides as Cl	Max. 0.00005%
Phosphates as PO_4	Max. 0.00005%
Heavy Metals as Pb	Max. 0.00005%
Substances reducing Permanganate as SO_2	Max. 0.002%
Carbon Dioxide (CO_2)	Max. 0.002%
Residue after Ignition	Max. 0.0003%
Total Sulfur as SO_4	Max. 0.0002%
Iron (Fe)	Max. 0.00002%

SEE OTHER SIDE FOR YOUR DISTRIBUTOR ▶

BUY DU PONT REAGENTS FROM:

ALABAMA: BIRMINGHAM—Cenco Instruments Corp., 3232 Eleventh Ave., N., FA 4-2433; Wittichen Chemical, 1609 Second Ave., S., FA 2-1639. MOBILE—McKesson & Robbins, P.O. Box 106, AL 1-4171.

ARIZONA: PHOENIX—Van Waters & Rogers, 2930 W. Osborne Rd., AL 4-6111. TUCSON—Van Waters & Rogers, 2030 E. Broadway, MA 2-7796.

CALIFORNIA: LOS ANGELES—Van Waters & Rogers, 1363 S. Bonnie Beach Place, AN 9-9311. NATIONAL CITY—Van Waters & Rogers, 2100 Haffly St., GR 7-2171. SAN FRANCISCO—Van Waters & Rogers, 1400 Sixteenth St., HE 1-8800. WEST SACRAMENTO—Van Waters & Rogers, 850 S. River Rd., FR 1-7600.

COLORADO: DENVER—Van Waters & Rogers, 4300 Holly St., DU 8-5651.

CONNECTICUT: SHELTON—Axton-Cross, 113 Canal St., RE 5-4691.

DELAWARE: WILMINGTON—Danforth Drug Co., Inc., 124 Market St., OL 5-6271.

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GEORGIA: ATLANTA— Estes Surgical Supply Co., 410 W. Peachtree, 521-1700; Will Corporation of Georgia, P.O. Box 966, TR 4-3872.

HAWAII: HONOLULU—Van Waters & Rogers, 1637 Kapiolani Blvd., HO 6-4491.

IDAHO: BOISE—Van Waters & Rogers, 3430 Western Ave., 343-5468.

ILLINOIS: CHICAGO—Cenco Instruments Corp., 1700 W. Irving Park Rd., WE 5-8600; Chicago Apparatus Co., 1735 N. Ashland Ave., BR 8-4630; Graphic Arts Supply Co., 4027 LeMoyne St., HU 6-2200; C. P. Hall Company of Ill., 5245 W. 73rd St., PO 7-4600; McKesson & Robbins, Inc., 3100 S. California Ave., CL 4-1100; E. H. Sargent & Co., 4647 W. Foster Ave., SP 7-2700; Stansi Scientific Co., 1237 N. Honore St., AR 6-8737; Welch Scientific Co., Inc., 1515 Sedgwick St., MI 2-2000; Wilson & Co., Central Chem. Div., Prudential Plaza, WH 4-4600. DECATUR—McKesson & Robbins, Inc., P.O. Box 541, 428-3823. MOLINE—Dico Company Ltd., 2603 4th Ave., 764-6422. PEORIA—McKesson & Robbins, Inc., 812 S. W. Washington St., 673-9149. ROCKFORD—Industrial Oil & Chemical, 1227 22nd St., WO 3-5261; Libby Oil & Chemical Co., 1140 Harrison Ave., WO 8-9874. ROCK ISLAND—McKesson & Robbins, Inc., P.O. Box 795, 788-9351.

INDIANA: FORT WAYNE—Inland Chemical Corp., P.O. Box 36, A-4481. INDIANAPOLIS — Globe Chemical Co., 1120 S. Harding Ave., ME 2-8546; William Lynn Chemical Co., 121-131 N. Davidson St., ME 7-3463.

IOWA: BURLINGTON—McKesson & Robbins, Inc., 100 North Fourth St., 754-4601. CEDAR RAPIDS — McKesson & Robbins, Inc., 900 Second St., S. E., EM 2-2169. DES MOINES—Dico Company Ltd., 200 S. W. 16th St., CH 4-7286; McKesson & Robbins, Inc., 216 Elm St., AT 2-4392. SIOUX CITY—McKesson & Robbins, Inc., 5-0123.

KANSAS: WICHITA—Barada & Page Co., Branch of McKesson & Robbins, Inc., 2041 N. Mosley, AM 7-6293.

KENTUCKY: HENDERSON—P. B. & S. Chemical Co., 1100 N. Adams St., VA 7-3545. LOUISVILLE—Globe Chemical Co., 105 N. 15th St., JU 7-6506; Love Chemical Co., 1400 S. 12th St., ME 5-7803; McKesson & Robbins, Inc., Merchants Chemical Branch, 4007 Crittenden Dr., EM 6-1406; Wm. Lynn Chemical Co., 721 W. Washington St., 583-8369; B. Preiser Co., Inc., 949 S. Third St., JU 3-0666.

LOUISIANA: NEW ORLEANS—W. H. Curtin Co., 621 Celeste St., 524-0475.

MARYLAND: BALTIMORE—Leidy Chemicals Corp., 900 S. Eutaw St., MU 5-2200.

MASSACHUSETTS: CAMBRIDGE—Central Scientific Co., 79 Amherst St., PR 6-1800. FRAMINGHAM—Axton-Cross Corp., 817 Waverly St., TR 2-4378. SPRINGFIELD—Hampden Color & Chemical Co., P.O. Box 558, RE 2-2112. WORCESTER—Worcester Chemical Dist. Corp., 100 Webster St., PL 6-3586.

MICHIGAN: DETROIT—Eaton Chemical & Dyestuff Co., 1490 Franklin St., WO 2-5216; Udylite Corp., 1651 E. Grand Blvd., WA 1-3500. GRAND RAPIDS—Wolverine Solvents & Chemicals Co., 2940 Stafford Ave., S.W., CH 5-9111. LANSING—Carrier-Stephens Co., P.O. Box 501, IV 2-0838. WARREN—Udylite Corp., 2144 Hoover Rd., SL 7-8200.

MINNESOTA: DULUTH — McKesson & Robbins, Inc., RA 7-4666. HIBBING—Lerlab Supply Co., P.O. Box 810, AM 2-3456. MINNEAPOLIS —T. K. Gray, Inc., 1812 S. 6th St., FE 2-0536; McKesson & Robbins, Inc., Merchants Chemical Branch, 111 22nd Ave., N.E., ST 9-2403; Geo. T. Walker & Co., 2218 University Ave., S.E., FE 3-3343. ST. PAUL —Lyon Chemicals, Inc., 2305 Hampden Ave., MI 6-1351.

MISSOURI: KANSAS CITY—Barada & Page Co., Division McKesson & Robbins, Inc., Guinotte & Michigan Aves., VI 2-6240. ST. LOUIS—Barada & Page Co., Div. McKesson & Robbins, Inc., Foot of Destreham St., CE 1-0944.

NEBRASKA: OMAHA—McKesson & Robbins, Inc., 902 Farnam St., 341-5000.

NEW JERSEY: PATERSON—Brown Chemical Co., 181 Warren St., MU 4-0388. MOUNTAINSIDE—Central Scientific Co., 237 Sheffield St., AD 3-2000. NEWARK—Dooner & Smith Chemical Co., 374 Mulberry St., MA 3-1905.

NEW MEXICO: ALBUQUERQUE—Van Waters & Rogers, Inc., Braun Division, 324 Industrial Ave., N.E., DI 4-3407.

NEW YORK: BINGHAMTON — Collier Chemicals, 17 Broad St., RA 3-5455. BROOKLYN—Enequist Chemical Co., 100 Varick Ave., HY 7-1200; Robinson Bros. Chemicals, Inc., 255 Randolph St., HY 7-0043. GLOVERSVILLE—S. H. Ireland Chemical Co., JO 6-3173. NEW YORK CITY—Berg Chemical Co., 441 W. 37th St., LO 3-2684; McKesson & Robbins, Inc., 155 E. 44th St., YU 6-6400; Standard Scientific & Supply Co., 808 Broadway, SP 7-0660. NORTH TONAWANDA—Riverside Chemical Co., River & Rosch Rd., NX 2-1350. RENSSELAER — Eastern Chemicals, Inc., South St., HO 5-2474. ROCHESTER — H & W Chemicals, Inc., 182-200 Anderson Ave., GR 3-6650. UTICA — Monarch Chemicals, Inc., 420 Broad St., RE 2-6151.

NORTH CAROLINA: CHARLOTTE—F. H. Ross & Co., 3930 Glenwood Dr., EX 2-2121. DURHAM—Cardinal Products Co., P.O. Box 1611, 681-2017. ELON COLLEGE—Carolina Biol. Supply Co., JU 4-8801. GREENSBORO—Axton-Cross Co., 2605 Branchwood Dr., 275-7208.

OHIO: AKRON—Farley Chemical & Solvents Co., 309 Silver St., PO 2-7261. CANTON—Bison Corporation, Canton Platers Supply Div., 1936 Allen Ave., GL 5-0284. CINCINNATI—Harshaw Chemical Co., Harshaw Scientific Div., 6265 Wiehe Rd., RE 1-9100; Laboratory Services, Inc., 4024 Rosslyn Dr., BR 1-5700. McKinley Litho Supply Co., Inc., 1623 John St., CH 1-6323; Merchants Chemical Branch, McKesson & Robbins, Inc., 3025 Exon Ave., PR 1-4311. CLEVELAND—Chemical Rubber Co., 2310 Superior Ave., SU 1-8330; Harshaw Chemical Co., 1945 E. 97th St., RA 1-8300; Inland Chemical Corp., 1681 Fall St., MA 1-5897; Harold M. Pitman Co., 3501 W. 140th St., WI 1-5250; Platers Supply Co., 2059 Hamilton St., TO 1-6670. COLUMBUS—Globe Chemical Co., 648 Concrea, BE 1-3671; McKesson & Robbins, Inc., Merchants Chemical Branch, 1795 S. High St., HI 3-7629. DAYTON—Globe Chemical Co., 967 Deeds Ave., BA 2-4035; Industrial Chemical Prod. Co., 422 E. Bacon St., BA 2-6391. LIMA—Inland Chemical Corp., 619 N. Jackson St., 223-2075. ST. BERNARD—Globe Chemical Co., Murray Rd. & Big Four R.R., AV 1-7400. TOLEDO —Inland Chemical Corp., 1120 Bush St., CH 3-5296; Rigby Scientific Co., 5649 Alexis Rd., TU 2-2028. YOUNGSTOWN—Superior Chemical Products Co., 40 N. Watt St., RI 4-4151.

OKLAHOMA: OKLAHOMA CITY—McKesson & Robbins, Inc., 1700 W. Grand Ave., CE 2-1351. TULSA—Chemical Products, Inc., 501 W. First St., LU 7-8135.

OREGON: PORTLAND—Van Waters & Rogers, 3950 Northwest Yeon, CA 2-1721.

PENNSYLVANIA: PHILADELPHIA—Phillips & Jacobs Co., 622 Race St., WA 2-3655; Pioneer Salt Co., 940 N. Delaware Ave., MA 7-1200. YORK—North Chemical Company, 609 E. King St., 5584.

RHODE ISLAND: PROVIDENCE — McKesson & Robbins, Inc., 68 Traverse, GA 1-0262.

SOUTH CAROLINA: CHARLESTON—Burris Products Co., Stark Industrial Park, SH 4-7421.

SOUTH DAKOTA: RAPID CITY—Tri State Milling Co., FI 2-6172.

TENNESSEE: CHATTANOOGA— Burkart Schier Chemical Co., 1228 Chestnut St., AM 6-0101. KNOXVILLE—Burkart Schier Chemical Co., 1705 Boone, N.E., 522-1119. MEMPHIS—Ideal Chemical & Supply Co., 1301 Heistan Ave., BR 6-7331. NASHVILLE—Burkart Schier Chemical Co., 809 16th Ave., N., AL 5-0487.

TEXAS: AMARILLO—State Chemical Co., 100 Houston St., DR 3-4253. DALLAS—W. H. Curtin & Co., 1812 Griffin St., RI 7-2503. EL PASO—Van Waters & Rogers, 6980 Market Ave., PR 8-7225. HOUSTON—W. H. Curtin & Co., 4220 Jefferson Ave., WA 3-1661; Harshaw Chemical Co., Harshaw Scientific Div., 6622 Supply Row, WA 3-1627; Refinery Supply Co., Sub. of Central Scientific Co., 6610 Stillwell St., MI 4-1401.

UTAH: SALT LAKE CITY—Van Waters & Rogers, 650 W. Eighth South, DA 8-1112.

WASHINGTON: SEATTLE—Van Waters & Rogers, 4000 First Avenue South, MA 4-5050. SPOKANE—Van Waters & Rogers, North 809 Washington St., RI 7-4183.

WEST VIRGINIA: CHARLESTON—B. Preiser Co., Inc., 900 MacCorkle Ave., S. W., DI 3-5515. HUNTINGTON—Cabell Chemical Company, 101 22nd St., 2-3122.

WISCONSIN: APPLETON—McKesson & Robbins, Inc., Merchants Chemical Branch, 1836 W. Rogers Ave., RE 4-9888. MILWAUKEE—McKesson & Robbins, Inc., Merchants Chemical Branch, 1100 S. Barclay St., MI 5-7909; Topp Oil & Chemical Co., 1033 N. Hawley Rd., BL 8-4235. WAUKESHA—F. P. Jay Chemical, Inc., P.O. Box 42, LI 2-4264.

April, 1962

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I&B INDUSTRIAL CHEMICALS

Industrial and Biochemicals Dept.

Announcing the Formation of

SULFRIAN Cryogenics, INC.

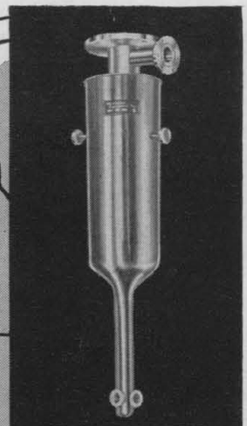
CRAFTSMANSHIP! INGENUITY! TALENT!

The formation of Sulfrian Cryogenics represents a consolidation of the finest engineering and manufacturing capabilities in the low temperature field. The new organization is the culmination of two decades of cryogenic experience on the part of its founder and President, Gerard F. Sulfrian, producer of the first liquid helium container, the first stainless steel liquid helium research dewar, and the first non-nitrogen shielded dewar!

Sulfrian Cryogenics, Inc. dedicates itself to providing the MOST RELIABLE EQUIPMENT . . . TO DELIVERING IT QUICKLY . . . AND TO BEING FULLY RESPONSIBLE FOR ITS PERFORMANCE.

The name Sulfrian has always stood for the best . . . it now stands for the leader in the field . . . and the foremost source for truly reliable low temperature equipment for industry and science.

Ask about our new helium liquid level indicator.



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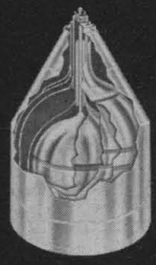

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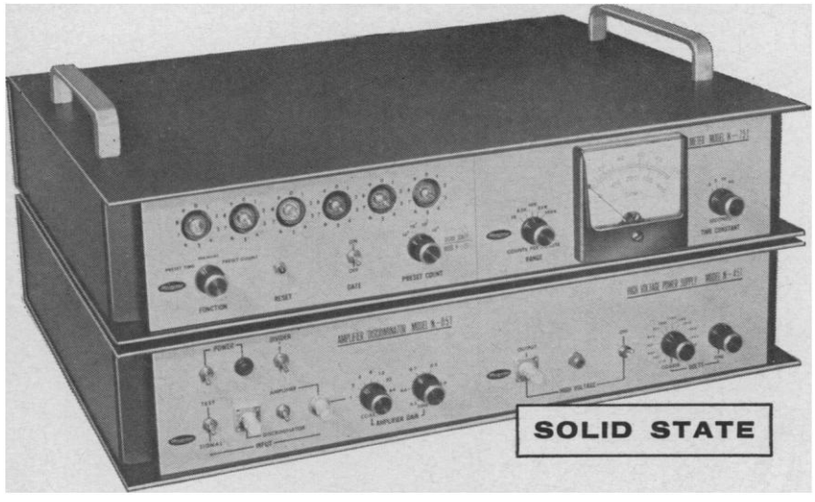


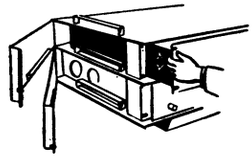
A New Ultra-Reliable Nuclear System for Routine Counting and Analysis!

Hamner's proven reputation for the optimum in reliability and stability backs this basic counting and analysis system. At the same time, a unique concept in packaging . . . MODUFLEX . . . is presented that provides a major improvement in space saving and a new wide range of flexibility in handling and combining mstruments.

System Reliability

All units in this series have been designed to take advantage of the inherent reliability of solid state devices. Protection against surges in voltage applied to solid state components, latest techniques in printed board construction, and conservative rating of components provide the highest levels of reliability over greatly extended periods of operation.

What is MODUFLEX?

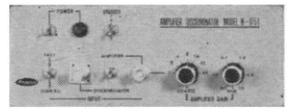


Hamner's MODUFLEX cases can be stacked to form systems of any size, or can house individual units. Cases nest and interlock — may be assembled or disassembled without tools. And no tools are needed to remove instruments. MODUFLEX will accept 19" x 3½" units or two 9" x 3½" units side-by-side.

Write for detailed brochure

HAMNER ELECTRONICS CO., INC.

Dept. S5, P. O. BOX 531, PRINCETON, NEW JERSEY



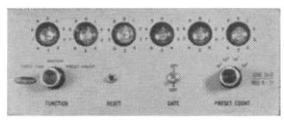
N-051

POWER SUPPLY AND INPUT UNIT

Contains a power supply suitable for operating the N-251 scaler and N-751 ratemeter. Also contains a non-overload linear amplifier and discriminator suitable for driving these units.

The amplifier with its adjustable gain allows input sensitivity to be as low as 10 millivolts. The amplifier is followed by a fast discriminator.

Following the discriminator is a fast "scale of four", which may be switched in or out. When used, it allows a 1 μs pulse pair resolving time to apply to both scaler and ratemeter; it doubles the number of count ratemeter ranges available and doubles the number of preset counts usable in the scaler.



N-251

TRANSISTORIZED SCALER

Input Requirements: As provided by N-051 Input Unit.

Modes of Operation: Manual — Scaler is stopped and started by front panel switch.

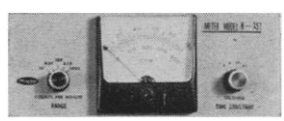
Preset Time—Scaler is controlled by associated timer providing mechanical contact closure through rear panel connector.

Preset Count — Selectable at 1,000, 10,000, 100,000 or 1,000,000 counts. These become 4,000, 40,000, 400,000 or 4,000,000 counts when X4 divider on Input Unit is used.

Counting Characteristics:

Display: 6 Glow Transfer Tubes — no mechanical register.

Resolution: Better than 10 μs for pulse pairs with 100 Kc continuous repetition rate. With X4 divider — better than 1 μs pulse pair resolution with 400 Kc continuous repetition rate.



N-751

TRANSISTORIZED COUNT RATEMETER

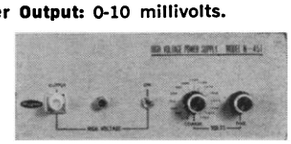
Input Requirements: As provided by N-051 Input Unit.

Ranges: 100, 1,000, 10,000, 100,000 and 1,000,000 counts/minute. (With addition of 400, 4,000, 40,000 and 4,000,000 counts/minute by use of X4 divider on N-051 Input Unit.

Time Constants: 0.5, 2, 10 and 40 seconds.

Accuracy: Better than ±2%.

Recorder Output: 0-10 millivolts.



N-451

HIGH VOLTAGE POWER SUPPLY

Designed for use not only in routine counting, but in more elaborate experiments involving analysis. Offers low noise with both line and load regulation.

Output: 510 to 1800 volts at 1 ma

Ripple: Better than 10 mv RMS

Adjustment: By 85 volt steps with 100 volt fine control

Line Regulation: ±.05% for line changes between 105 and 125 volts

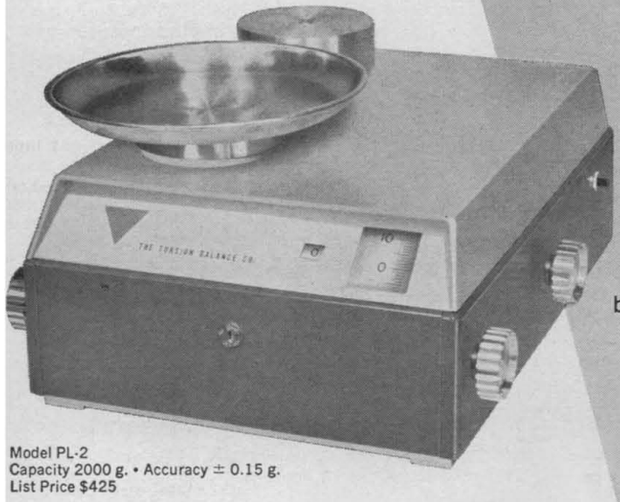
Load Regulation: Better than .09% for 10% load change

Power Requirements: 105-125V, 60 cycle, 15 watts

NO KNIFE EDGES IN NEW

OPTICAL PROJECTION TORSION BALANCE

By eliminating knife edges with Torsion's practically one-piece construction, Model PL-2 is designed to operate even in severely corrosive or dust-laden atmospheres where maintenance costs for ordinary "knife-edge" balances would be prohibitive. ● The long lasting accuracy of this Torsion construction, with Dynavar bands, has been proved by a testing device that made continuous weighings 24 hours a day for six months. Over 1,750,000 operations later the Torsion mechanism still had its original sensitivity and accuracy.



Model PL-2
Capacity 2000 g. • Accuracy ± 0.15 g.
List Price $425

ADDITIONAL FEATURES

True Weight even when out of level

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

Weight Loading

Weight loading knobs are conveniently located on both sides of the balance for easy operation by either right or left hand. Weighing by substitution to 1000 grams is used in this New Torsion Laboratory Balance.

Unlimited Tare Range

Taring through a 125 gram range is accomplished with a built-in knob on the side of the balance. By adding weights to the second pan the balance can be made to tare throughout its 2 kilogram capacity.

In addition to these features, Torsion's Model PL-2 offers a sharp image with a high degree of illumination for easy reading and an oil damper to speed up weighing.

Ask your laboratory supply salesman for a demonstration or write us for Bulletin PL-2 which gives complete specifications.

The **Torsion Balance** *Company*

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

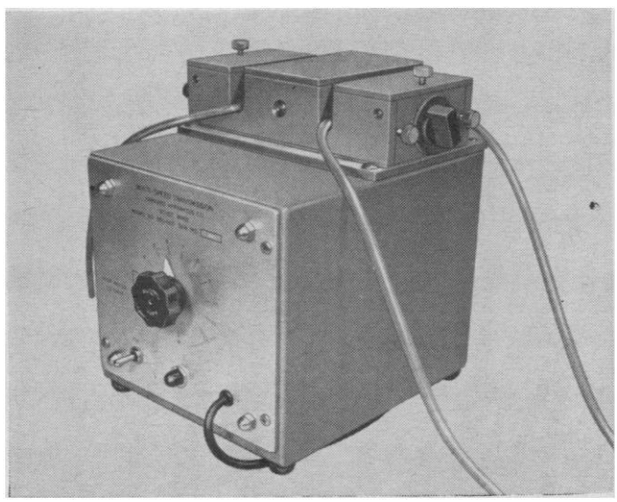
TWO NEW PERISTALTIC PUMPS

Harvard Apparatus Co., Inc. offers two new and extremely versatile peristaltic pumps designed to transfer liquids and semiliquids by means of peristaltic action on plastic or rubber tubing.

Tubing is inserted into two tube-holding channels, one on either side of the pumping mechanism. Thus the pumps can be used for multiple as well as single tube operation, making it possible to multiply the capacity of the pumps or to feed multiple circuits simultaneously. Since the action on one side of the mechanism is 180° out of phase with the other, it is possible to accomplish virtually pulse-free pumping by using two tubes in parallel.

All motion is at right angles to the tubing. Therefore, there is no tendency for the tubing to creep. A pair of screw-driven compression plates is used to occlude the tubing and to adjust for various diameters. Maximum tube capacity is two ½" x ⅜" plastic tubes, one on each side. The pumps will accommodate as many smaller tubes as circumstances permit.

The design of the pumps is such that flow rate is directly proportional to speed over a wide range of pressure.



MODEL 600-1200 This pump features a synchronous reversible motor and accurate gearbox with 12 gearshift positions. In operation, any speed over a 5000 to 1 range can be selected simply by turning the gearbox knob. Model 600-1200 is intended for low volume, high accuracy applications.

SPECIFICATIONS

Flow Rate: Maximum (one ½" x ⅜" plastic tube on each side) 114 ml./min.
Minimum practical (one ¼" x ⅛" plastic tube) 0.0021 ml./min.

Reversible: Motor reversing switch changes direction of flow

Output Pressure: in excess of 200 mm. Hg

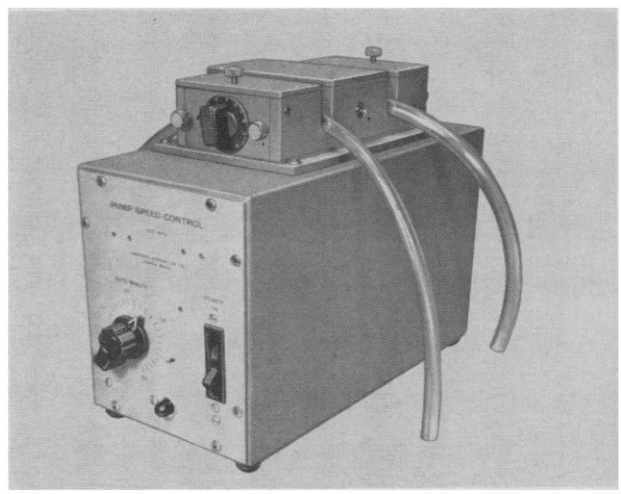
Hemolysis: negligible

Reproducibility: ±0.1% (average)

Dimensions: 10½" high x 7⅝" wide x 8¾" long

Weight: 23 lbs.

$400.00—f.o.b. Dover, Mass.



MODEL 500-1200 The pump mechanism is driven by a heavy duty, high speed, variable motor. The speed control is solid state and produces rates over a 50 to 1 range with a given size tube. Model 500-1200 is intended for applications requiring high flow rates at reasonable accuracies.

SPECIFICATIONS

Flow Rate: Maximum (one ½" x ⅜" plastic tube on each side) 760 ml./min.
Minimum practical (one ¼" x ⅛" plastic tube) 1.4 ml./min.

Speed Control: Solid state with compensating feedback network

Output Pressure: in excess of 700 mm. Hg

Hemolysis: negligible

Reproducibility: ±7% under extreme line voltage and load fluctuations

Dimensions: 10½" high x 6¼" wide x 12½" long

Weight: 35 lbs.

$450.00—f.o.b. Dover, Mass.

VARIATIONS AND OPTIONS AVAILABLE

MOTOR SPEEDS A variety of motors with speeds other than standard are available. These motors have the effect of either multiplying or dividing rates by a given factor. Unless otherwise specified, pumps will be shipped with standard motor.

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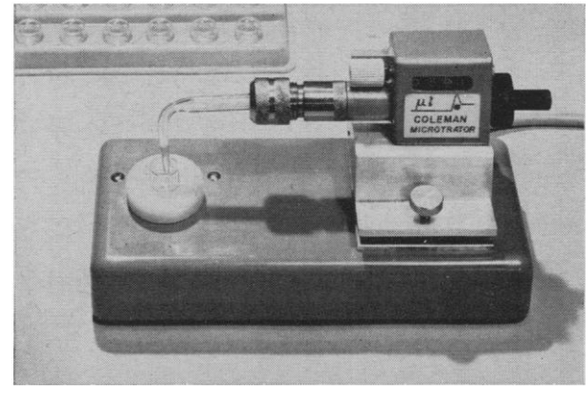

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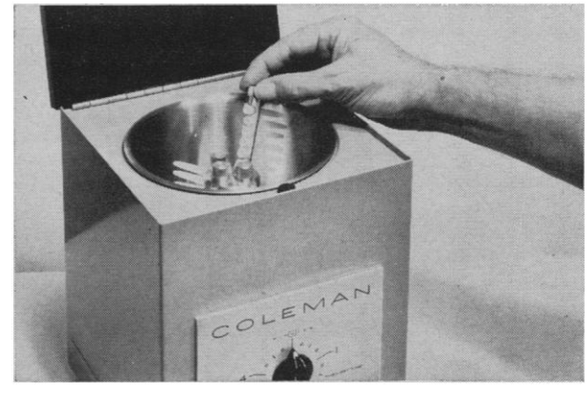

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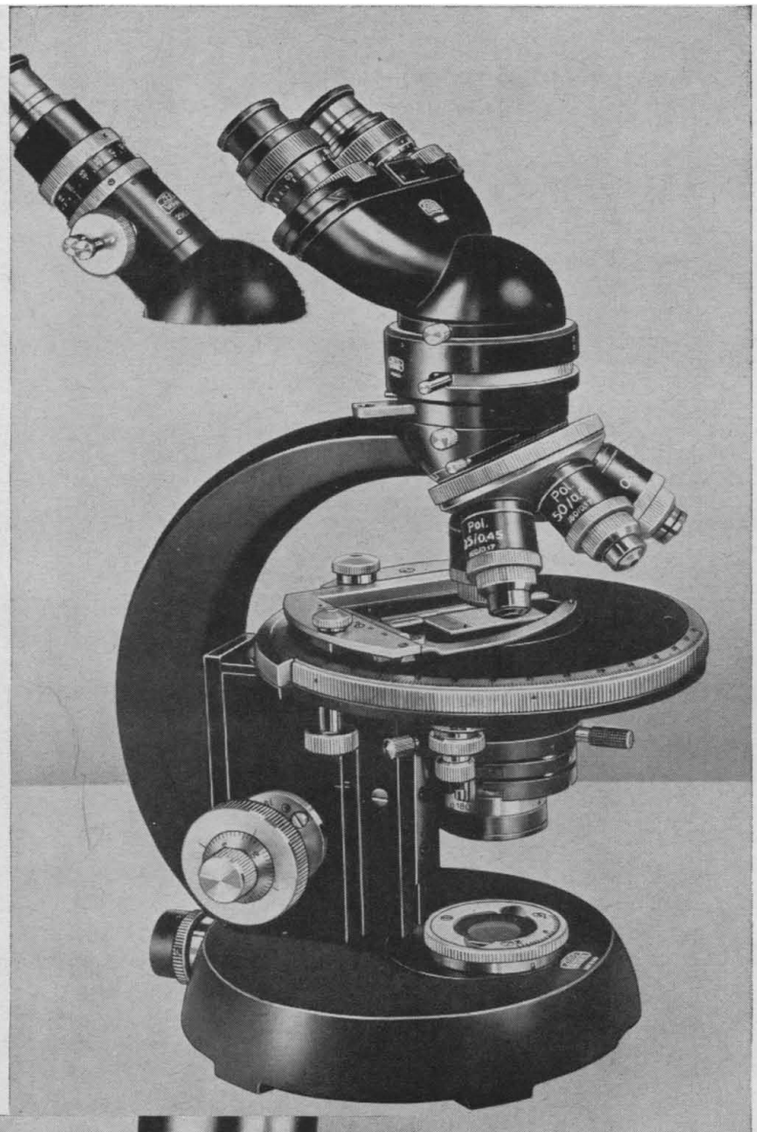

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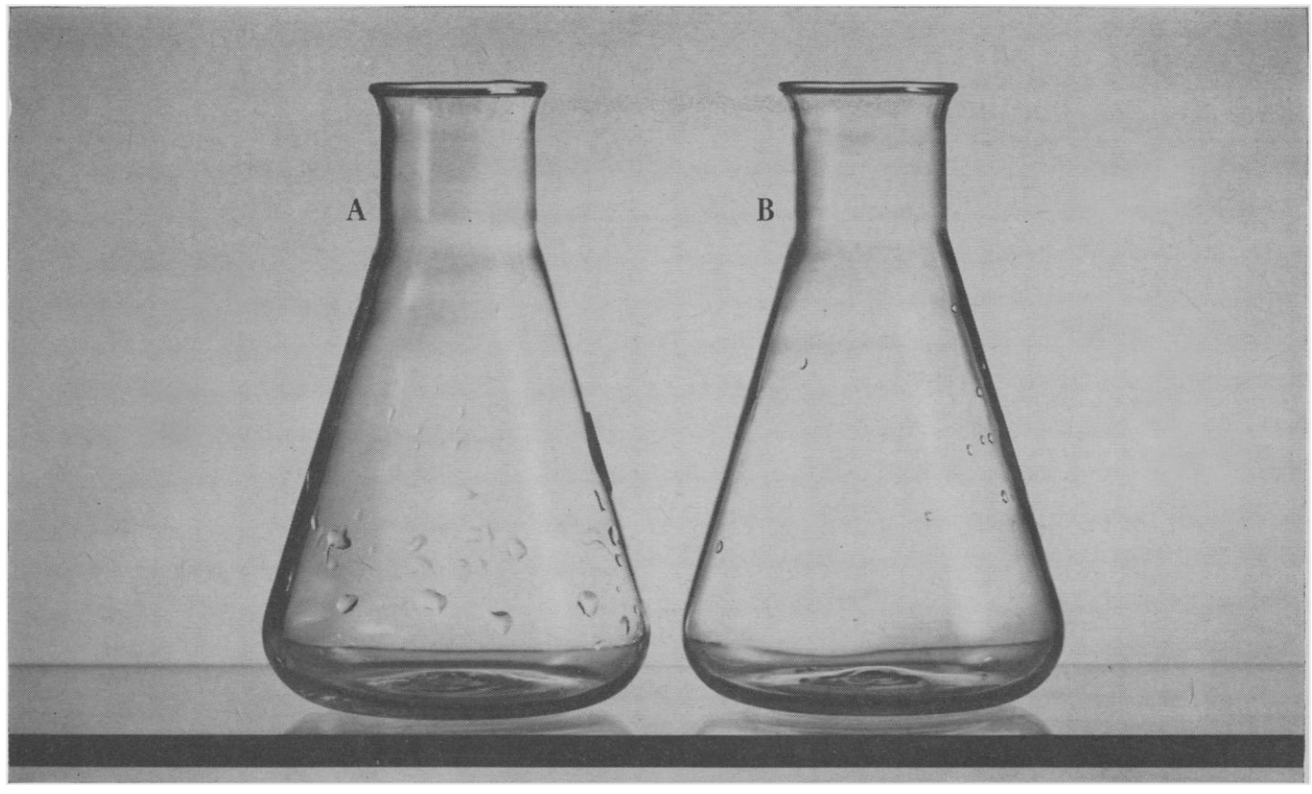

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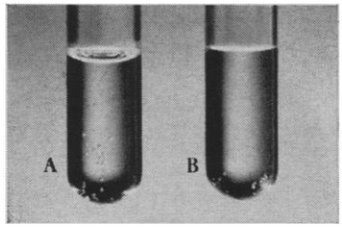

Just where is the surface of the liquid in tube A? With ordinary meniscus surface you can't be sure. In Siliclad-treated tube B liquid forms flat surface, allows more accurate determination.

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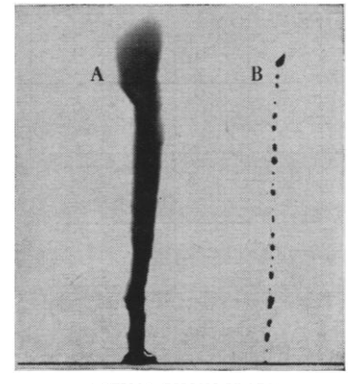
**Note:* Siliclad should not be used for glass items which depend on capillary action or adhesion to perform properly.



ACTUAL PHOTOGRAPH

Equal amounts of blood dropped simultaneously on glass plate at 90° angle.
A. Blood on untreated surface clings to glass, spreads slowly down glass, pools at bottom edge.
B. Blood on Siliclad-treated surface runs down glass plate immediately. Does not cling, stick, or pool at bottom edge of plate. Gentle tapping of glass plate removes few "beads" remaining.

References: (1) Levin, H. L.: Milit. Med. *121*:397 (Dec.) 1957. (2) Harkins, G. A.: J. Thoracic & Cardiovas. Surg. *40*:549 (Oct.) 1960. (3) Cantor, M. O.: Am. J. Surg. *100*:584 (Oct.) 1960.

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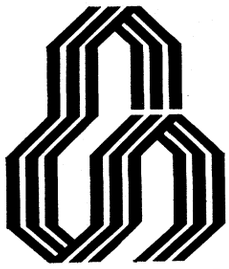

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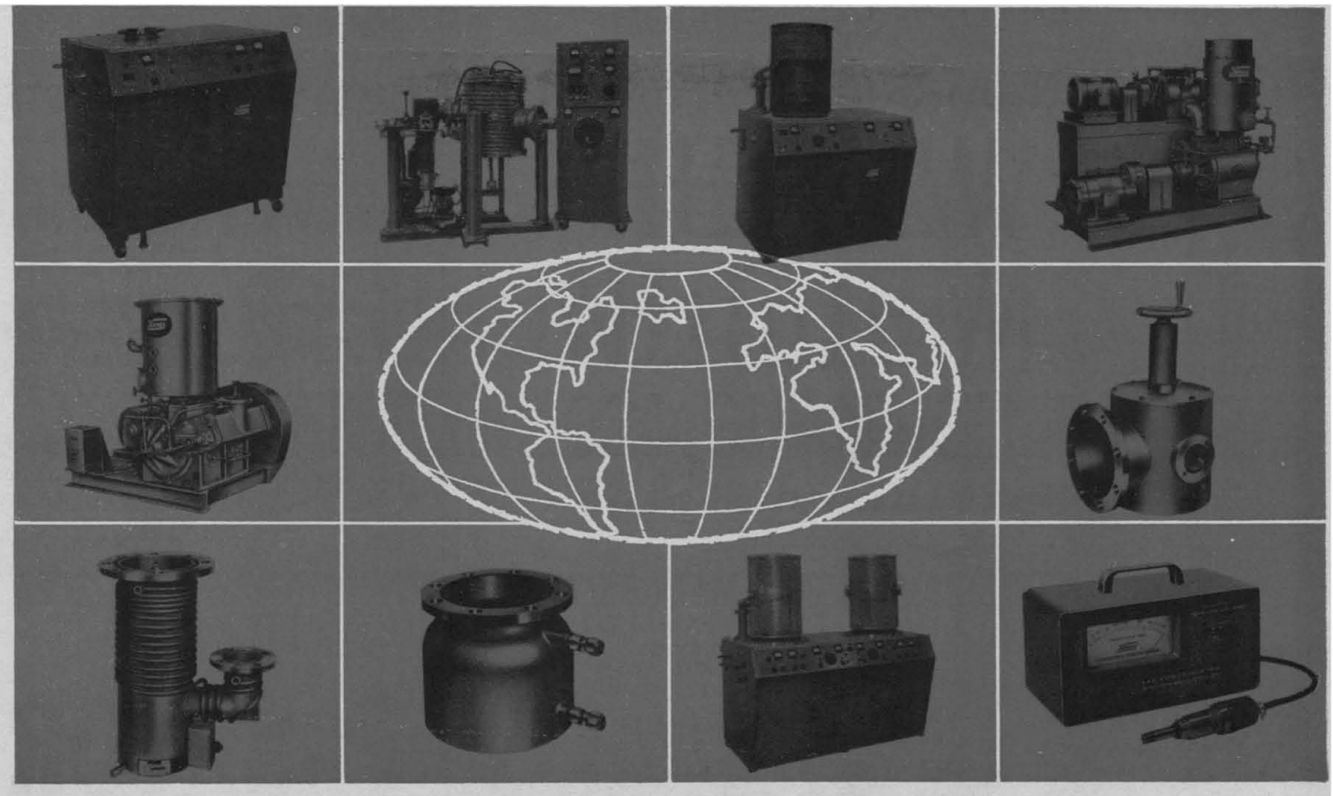

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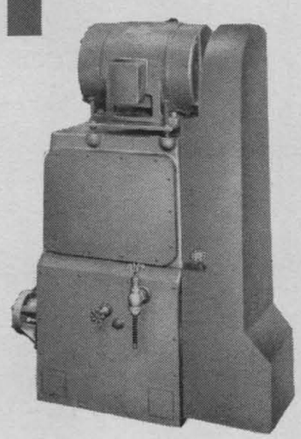

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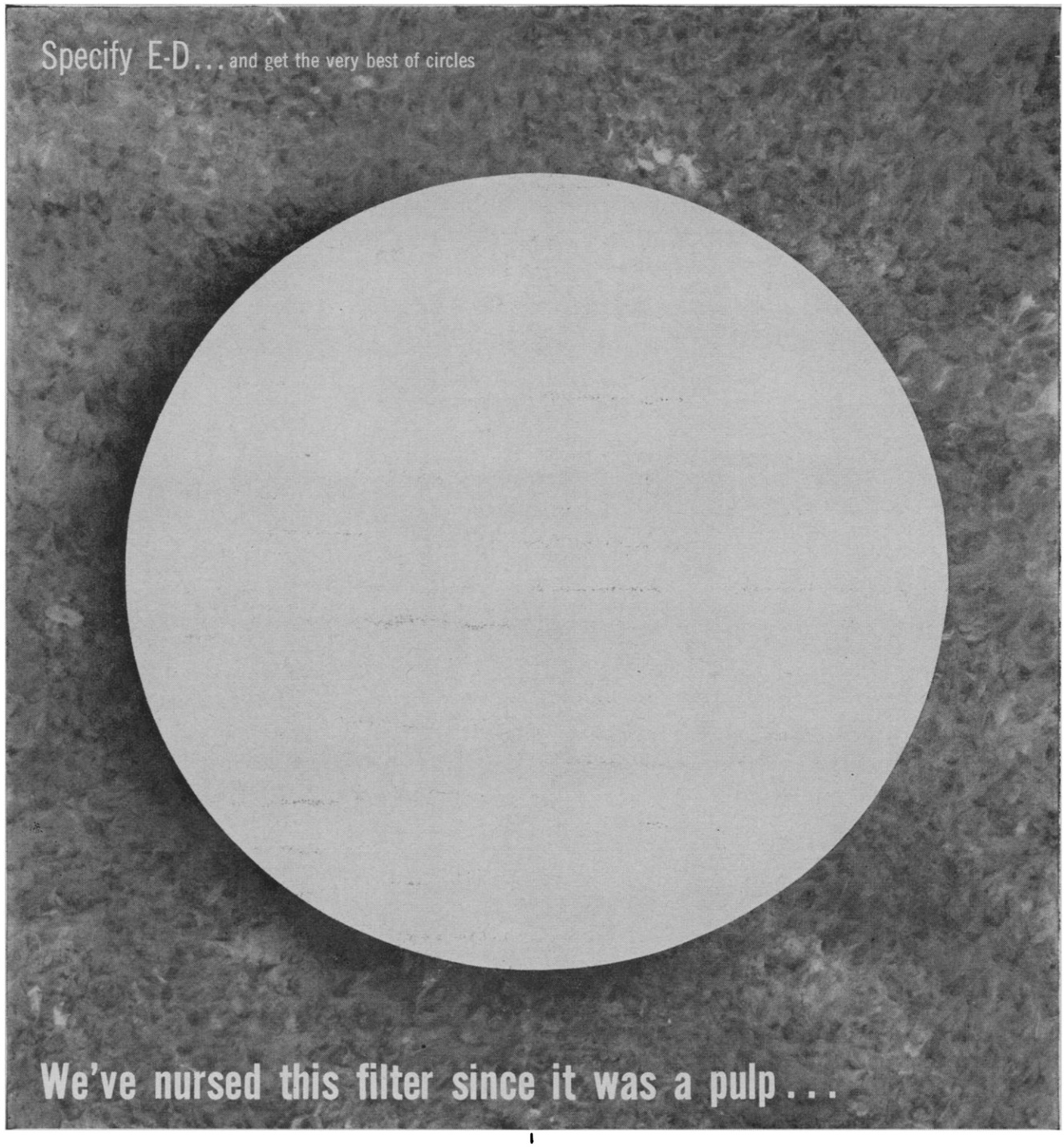

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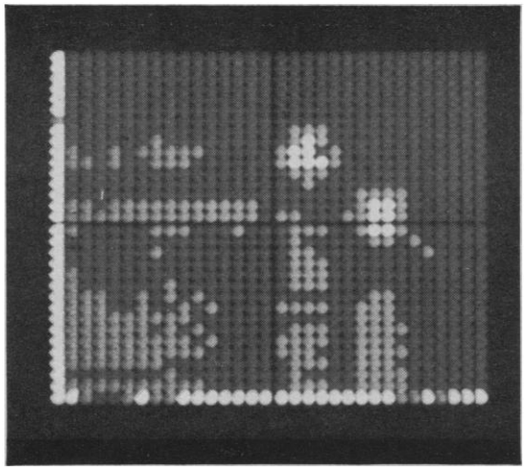

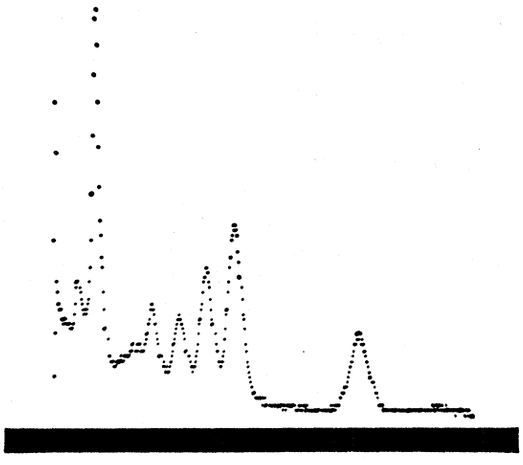

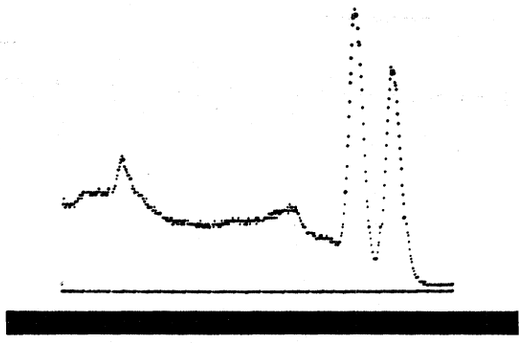

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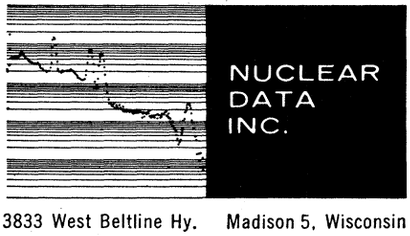

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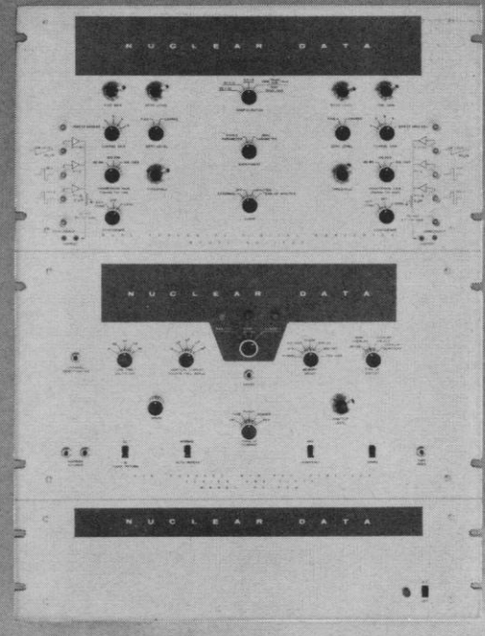

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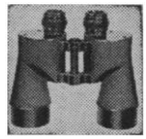

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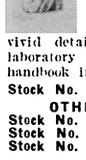

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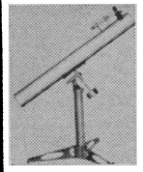

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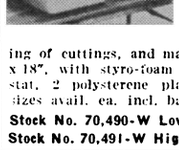

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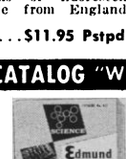

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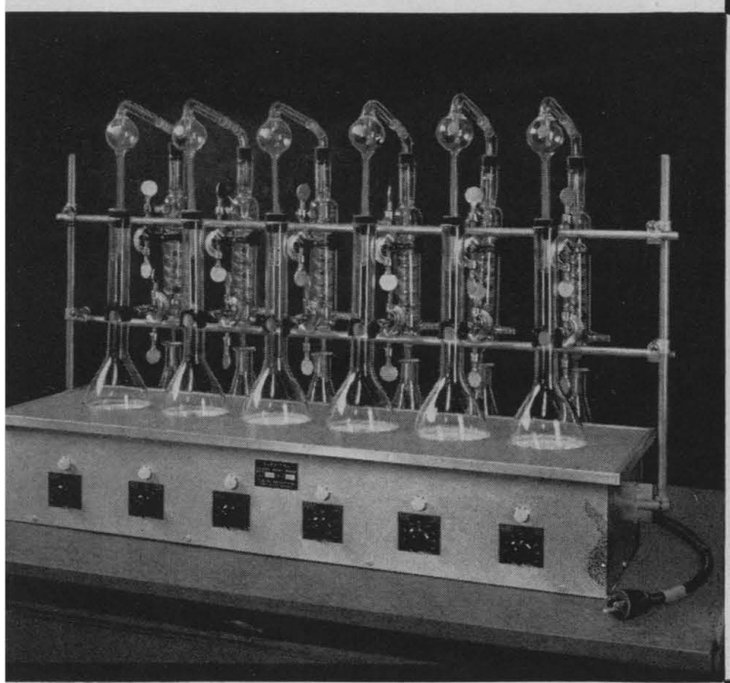

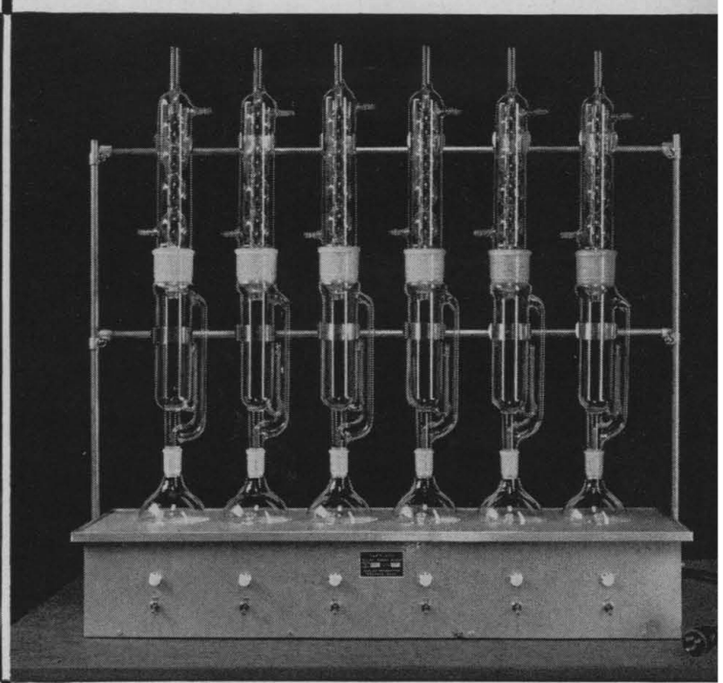

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SPECIFICATIONS

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Replacement heating elements.....$12.00 each

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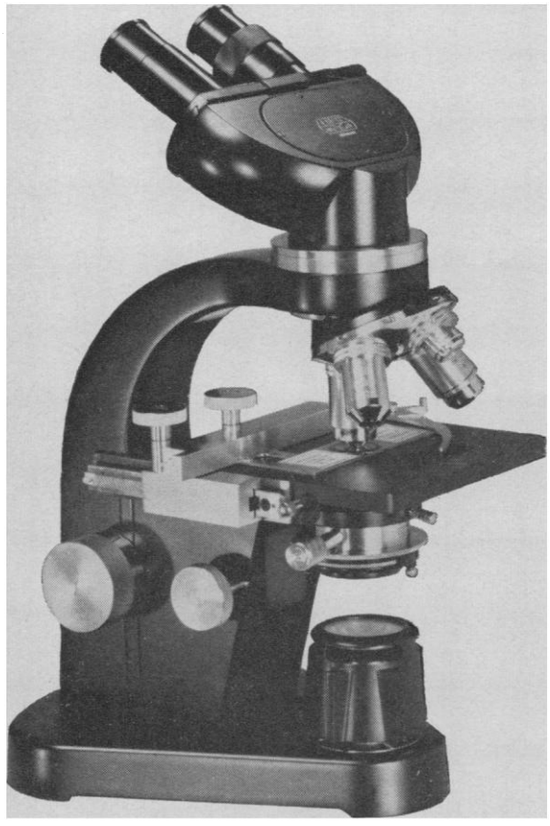

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11 May 1962, Volume 136, Number 3515 **SCIENCE**

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Federal Pay Reform

In our highly mobile society all employers—among them corporations, universities, and governments—are competing for the services of highly talented administrators and professional men and women. This competition has forced industrial and university salaries and fringe benefits steadily upward, and those who cannot meet the going price are likely to lose some of their most valuable employees and to be unable to recruit their fair share of the new generation of the college-trained.

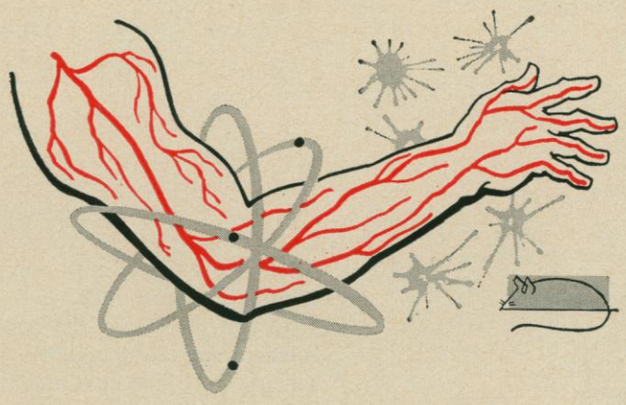
Recent studies by the Bureau of the Budget, the Civil Service Commission, and the President's Advisory Committee on Federal Pay Systems (chaired by Clarence Randall) show that the government, once in a favorable competitive position for recruiting the best, has fallen farther and farther behind in recent years. Civil Service (General Schedule) jobs are classified in 18 categories. The higher up one goes in the scale, the greater is the discrepancy between federal and industrial salaries. The average salaries for some of the federal classifications follow (comparable salaries for industrial jobs with similar requirements are in parentheses): GS-7, $5,280 ($6,648); GS-13, $11,415 ($13,152); GS-15, $14,705 ($19,348); GS-16, $15,775 ($25,900); and GS-17, $17,050 ($33,438). At present the top level for any Civil Service employee is GS-18, with a salary of $18,500. On the other hand, in 1961–62, 628 professorial positions in the United States carried salaries of $18,000 or more for a 9-month period, and the minimum salary for a full professor at Harvard is now $18,750.

The Randall Committee, the agencies mentioned above, and the President concur in thinking that the discrepancy between salaries in and out of government is a serious matter. The Administration has proposed that salary structure be made to conform to two principles: (i) the principle that federal salaries should be comparable to salaries paid by private enterprise for work at the same level and (ii) the principle of internal alignment—equal pay for equal work in different branches of the government, and pay distinctions appropriate to the level of the work and the merit of the employee.

Last week the House Committee on Post Office and Civil Service began hearings on Representative Tom Murray's bill (H.R. 10480), which embodies the Administration's views. Among the specific proposals are the creation of two new top-level grades, GS-19 and GS-20, and orderly increases in salaries in all grades over a 3-year period. In general, the largest increases, both absolute and proportional, would be at the higher levels, where the discrepancies are greatest. By January 1965, the top salaries in several grades would be as follows: GS-7, $7,550; GS-13, $15,835; GS-15, $21,615; GS-16, $22,935; GS-17, $23,930; GS-18, $24,500; GS-19, $27,290; GS-20, $28,000.

The bill also provides that the Bureau of Labor Statistics shall regularly collect information on salaries in private industry, and that the President shall report these data to Congress, with recommendations for revisions in government salaries or policy.

It is difficult to estimate the chances for passage of the bill at this session of Congress. But the studies clearly indicate that Congress must pass this or some similar bill, or the federal government will find it more and more difficult to obtain the services of the competent and the talented. The salary scale for government blue-collar workers has long been based on the principle of comparability; extension of the principle to all classified employees is both feasible and desirable.—G.DuS.



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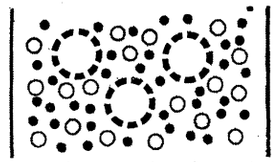
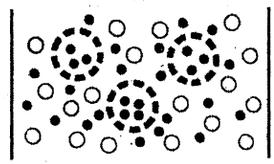
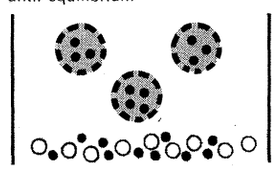


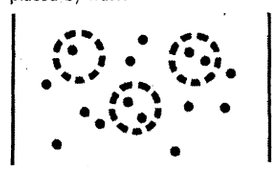
1. Outside water replaced by solution



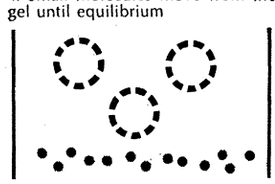
2. Small molecules move into the gel until equilibrium



3. Volume outside gel particles replaced by water



4. Small molecules move from the gel until equilibrium



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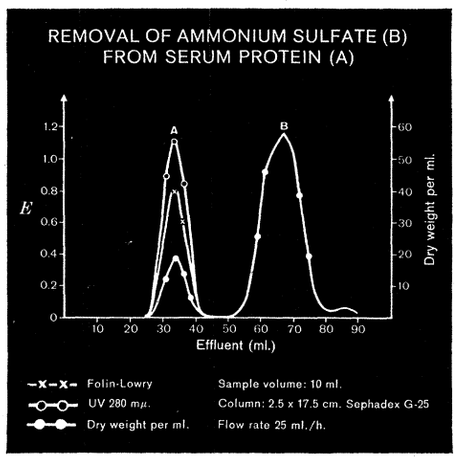

Reference: Porath, J., Flodin, P.: Gel Filtration: A method for desalting and group separation, Nature, vol. 183, pp. 1657-1659, 1959.

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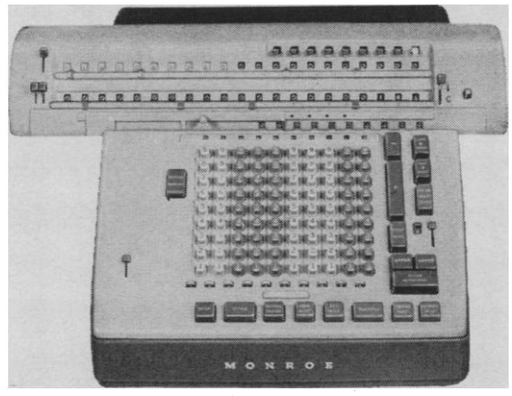

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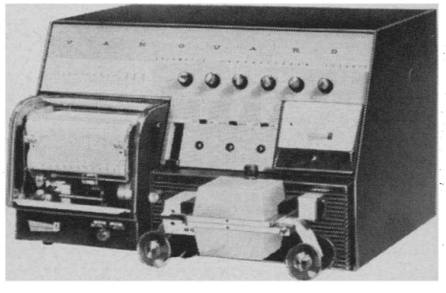

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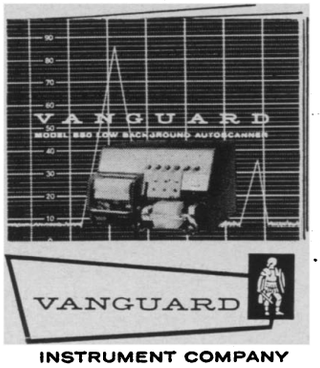

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Abstracts of New World Archeology, vol. 1, R. B. Woodbury, Ed. (Univ. of Utah Press), 21 Apr. 1961, 1241

The Ancient Culture of the Bering Sea and the Eskimo Problem, S. I. Rudenko (Arctic Inst. of North America and Univ. of Toronto Press), 6 Oct. 1961, 999

The Ancient Sun Kingdoms of the Americas, V. W. Von Hagen (World), 2 Feb. 1962, 364

Apples of Immortality from the Cuna Tree of Life, C. E. Keeler (Exposition Press), 28 July 1961, 278

The Application of Quantitative Methods in Archaeology, R. F. Heizer and S. F. Cook, Eds. (Quadrangle Books), 21 Apr. 1961, 1241

Archaeology in the USSR, A. L. Mongait (Penguin Books), 24 Nov. 1961, 1685

Becoming More Civilized, L. W. Doob (Yale Univ. Press), 12 May 1961, 1471

Black Sand, H. S. Colton (Univ. of New Mexico Press), 9 Feb. 1962, 425

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The Dawn of Civilization, S. Piggott, Ed. (McGraw-Hill), 15 Sept. 1961, 723

The Epic of Man, L. Barnett (Time), 9 Feb. 1962, 428

Eskimo Childhood and Interpersonal Relationships, M. Lantis (Univ. of Washington Press), 19 May 1961, 1591

Essays in Pre-Columbian Art and Archaeology, S. K. Lothrop *et al.* (Harvard Univ. Press), 30 Mar. 1962, 1121

The Golden Age of American Anthropology, M. Mead and R. L. Bunzel, Eds. (Braziller), 26 May 1961, 1699

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Orthographic Atlas of the Moon, compiled by D. W. G. Arthur and E. A. Whitaker, G. P. Kuiper, Ed. (Univ. of Arizona Press), 4 Aug. 1961, 323

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Experimental Immunochemistry, E. A. Kabat (Thomas), 11 Aug. 1961, 380

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plastics processing. The society is growing steadily and is keeping pace with the dynamic expansion of the plastics industry.

"SPE," as it is known throughout the world, was founded in Detroit in 1941. It was incorporated in 1942 under the laws of the state of Michigan as a nonprofit organization. From its birth it has kept pace with the industry, and today it sponsors 48 geographical sections in this country and abroad. It is actively and effectively advancing plastics scientific theory and fundamental engineering technology and, by such activity, enhancing the status of the plastics engineer and scientist by encouraging their participation, as members of the society, in SPE's many and various technical programs.

These include publication of original engineering or scientific articles in either of the two society publications—the *SPE Journal* and *SPE Transactions*. Also, a series of technical volumes is continuously sponsored by the society, authored and edited by members of SPE. Technical meetings and conferences play a vital role in the society's activities. Such meetings include monthly section meetings, several regional technical conferences held each year, and the annual technical conference of the soceity.

The society is governed by a council which is comprised of the officers of the society and one elected councilman from each section. The section, the basic unit of the society, is managed by its own officers and board of directors.

Membership in the Society of Plastics Engineers is extended to all whose previous technical and scientific education or training, experience, or present occupation qualify them to carry out the objectives of the society. There are four distinct classifications of membership: senior, associate, junior, and student.

In addition, SPE sponsors 16 professional activity groups, each designed to meet the specific requirements of specialized technical fundamentals of the plastics and related industries.

Officers of the society for 1962 are as follows: president, James R. Lampman (General Electric Company); secretary, George P. Kovach (Foster Grant Company); and executive secretary, Colin Campbell (Society of Plastics Engineers).

F. W. REYNOLDS

Society of Plastics Engineers, Inc., Stamford, Connecticut

Society for Clinical and Experimental Hypnosis

The Society for Clinical and Experimental Hypnosis, a new affiliate of the AAAS, was organized in 1949 and included among its early members some 25 contributors who had been active in this field. The founding president, Jerome M. Schneck, served until 1955. He was succeeded by Bernard B. Raginsky (1955–58), Roy M. Dorcus (1958–59), and Jacob H. Conn (1959–61). The present membership exceeds 600.

The objectives of the society, as defined in its constitution, are "to stimulate and support the professional pursuit of research in this field [hypnosis] and its boundary areas, to encourage cooperation among members of professional and scientific disciplines with regard to the utilization of hypnosis in research and in practice, to support communication by scientific meetings as well as by publications, to set up standards of adequacy and ethics for those making use of hypnosis, and to strive toward the establishment of formal and standardized training facilities for those who qualify."

In its early days the society was composed primarily of psychologists and psychiatrists who had published widely. Later, its membership was broadened to include physicians and dentists.

Requirements for associate membership at present are as follows: the applicant must possess a doctor's degree in medicine, dentistry, or psychology, must have completed an acceptable initial course in hypnotic techniques, and must be actually using hypnosis in his clinical practice or research. Full membership requires that the person shall have had an additional 2 years of acceptable experience in the clinical uses of hypnosis, or that he shall have published a scientific paper in the field. The designation "fellow" is an honor awarded by special action of the executive council to members who have made outstanding contributions either to the society or to the field of scientific hypnosis.

Membership within the society is drawn from the disciplines of medicine, dentistry, and psychology, and the emphasis is on encouraging intercommunication between research worker and practicing clinician. One of the basic tenets of the society is that clinical practice, to be sound, should not be separated from basic science. The society name reflects this view.

The society encourages its members to undertake original scientific studies. As a result, at least three-fourths of all English-language publications in the field of scientific hypnosis appearing within the past decade have been written by members of the society. A few nondoctoral scientists (not more than ten) who have made outstanding published contributions to the field have been admitted to membership.

The Institute for Research in Hypnosis was organized to serve as a research and training center in scientific hypnosis. It was incorporated in the state of New York as a nonprofit scientific foundation, was granted a charter by the Department of Education of that state, and was made responsible to the Board of Regents of the University of the State of New York through the New York State Commissioner of Education.

The institute has received funds donated to it for research purposes, has sponsored and presented courses and workshops, has made awards for outstanding papers, and has initiated and carried through various research projects. Through its publications society, numerous books and monographs have been published.

The quarterly *International Journal of Clinical and Experimental Hypnosis*, originally entitled the *Journal of Clinical and Experimental Hypnosis*, has been published by the society since 1953. Its pages have been devoted to original papers and are open to contributors on a world-wide basis, whether or not they are affiliated with the society. In January 1959 the *Journal* enlarged its editorial board to include a number of distinguished foreign editors and was given its present name.

With the broadening of membership in the society to provide for the affiliation of people who did not yet have the many years of experience and the research skill which characterized early members, the executive council became increasingly aware of the need for some high-level accreditation, some way of indicating individuals whose background enabled them to provide "expert" skills in using hypnosis in research and in clinical practice. Its thinking in this respect paralleled that which brought about the establishment of specialty boards in the professions of medicine, dentistry, and psychology.

In the summer of 1958 the executive council voted to instruct its research and training branch, the Institute for Research in Hypnosis, to incorporate under its charter the American Board of Clinical Hypnosis, with three autonomous subsections: the American Board of Medical Hypnosis, the American Board of Hypnosis in Dentistry, and the American Board of Examiners in Psychological Hypnosis.

The American Board of Clinical Hypnosis was incorporated in the state of New York with the "consent" of the state Commissioner of Education, to whom the institute is responsible. While the three subboards are autonomous and have no authority regarding the evaluation of each other's candidates, they maintain continuous communication and have established comparable requirements for their respective certifications.

An applicant to the American Board of Medical Hypnosis must hold a diploma from a medical specialty board or be an active member of the Academy of General Practice. Seven or more years of substantial experience in the clinical uses of hypnosis are required for admission to the examinations of the board.

The American Board of Examiners in Psychological Hypnosis issues diplomas in "clinical hypnosis" and in "experimental hypnosis." Candidates for the "clinical" diploma are now required (by agreement with the American Psychological Association) to be holders of diplomas from the American Board of Examiners in Professional Psychology. Five years of creditable experience in the clinical or experimental uses of hypnosis are a prerequisite for admission to the examinations.

The American Board of Hypnosis in

Dentistry maintains standards in its held similar to those established by the medical and psychological boards. All three of these boards provided for an initial period during which some of the formal requirements (including examinations) were waived for qualified senior workers in the field.

The society holds an annual scientific meeting (the 14th such meeting will be held in Portland, Oregon, in August 1962) as well as many regional meetings through its official sections.

MILTON V. KLINE

Headquarters, Society for Clinical and Experimental Hypnosis, 33 East 65 Street, New York

Forthcoming Events

May

13–16. American Acad. of Dental Medicine, annual, Baltimore, Md. (P. Block, 36 N. Luzerne Ave., Baltimore)

13–16. Transfer of Calcium and Strontium across Biological Membranes, conf., Ithaca, N.Y. (R. H. Wasserman, Dept. of Physical Biology, New York State Veterinary College, Cornell Univ., Ithaca)

13–17. American Industrial Hygiene Assoc., conf., Washington, D.C. (W. S. Johnson, Bethlehem Steel Co., Bethlehem, Pa.)

14–16. National Aerospace Electronics Conf., Dayton, Ohio. (Inst. of the Aerospace Sciences, 2 E. 64 St., New York 21)

14–16. Technical Assoc. of the Pulp and Paper Industry, coating conf., annual, Cincinnati, Ohio. (TAPPI, 155 E. 44 St., New York 16)

14–18. American Soc. of Civil Engineers, convention, Omaha, Neb. (W. H. Wisely, 345 E. 47 St., New York 17)

14–18. Hormonal Steroids, intern. congr., Milan, Italy. (L. Martini, Instituto de Farmacologia e Terapia, 21 Via A. del Sarto, Milan)

14–19. International Office of Epizootics, Paris, France (Office Internationale des Epizooties, 12, rue de Prony, Paris)

15–16. Council on Medical Television, annual, Bethesda, Md. (J. F. Huber, CMT, Inst. for Advancement of Medical Communication, 33 E. 68 St., New York 21)

15–16. Injury, Inflammation, and Immunity, intern. symp., Elkhart, Ind. (L. Thomas, Dept of Medicine, New York Univ., Bellevue Medical Center, New York, N.Y.)

15–17. World Food Forum, Washington, D.C. (J. K. McClarren, U.S. Dept. of Agriculture, 409 Administration Bldg., Washington 25)

15–19. International College of Surgeons, European federation, surgical congr., Amsterdam, Netherlands. (J. Blazenburg, ICS Netherlands Section, A. Perkstraat 57, Hilversum, Netherlands)

16. Design of Talking and Writing Machines for the Rehabilitation of Communication Disabilities, conf., New York, N.Y. (C. Berkeley, Foundation for Medical

Technology, 2 E. 63 St., New York 21)

16–17. Navy Medical-Dental TV Workshop, Bethesda, Md. (Inst. for Advancement of Medical Communication, 33 E. 68 St., New York 21)

16–18. Conference on Dust, Scheveningen, Netherlands. (Fachgruppe Staubtechnik, Prinz-Georg-Str. 77/79, Düsseldorf 10, Germany)

16–18. Noise Abatement, intern. congr., Salzburg, Austria. (Osterreichischer Arbeitsring für Lärmbekämpfung, Stubenring 1, Vienna 1, Austria)

16–26. Large Electric Systems, intern. conf., Paris, France. (ICLES, 112 Boulevard Haussmann, Paris 8")

17–18. Regional Implications of Space Research, symp. (by invitation), Durham, N.C. (C. E. Whitefield, Bureau of Public Information, Duke Univ., Durham)

17–19. American Inst. of Industrial Engineers, annual, Atlantic City, N.J. (W. J. Jaffe, Newark College of Engineering, Newark, N.J.)

17–19. Eccrine, Apocrine, and Holocrine Glands, symp., Madison, Wis. (Div. of Postgraduate Medical Education, University of Wisconsin Medical School, Madison 6)

17–19. Nepiology, intern. conf., Catania, Sicily. (S. Rapisardi, Via Mavilla 37, Catania)

17–19. Paralanguage and Kinesics, conf., Bloomington, Ind. (T. A. Sebeok, Research Center in Anthropology, Rayl House, Indiana Univ., Bloomington)

17–20. International Medical Soc. of Endoscopic Photocinematography, Television and Radiocinematography, Louvain, Belgium. (J. M. Dubois de Montreynaud, Société Médicale Internationale d'Endoscopie et de Radiocinématographie, 4, rue du Général-Baratier, Rheims, France)

17–31. Special Libraries Assoc., Washington, D.C. (J. B. North, Missile and Space Div., Lockheed Aircraft Corp., 50-14, Palo Alto, Calif.)

18. Problems of Finding and Using the Chemical Literature, symp., Columbus, Ohio. (B. S. Youngblood, Columbus Section, American Chemical Soc., 2835 Pontiac Ave., Columbus 11)

18–19. Indiana Acad. of Science, Mitchell. (W. W. Bloom, Valparaiso Univ., Valparaiso, Ind.)

18–29. European Plastics and Rubber Conf., Paris, France. (Du Mont Publicity Co., 18 Queensberry Place, London, S.W.7, England)

19–20. International Assoc. for the Study of the Liver, Munich, Germany. (G. A. Martini, c/o Universitäts Krankenhaus, Eppendorf, Hamburg, Germany)

20–23. American Inst. of Chemical Engineers, natl., Baltimore, Md. (F. J. Van Antwerpen, AICE, 345 E. 47 St., New York 17)

20–23. Humidity and Moisture, intern. symp., Washington, D.C. (W. A. Wildhack, Office of Basic Administration, Natl. Bureau of Standards, Washington 25)

20–23. Radiation Research Soc., annual, Colorado Springs, Colo. (E. L. Powers, RRS, Argonne Natl. Laboratory, Argonne, Ill.)

20–24. Air Pollution Control Assoc., annual, Chicago, Ill. (D. A. Sullivan, APCA, 4400 Fifth Ave., Pittsburgh, Pa.)

20–24. American Assoc. of Cereal

Chemists, Saint Louis Park, Minn. (B. S. Miller, Dept. of Flour and Feed Milling, Kansas State Univ., Manhattan)

21–22. Society of American Military Engineers, annual, Washington, D.C. (SAME, 808 Mills Bldg., Washington 6)

21–23. National Aerospace Instrumentation Symp., Washington, D.C. (C. Creveling, Goddard Space Flight Center, Greenbelt, Md.)

21–24. Air Pollution Instrumentation Symp., Chicago. Ill. (D. F. Adams, Div. of Industrial Research, Washington State Univ., Pullman)

21–25. Max Planck Inst. for the Advancement of Science, general assembly, Düsseldorf, Germany. (MPIAS, Kaiserswerther Str. 164, Düsseldorf)

21–25. Plastic and Reconstructive Surgery of the Eye and Adnexa, intern. symp., New York, N.Y. (R. Troutman, Manhattan Eye, Ear & Throat Hospital, 210 E. 64 St., New York 21)

21–25. Thermodynamics of Nuclear Materials, symp., Vienna, Austria. (Intern. Atomic Energy Agency, 11 Kärntner Ring, Vienna 1)

21–26. Ceramic Congr., intern., Copenhagen, Denmark. (Arbejdsgivere, Indenfor de Keramiske Industrier, Nørre Volgade 34, Copenhagen K)

21–26. Rubber Technology Congr., annual, London, England. (Secretary, Institution of the Rubber Industry, 4, Kensington Palace Gardens, London, W.8)

22–24. National Microwave Theory and Techniques, symp., Inst. of Radio Engineers, Boulder, Colo. (L. G. Cumming, IRE, 1 E. 79 St., New York 21)

22–24. Self-Organizing Systems, conf., Chicago, Ill. (G. T. Jacobi, Armour Research Foundation, 10 W. 35 St., Chicago 16)

22–25. Rationalizing Consumption of Electric Power, intern. symp., Warsaw, Poland. (Ministry of Mines and Power, Krucza 36, Warsaw)

22–25. Rubber Technology Conf., Scarborough, England. (Institution of the Rubber Industry, 4 Kensington Palace Gardens, London, W.8)

22–26. Disposal and Utilization of Solid Domestic and Industrial Wastes, intern. congr., Essen, Germany. (Haus der Technik, Schliessfach 668, Essen)

22–26. International Medico-Athletic Federation, congr., Santiago, Chile. (G. La Cava, Via A. Serra, 104, Rome, Italy)

23–24. Forming and Testing of Sheet Metal, intern. colloquium, Düsseldorf, Germany. (J. Hooper, Intern. Deep Drawing Research Group, John Adam St., Adelphi, London, W.C.2, England)

23–25. American Soc. for Quality Control, annual, Cincinnati, Ohio. (A. W. Wortham, Texas Instruments, Inc., P.O. Box 5474, Dallas 22)

24–26. Institute of Radio Engineers, conf. on space communications, Seattle, Wash. (IRE, 1 E. 79 St., New York 21)

24–26. International Assoc. for Bronchology, Bruges, Belgium. (R. Pannier, c/o Service de Pneumo-Phtisologie, Hôpital Saint-Jean, Bruges)

25–27. Society for Applied Anthropology, annual, Kansas City, Mo. (C. Price, Menninger Foundation, Topeka, Kansas)

26–27. Ukrainian Medical Assoc. of North America, biennial, Detroit, Mich. (R. W. Sochynsky, UMANA, 2 E. 79 St., New York 21)

26–30. International Federation for Hygiene and Preventive Medicine, intern. congr., Vienna, Austria. (E. Musil, IFHPM, Mariahilfer Strasse 177, Vienna)

27–30. Chemical Inst. of Canada, annual conf. and exhibition, Edmonton. (CIC, 48 Rideau St., Ottawa 2, Ont.)

27–30. East-West Diabetic Workshop, Chicago, Ill. (B. R. Hurst, 1646 Pittsfield Building, 55 E. Washington, Chicago 2)

27–2. International Federation of Prestressing, 4th congr., Rome, Italy. (IFP, 6, rue Paul Valéry, Paris, 16e)

28–30. American Assoc. for Contamination Control, 1st annual, San Francisco, Calif. (D. M. Petersen, Central Vacuum Corp., 3008 E. Olympic Blvd., Los Angeles 23, Calif.)

28–30. Biology of the Transuranic Elements, symp., Richland, Wash. (R. C. Thompson, Hanford Biology Laboratory, General Electric Co., Richland)

28–30. Heavy Water Reactors, Canadian Nuclear Assoc., annual conf., Ottawa, Ont., (CNA, 19 Richmond St. West, Toronto 1)

28–30. International Discussion on Heat Treating, Lausanne, Switzerland. (Institut für Härterei-Technik, Postfach 13, Bremen-St. Magnus, Germany)

28–1. Modern Techniques of Computation and Industrial Automation, colloquium, Paris, France. (Assoc. Française de

Régulation et d'Automatisme, 19, rue Blanche, Paris 9°)

28–2. International Ophthalmic Optical Congr., Berlin, Germany. (G. H. Giles, Intern. Optical League, 65 Brook St., London, W.1, England)

28–2. United Nations Scientific Committee on the Effects of Atomic Radiation, New York, N.Y. (United Nations, New York)

29–2. American College of Cardiology, Inc., Denver, Colo. (I. Brotman, 1746 K St., NW, Washington, D.C.)

29–3. Latin Oto-Rhino-Laryngology Soc., Madrid, Spain. (M. Calderin, Diego de Leon 62, Madrid)

29–22. World Meteorological Organization, congr., Geneva, Switzerland. (WMO, 41, Avenue Giuseppe Motta, Geneva)

29–31. Tissue Culture Assoc., annual, Washington, D.C. (R. E. Stevenson, Natl. Cancer Inst., Bethesda 14, Md.)

31–3. European Symp. on Fresh Water from the Sea, Athens, Greece. (P.O. Box 1199, Omonoia, Athens)

31–3. German Bunsen Soc. for Physical Chemistry, general assembly, Münster. (F. Vorländer, Varrentrappstr. 40–42, Frankfurt am Main, Germany)

31–7. Television Conf., intern., London, England. (Secretary, Institution of Electrical Engineers, Savoy Place, London, W.C.2)

June

1–2. European Acad. of Allergy, Prague, Czechoslovakia. (C. Herscheimer, Theyss-Str. 23, Berlin, Germany)

3–8. American Soc. for Testing and Materials, Committee on Mass Spectrometry, annual, New Orleans, La. (G. Crable, Physics Dept., Geneva College, Beaver Falls, Pa.)

4–6. Association of Iron and Steel Engineers, Colorado Springs, Colo. (T. J. Ess, AISE, 1010 Empire Bldg., Pittsburgh 22, Pa.)

4–6. Chemistry and Technology of Chloring and Chloroderivatives, mtg., Szczecin. Polish Chemical Soc. (A. Z. Zielinski, Politechnika Szczecinska, U1. Pułaskiego 10, Szczecin 3)

4–6. Edison Electric Inst., annual, Atlantic City, N.J. (A. B. Morgan, EEI, 750 Third Ave., New York 17)

4–6. International Water Study Sessions, Liége, Belgium. (CEBEDEAU, 2, rue Armand Stévart, Liége)

4–7. Nuclear Congr. and Intern. Atomic Exposition, biennial, New York, N.Y. (Engineers Joint Council, 29 W. 39 St., New York 18)

4–8. Medical Library Assoc., annual, Chicago, Ill. (D. Washburn, American Dental Assoc., 222 E. Superior St., Chicago 11)

4–8. Modern Thermal and Hydraulic Power Plants, intern. study days, Liége, Belgium. (Secretary, Assoc. des Ingénieurs Electriciens sortis de l'Institut Electrotechnique Montefiore, rue Saint-Gilles, 31, Liége)

4–8. Society of Chemical Industry, overseas section, annual, Stockholm, Sweden. (G. P. Armstrong, c/o Distillers Co. Ltd., 21 St. James Sq., London, England)

4–8. Society of Physical Chemistry, annual, Paris, France. (O. Emschwiller, Ecole Supérieure de Physique et de Chimie, 10 rue Vauquelin, Paris 5°)

4–10. Corrosion of Reactor Materials, conf., Intern. Atomic Energy Agency, Salzburg, Austria. (IAEA, 11 Kaerntnerring, Vienna 1, Austria)

5–6. International Neurological Meeting, Paris, France. (J. Sigwald, Société Française de Neurologie, 68, Boulevard de Courcelles, Paris 17°)

5–7. Fuels Symp., American Soc. of Mechanical Engineers, New Brunswick, N.J. (C. R. G. Dougherty, College of Engineering, Rutgers Univ., New Brunswick)

5–8. Microwave Communication, Budapest, Hungary. (G. Bognár, Hungarian Acad. of Sciences, Akadémia utca 2, Budapest V)

5–8. Group for the Advancement of Spectrographic Methods, annual congr., Paris, France. (Groupement pour l'Advancement des Méthodes Spectrographiques, 1, rue Gaston-Boissier, Paris 15°)

6–8. American Scientific Glassblowers Soc., annual symp. and exposition, Washington, D.C. (G. A. Sites, ASGS, 309 Georgetown Ave., Wilmington 3, Del.)

6–8. Canadian Federation of Biological Societies, annual, Quebec. (A. H. Neufeld, Dept. of Pathological Chemistry, Univ. of Western Ontario, London, Ont., Canada)

6–9. International Assoc. for Cereal Chemistry, Vienna, Austria. (F. Schweitzer, Maurer, Heudöfelgasse 41, Vienna 23)

7–9. Manufacturing Chemists' Assoc., Inc., White Sulphur Springs, W.Va. (R. D.

Lambert, MCA, 1825 Connecticut Ave., NW, Washington 9)

7–9. U.N. Food and Agriculture Organization–Intern. Union of Forest Research Organizations, Joint Committee on Bibliography, Freiburg, Switzerland. (Intern. Agency Liaison Branch Office of Director General, FAO, Viale delle Terme di Caracalla, Rome, Italy)

7–13. Quantitative Biology, symp., Cold Spring Harbor, N.Y. (Long Island Biological Assoc., Cold Spring Harbor)

8–9. Nutrition Soc. of Canada, annual, Quebec City. (E. V. Evans, Dept. of Nutrition, Ontario Agricultural College, Guelph, Ont., Canada)

9. Community Air Pollution, conf., Austin, Tex. (J. O. Ledbetter, 305 Engineering Laboratories Bldg., Univ. of Texas, Austin 12)

10–14. Institute of Food Technologists, Miami Beach, Fla. (C. L. Willey, 176 W. Adams St., Chicago 3, Ill.)

10–16. International Congr. of Sanitary Engineering, Washington, D.C. (E. E. Wagner, Engineering & Sanitation Branch, Office of Public Health, Intern. Cooperation Administration, Washington 25)

11. International Soc. of Neurovegetative Research, symp., Marseilles, France. (Prof. Mosinger, Institut de Médecine Légale, Faculté de Médecine, Marseilles)

11–13. Chemical Physics in the Onsager Reciprocal Relations, intern. conf., Providence, R.I. (J. Ross, Dept. of Chemistry, Brown Univ., Providence)

11–13. Microscopy, symp., Chicago, Ill. (McCrone Research Inst., 451 E. 31 St., Chicago 16)

11–14. Health Physics Soc., Inc., annual, Chicago, Ill. (C. C. Palmiter, c/o Federal Radiation Council, Rm. 597, Executive Office Bldg., Washington 25)

11–14. Instrument Soc. of America, instrument-automation conf. and exhibit, Seattle, Wash. (W. H. Kushnick, ISA, 313 Sixth Ave., Pittsburgh 22, Pa.)

11–15. American Medical Assoc., annual, Chicago, Ill. (F. J. Blasingame, AMA, 535 N. Dearborn St., Chicago 10)

11–15. International Congr. on Rehabilitation, Dresden, Germany. (K. Werner, Intern. Congr., Harz 42–44, Halle an der Saale, Germany)

11–15. International Council for Bird Preservation, intern. conf., New York, N.Y., (British Museum of Natural History, Cromwell Rd., London, S.W.7, England)

11–15. Molecular Structure and Spectroscopy, symp., Columbus, Ohio. (R. A. Oetjen, Dept. of Physics and Astronomy, Ohio State Univ., 174 W. 18 Ave., Columbus 10)

11–18. Industrial Statistics and Quality Control for Chemical and Processing Industries, seminar, Rochester, N.Y. (Extended Services Div., Rochester Inst. of Technology, Rochester 8)

11–22. All-European Inst. of Scientific Studies for the Prevention of Alcoholism, Warsaw, Poland. (A. Tongue, Intern. Bureau against Alcoholism, Case Gare 49, Lausanne, Switzerland)

11–22. Geophysics, summer seminar, Cloudcroft, N.M. (J. R. Foote, P.O. Box 1053, Holloman AFB, N.M.)

11–24. Electronics, Nuclear Energy, Wireless, Television, and Cinema, intern. exhibition, Rome, Italy. (Secretariat, Ras-

segna Internazionale Elettronica, Nucleare e Teleradiocinematografica, Via della Scrofa 14, Rome)

11–24. Stratigraphy and Structure of the Appalachians, summer conf., Washington, D.C. (M. F. Norton, Dept. of Earth Sciences, American Univ., Massachusetts and Nebraska Aves., NW, Washington, D.C.)

12. Society of Plastics Engineers, technical conf., Boston, Mass. (H. C. Cookingham, c/o D. H. Litter Co., Inc., P.O. Box 247, Ballardvale, Mass.)

12–15. American Soc. of Mammalogists, annual, Middlebury, Vt. (B. P. Glass, Dept. of Zoology, Oklahoma State Univ., Stillwater)

12–15. Organic Chemistry of Natural Products, intern. symp., Brussels, Belgium. (Secrétariat du Symposium Internationale de Chimie Organique, c/o Fédération des Industries Chimiques de Belgique, 32, rue Joseph II, Bruxelles 4)

12–15. Textile Inst., intern. meeting, Eastbourne, England. (D. Moore, 10 Blackfriars St., Manchester 3, England)

12–16. American Soc. of Parasitologists, Washington, D.C. (F. J. Kruidenier, Dept. of Zoology, Univ. of Illinois, Urbana)

13. International Commission for the Prevention of Alcoholism, annual, Warsaw, Poland. (ICPA, 6840 Eastern Ave., NW, Washington 12)

13–16. American Assoc. of Bioanalysts, Philadelphia, Pa. (L. D. Hertert, 490 Post St., Rm. 1049, San Francisco 2, Calif.)

13–16. Gas Chromatography, intern. symp., Hamburg, Germany. (W. Fritsche, Gesellschaft Deutscher Chemiker, Frankfurt am Main, Postfach 9075, Germany)

13–29. International Radio Consultative Committee, Bad Kreuznach, Germany. (Villa Bartholoni, 128, rue de Lausanne, Geneva, Switzerland)

14–15. DECHEMA Annual Meeting, Frankfurt am Main, Germany. (DECHEMA, Postfach 7746, Frankfurt am Main 7)

14–16. American Assoc. of Feed Microscopists, annual, Chicago, Ill. (T. G. Campbell, AAFM, 1825 N. Laramie Ave., Chicago 39)

14–17. American Soc. of Ichthyologists and Herpetologists, Washington, D.C. (J. A. Peters, Biology Dept., San Fernando Valley State College, Northridge, Calif.)

15–17. Congress of Scientists on Survival, natl. conf., annual, New York, N.Y. (H. H. Lerner, SOS, 51 E. 90 St., New York 28)

15–19. European Orthodontic Soc., congr., Groningen, Netherlands. (K. G. Bijlstra, Kamplaan 5, Groningen)

17–20. American Dairy Science Assoc., College Park, Md. (H. F. Judkins, 32 Ridgeway Circle, White Plains, N.Y.)

17–20. American Soc. of Agricultural Engineers, Washington, D.C. (J. L. Butt, ASAE, 420 Main St., St. Joseph, Mich.)

17–20. Botanical Soc. of America, field meeting, Newark, Del. (G. F. Somers, Dept. of Biological Sciences, Univ. of Delaware, Newark)

17–21. American Nuclear Soc., annual, Boston, Mass. (O. J. DuTemple, ANS, 86 E. Randolph St., Chicago 1, Ill.)

17–21. Enzymic Action of the Central Nervous System, intern. symp., Göteborg, Sweden. (A. Lowenthal, Institut Bunge, 59,

rue Philippe Williot, Berchem-Antwerp, Belgium)

17–21. International Ornithological Congr., Ithaca, N.Y. (G. Sibley, Cornell Univ., Fernow Hall, Ithaca)

17–22. American Inst. of Electrical Engineers, summer meeting, Denver, Colo. (R. S. Gardner, AIEE, 33 W. 39 St., New York 18)

17–22. American Soc. of Medical Technologists, Washington, D.C. (S. Saarnijoki, R.R. #2, Hill Rd., c/o W. C. Maine, Harwinton, Conn.)

17–23. American Library Assoc., Miami Beach, Fla. (D. H. Clift, ALA, 50 E. Huron St., Chicago 11, Ill.)

18–19. Broadcast and Television Receivers, conf., Institute of Radio Engineers, Chicago, Ill. (IRE, 1 E. 79 St., New York 21)

18–20. American Neurological Assoc., annual, Atlantic City, N.J. (M. D. Yahr, Neurological Inst., 710 W. 168 St., New York 32)

18–21. Agricultural Inst. of Canada, annual conf., Ottawa, Ont. (AIC, Univ. of Ottawa, Ottawa, Ont.)

18–21. U.S. Congress on Theoretical and Applied Mechanics, Berkeley, Calif. (W. Goldsmith, Dept. of Applied Mechanics, Univ. of California, Berkeley 4)

18–22. American Soc. for Engineering Education, Colorado Springs, Colo. (W. L. Collins, Univ. of Illinois, Urbana)

18–22. Combustion Engines, intern. congr., Copenhagen, Denmark. (R. L. Stanley, U.S. Natl. Committee for ICCE, 2000 K St., NW, Washington 6)

18–22. Mathematical Programming, symp., Chicago, Ill. (R. L. Graves, Graduate School of Business, Univ. of Chicago, Chicago 37)

18–22. Research and Development of Technical Devices for the Blind, intern. congr., New York, N.Y. (N. C. Holopigian, American Foundation for the Blind, 15 W. 16 St., New York 11)

18–22. Spectroscopy, intern. conf., College Park, Md. (B. F. Scribner, Natl. Bureau of Standards, Washington 25, D.C.)

18–23. American Soc. for Horticultural Science, Caribbean region, annual, Antigua, Guatemala. (E. H. Cásseres, Londres 40, México 6, D.F.)

18–23. Continuous Culture of Microorganisms, intern. symp., Prague, Czechoslovakia. (I. Málek, Czechoslovak Acad. of Science, Inst. of Biology, Na cvičišti 2, Prague 6)

18–23. International Scientific Congr. on Electronics, Rome, Italy. (Rassegna Eletronica, Nucleare e della, Cinematografia, Via della Scrofa 14, Rome)

18–23. U.N. Educational Scientific and Cultural Organization, Youth Inst., Study Seminar on Natural Sciences in Youth Science Clubs, Munich, Germany (UNESCO, Germeringerstrasse 30, Munich/Gauting, Germany)

18–24 Aug. Institute of Theoretical Physics, annual, Boulder, Colo. (W. E. Brittin, Dept. of Physics, Univ. of Colorado, Boulder)

19–20. Applications of Quality Control in Chemical and Processing Industries, seminar, Rochester, N.Y. (Extended Services Div., Rochester Inst. of Technology, Rochester 8)

19–21. American Physical Soc., Evans-

ton, Ill. (K. K. Darrow, Pupin Physics Lab., Columbia Univ., New York 27)

19–21. Biomedical Engineering Symp. and Exhibit, annual, San Diego, Calif. (Program Committee, Inter-Science, Inc., 8484 La Jolla Shores Dr., La Jolla, Calif.)

19–22. Institute of the Aerospace Sciences, natl. summer meeting, Los Angeles, Calif. (H. S. Hansen, Halex, Inc., P.O. Box 546, El Segundo, Calif.)

19–22. Data Processing, intern. conf., New York, N.Y. (Conf. Registrar, Natl. Machine Accountants Assoc., 507 Fifth Ave., New York 17)

20–24. Long-Term Climatic Variations, conf., Aspen, Colo. (F. Ward, CRZH, AFCRL, Hanscom Field, Mass.)

20–29. European Federation of Chemical Engineering, annual congr., Olympia, London, England. (Congr. Secretary, Institution of Chemical Engineers, 16 Belgrave Square, London, S.W.1)

21–22. American Rheumatism Assoc., annual, Chicago, Ill. (F. E. Demartini, 622 W. 168 St., New York 32)

21–23. Astronomical Soc. of the Pacific, summer meeting, Victoria, B.C. (H. A. Abt, Kitt Peak National Observatory, Kitt Peak, Ariz.)

21–23. Endocrine Soc., annual, Chicago, Ill. (N. L. Mattox, 1200 N. Walker, Oklahoma City, Okla.)

21–23. Interaction Between Fluids and Particles, London, England. (Soc. of Chemical Industry, 14 Belgrave Sq., London, S.W.1)

21–25. American College of Chest Physicians, annual, Chicago, Ill. (M. Kornfeld, ACCP, 112 E. Chestnut St., Chicago 11)

21–28. Design of Experiments for Chemical and Processing Industries, seminar, Rochester, N.Y. (Extended Services Div., Rochester Inst. of Technology, Rochester 8)

22–3. International Conf. on Chemical Arts—Chemistry Exhibition, Paris, France. (Société de Chimie Industrielle, 28, rue Saint Dominique, Paris, 7°)

24–27. Cytodifferentiation and Macromolecular Synthesis, symp., Soc. for the Study of Development and Growth, Monterey Peninsula, Calif. (A. C. Braun, Rockefeller Inst., New York 21)

24–28. Association of Official Seed Analysts, Miami, Fla. (E. W. Sundermeyer, 325 U.S. Court House, 8th and Grand Ave., Kansas City 6, Mo.)

24–29. American Soc. for Testing and Materials, annual meeting and exhibit, New York, N.Y. (ASTM, 1916 Race St., Philadelphia 3, Pa.)

25–27. American Soc. of Heating, Refrigerating and Air-Conditioning Engineers, Inc., annual, Miami Beach, Fla. (ASHRAE, United Engineering Center, 345 E. 47 St., New York 17)

25–27. National Convention on Military Electronics, annual, Washington, D.C. (J. J. Slattery, Electronics Div., Martin Co., Baltimore, Md.)

25–28. Society for Investigative Dermatology, Chicago, Ill. (H. Beerman, SID, 255 S. 17 St., Philadelphia 3, Pa.)

25–29. Coordination Chemistry, intern. conf., Stockholm, Sweden. (L. G. Sillen, Dept. of Inorganic Chemistry, Royal Inst. of Technology, Stockholm 70)

New Products

Thermoelectric titration apparatus (Titrathermomat) follows the course of neutralization, precipitation, chelation, and redox reactions by monitoring the liberation or absorption of heat during the addition of titrant. Aqueous or nonaqueous titrations that cannot be done with indicators because of opacity or insufficient ionization generally liberate or absorb sufficient heat of reaction to permit these determinations to be performed in dilute solutions with reproducibility of the order of ±2 percent. In operation 15 to 20 ml of sample containing enough unknown to liberate or absorb 1 cal or more during the titration is enclosed in a Styrofoam insulation chamber and stirred. A thermistor probe in the solution monitors the temperature to establish a baseline recorded against time. Titrant is then introduced at a constant rate as the recorder plots the temperature. A sharp change in the slope of the temperature curve as the titrant is added continues until the end point is signaled by the return of the slope to that of the baseline. As titrant is added at a constant rate, the quantity of titrant added can be determined from the time elapsed between the changes in slope. Alternatively the system can be calibrated to indicate the total heat liberated during the titration. Heating the sample with an immersed heater with a known electrical input calibrates the system so that the total number of calories exchanged can be read from the record. When the energy exchange of the reaction is known and the number of released calories is known, one can calculate the quantity of unknown titrated without exact knowledge of the concentration of the titration reagent. As best results are obtained when the sample and titrant are within 0.2°C of one another, an additional thermistor temperature sensor in the titration burette is provided to monitor the titrant temperature. The sample can be warmed to this temperature by means of the calibrating heater. Direct boric acid titrations at pK 5.8 $\times$ 10^{-10} ordinarily impossible colorimetrically can be performed in the range of 1 to 40 mmole/lit. with a reproducibility of better than ±2 percent.—R.L.B. (American Instrument Co., 8030 Georgia Ave., Silver Spring, Md.)

(Circle 1 on Readers' Service card)

Electronic manometer utilizes as pressure transducer a thin metal diaphragm stretched to very high tension. Displacement of the diaphragm is picked up capacitively by two electrodes spaced on each side of the diaphragm. Interchangeable sensing heads are available in full-scale ranges of 30, 100, 300, and 1000 mm-Hg. These are connected by cable to an electronic indicator. The latter operates through a balanced bridge permitting readout to five places on decade dials with further expansion on a meter. The meter scale can be expanded in eight ranges so that from the full range of the gage, down to 0.003 full range, is displayed as full scale on the meter. This permits the operator to set a desired pressure and then expand the scale by as much as 10,000 times to observe pressure changes around the setting of as little as 10^{-6} of full scale. The instrument can be used to read either differential, gage, or absolute pressure from 10^{-6} to 20 lb/in^2. Hysteresis is said to be less than 0.004 percent of full scale and zero drift less than 0.0001 per degree Fahrenheit.—J.S. (MKS Instruments, 1776 Massachusetts Ave., Lexington, Mass.)

(Circle 2 on Readers' Service card)

Portable **laser** (Fig. 1) is a compact, pulsed, coherent light source. A dual-trigger design feature does not permit the unit to fire unless both triggers are pressed, thus preventing accidental discharge. The device uses an eliptical housing for the ruby rod and the flash tube with its polished aluminum reflector. The coherent light output has a wavelength of 6943 A. Light-pulse train duration is approximately 0.2 msec. Beam divergence is less than 0.3 deg. The four models available offer choices of automatic or manual control, battery or power-line operation, and variable pump power voltage or fixed energy. Custom built models can also be furnished.—J.S. (Kollsman Instrument Corp., Elmhurst 73, N.Y.)

(Circle 3 on Readers' Service card)

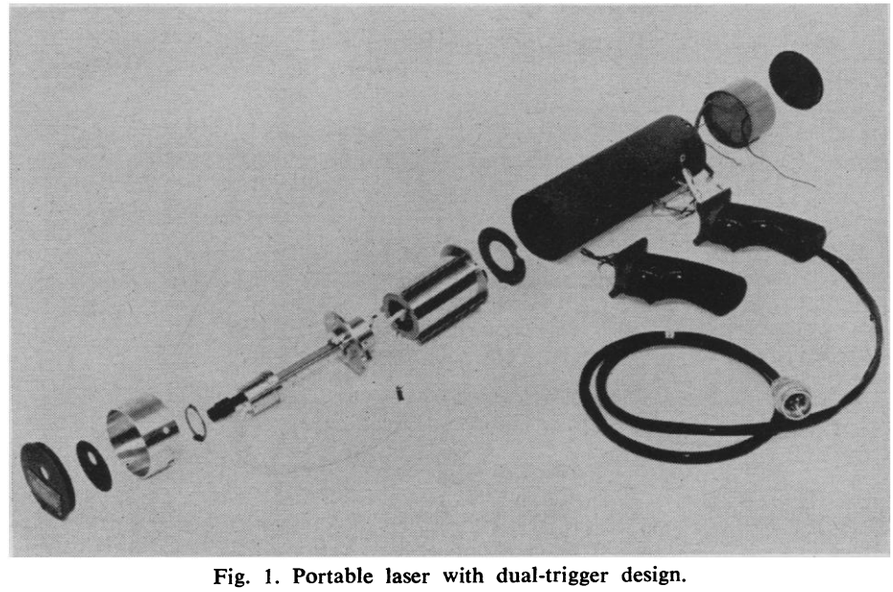


Fig. 1. Portable laser with dual-trigger design.

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

Robert L. Bowman (R.L.B.), 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 page 435. Circle the department number of the items in which you are interested on this card.

Strip-chart recorder (Speedomax H) is an adjustable-zero, adjustable-range instrument that can be set to provide any calibrated span between 0.67 and 100 mv and any zero suppression between −50 and +50 mv. Flexibility is accomplished with six switch-selected spans, plus continuous attenuation of each to provide continuously calibrated spans. In addition, a choice of five steps of zero suppression or elevation, plus a continuous adjustment that adds to these steps, is provided. The automatically balanced d-c potentiometer is housed in a case with span and zero controls integrally mounted below the recorder. Measuring circuits are continuously supplied by a-c line and are rectified and regulated by two Zener-diode circuits. Span response is nominally 1 second. Amplifier gain is automatically adjusted as the span switch is operated. A manual gain control simplifies initial sensitivity adjustment and rechecks. Chart record width is 6 inches with overtravel provided at each end.—J.S. (Leeds and Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa.)

(Circle 4 on Readers' Service card)

Vacuum ionization gage (type BGT-75) is a bare, flanged Bayard-Alpert type structure with two tungsten filaments. The bare structure permits direct mounting within the vacuum chamber to minimize effects due to ionic pumping and restrictive tubulation. A gold-gasket seal that can be baked is used to join the gage to the vacuum system. Sensitive range is said to extend from 10^{-3} to 10^{-10} mm-Hg. Specifications include: grid voltage, 150 v; collector voltage, −20 to −50 v; filament current, 4 to 6 amp at 3 to 5 v; sensitivity, 100 $\mu a/\mu$ at 10 ma grid current. —J.S. (Vacuum-Electronics Corp., Plainview, N.Y.)

(Circle 5 on Readers' Service card)

Electromagnetic blood flowmeter (model K-2000) operates on 400-cy/sec gating frequency to achieve high-frequency response for recording pulsatile flow. Range of operation is from 5 ml/min with small pick-up head to 10,000 ml/min with large pick-up head. Flow probes in several sizes are provided for chronic implantation, as well as for extracorporal monitoring of flow in connection with heart-lung or other perfusion techniques. The 400-cy/sec system features a 400-cy/sec band-pass filter that reduces extraneous electrical interference, thus permitting measurement of blood flow close to the heart

without interference from the electrocardiographic potentials. Electronic equipment housing is 9 (h) by 21 (w) by 13 (d) inches.—R.L.B. (Medicon, Division of Quality Precision Products, Inc., 2800 North Figueroa, Los Angeles 65, Calif.)

(Circle 6 on Readers' Service card)

Spring-driven **commutator switch** (model 93) for application to balloon sondes, telemetry, multiplexing, and laboratory tests, weigh 4 ounces. This switch has 4-hour running time from a spring-wound motor at 1 rev/min. The flush printed-circuit switch is available with four conducting segments or other arrangements. The device operates in environments from sea level to 120,000 feet altitude.—J.S. (Automation Dynamics Corp., 255 County Rd., Tenafly, N.J.)

(Circle 7 on Readers' Service card)

Analog-to-digital converter (model AD-10A) performs up to 500,000 ten-bit conversions per second. Output is either serial or parallel straight binary for all units. Serial output is 5×10^6 bits per second while parallel output is up to 500,000 words per second. Accuracy is said to be ±0.097 percent ± one-half the least significant bit. The unit can be operated internally or externally for sampling command. The instrument has 12 plug-in panels; ten logic panels are interchangeable.—J.S. (Raytheon Co., 1415 Providence Highway, Norwood, Mass.)

(Circle 8 on Readers' Service card)

Gravity-reference surface consists of an element with a reflecting surface, polished to one-quarter wavelength, and a convex spherical optical surface. The convex surface rests in a mating concave surface and is supported by air introduced in the center of the concave plate. The surface behaves as a stable liquid surface without the instabilities inherent in liquids. The instrument can be used with electronic or visual autocollimators.—J.S. (Keuffel and Esser Co., 3rd and Adams Sts., Hoboken, N.J.)

(Circle 9 on Readers' Service card)

A direct-reading **microhematocrit centrifuge** (Readacrit) is designed especially for physicians' offices and small laboratories. A built-in system permits hematocrit values to be read directly without removing the capillary tube from the centrifuge. No separate reader is required. The reading system utilizes

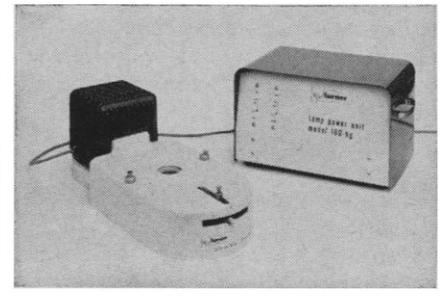
specially calibrated capillary tubes, "Pre-Cal" heparinized capillary tubes, designed specifically for use with the hematocrit. A 5-minute centrifuge cycle provides rapid results while the patient sits at the desk. A built-in cycle timer and an automatic brake, which stops in 35 seconds, eliminates the need to monitor the centrifuge while it is running. This device will accommodate from one to six capillary tubes thus making it ideal for use where only small numbers of hematocrit determinations are run at any one time. Separate tube channels and a heavy-gauge head cover which locks tubes in place eliminate any possibility of the tube shifting during the test. Each tube channel is numbered prominently. In addition to the head cover, the device has a heavy-gauge "see through" plastic cover secured by a safety lock. A fool-proof safety switch prevents the machine from starting unless the plastic centrifuge cover is not only properly closed but also securely locked. Compact, light, and portable (10-inch diameter, 7¾ inches high, 7½ lb), the Readacrit can be operated on practically any level surface—laboratory table, desk, or shelf. Perfect balance and unique shock mounting of the housing, motor, and head eliminate distracting noise, vibration, or creeping.—R.L.B. (Clay-Adams, Inc., 141 E. 25 St., New York 10)

(Circle 10 on Readers' Service card)

Automatic scanning thermometer (model 47) scans three, seven, or eleven thermistor-probe inputs. It indicates and provides recorder signals for each input for 20 seconds, 1 minute, or 5 minutes. Program and scan rate are chosen by front-panel switches. After completion of each cycle, the instrument goes to an identification channel that drives the recorder off scale for ease of input identification. The instrument is available in 19 different temperature spans covering various parts of the −45° to +150°C range.—J.S. (Yellow Springs Instrument Co., Inc., P.O. Box 106, Yellow Springs, Ohio)

(Circle 11 on Readers' Service card)

Microscope illuminator for fluorescence microscopy utilizes a new high-intensity mercury arc of extreme brilliance (140,000 ca/cm²). These quartz-enclosed arcs concentrate the 100-watt output into an arc only 1/64 inch in diameter to provide an unusually efficient source rich in fluorescence-stimulating ultraviolet light. High-efficiency reflecting optics collect the light and direct it upward through a window in a portion of the housing which fits under the microscope. This base housing also contains a filter selector which allows one to select visible or ultraviolet illumination. The lamp is operated on regulated and filtered direct current supplied by a companion power unit. This unit features simple-single switch starting of the lamp and a multistage solid-state regulator circuit with a Zener diode reference. The necessary filters for optimal operation with the currently used dyes are available.—R.L.B. (G. K. Turner Associates, 2524 Pulgas Ave., Palo Alto, Calif.)



(Circle 12 on Readers' Service card)

Cobalt-60 sources can now be purchased from Nuclear-Chicago at their regular price and returned up to 5 years later for 33⅓-percent credit toward the purchase of another cobalt-60 source. The exchange plan benefits those who require gamma emitters of constant intensity when working in such fields as radiography, medical therapy, and industrial gauging. The trade-in plan applies to a newly developed source which has a double encapsulation of the cobalt-60 pellet; this plan applies only to purchases made after 1 January 1962. Cobalt-60 sources are available with activities of 1 to 2000 mc.—R.L.B. (Nuclear-Chicago Corp., 359 E. Howard Ave. at Nuclear Dr., Des Plaines, Ill.)

(Circle 13 on Readers' Service card)

Portable reactor kinetic simulator permits simulation of reactors containing various fuels and moderators. A motor-driven calibrated control rod and a linear meter calibrated in terms of percent of full power provide visualization of actual reactor operation. Switches permit selection of fuels, neutron lifetimes, reactivity, operating level, and operating mode. Output is provided for feeding a recorder. If desired, the control rod may be coupled to an automatic control system. This is accomplished by feeding the neutron level signal into a suitable controller and driving the control rod through the motor terminals.—J.S. (Milletron, Inc., 454 Lincoln Highway East, Irwin, Pa.)

(Circle 14 on Readers' Service card)

Electrostatic voltmeter is a portable instrument said to be accurate to approximately ± 1 volt. Minimum resistance is 10^{17} ohms and maximum input capacitance is 10 pf. A selector switch operates in five positions, each with an increment of 50 volts to cover a total range of 250 volts. Each incremental range is calibrated in single volts. Power is supplied by six 22.5-volt batteries.—J.S. (Landsverk Electrometer Co., Glendale, Calif.)

(Circle 15 on Readers' Service card)

Vapor deposition unit uses an electron beam as a high-temperature heat source to evaporate refractory metals. The apparatus is self-contained and desk size. The vacuum chamber is machined from a single aluminum forging with highly polished interior surfaces. Liquid nitrogen traps above the diffusion pump and within the chamber prevent backstreaming contamination and condense vapors from the deposition zone. The electron-beam heating source consists of an annular gun and focusing shields. A high-reactance high-voltage power supply provides temperatures greater than 3600°C. A heated substrate holder with modular power supply and indexing rotary substrate holder for multi-sample depositions are available as optional equipment.—J.S. (MRC Manufacturing Corp., 47 Buena Vista Ave., Yonkers, N.Y.)

(Circle 16 on Readers' Service card)

Streak camera incorporates a mirror system that permits the recording of single or compound images. The primary optical system records a long modulated streak on a 10-inch length of 16-mm film moving at 5000 in./sec. A secondary optical system projects synchronized time marks at 10-μsec intervals on the edge of the film. The film is carried inside a cast-aluminum rotor driven at 30,000 rev/min.—J.S. (Photomechanisms, Inc., 15 Stepar Pl., Huntington Station, N.Y.)

(Circle 17 on Readers' Service card)

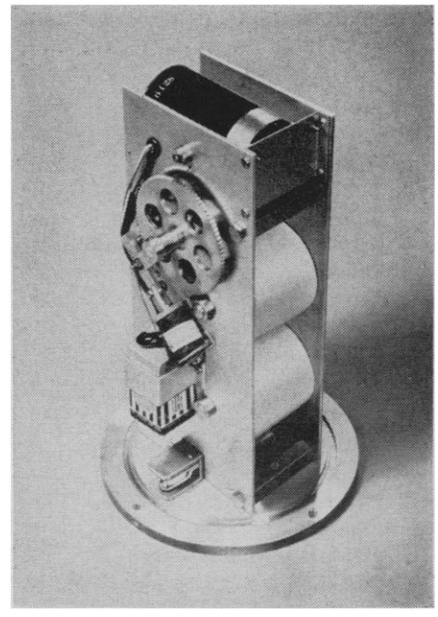
Microfilters for the continuous filtration of gases and liquids through microporous porcelain feature in-line mounting and positive sealing. The filtering elements attach separately to the mounting head, allowing the case to be removed without breaking line connections or disturbing the element. An O-ring seal and sleeve arrangement insures micro-tightness of the filter element. Since the only flow in and out of the filter is through the micro-porous porcelain elements, absolute retention of particles in sizes from 25 μ or larger down to 0.3 μ is achieved. These low-cost elements offer selective performance, as they are available in seven porosity grades ranging from 100 to 1.2 μ in pore size. Cases of carbon steel, stainless steel, and nickel-plated brass are offered with inlet connections of ⅜, ½, ¾, or 1 inch. All cases, including those of nickel-plated brass, can be used with system pressures to 250 lb/in.^{2} Applications suggested include the cold sterilization of pharmaceutical and bacteriological preparations. — R.L.B. (Selas Flotronics, Spring House, Pa.)

(Circle 18 on Readers' Service card)

Beta-ray spectrometer (model JBS-180) is a high-resolution double-focusing instrument. By varying the current to the deflecting magnet, the operator causes electrons of differing energy and momentum to be brought to a focus at the detector, a Geiger-Müller tube with window thickness of about 1 mg/cm^2. Detected beta rays are counted by a scaler for manual measurement, or they are measured by a rate meter and recorded for automatic operation. Resolution is determined by the transmission of the system which is controlled by adjusting variable baffles in the magnetic-field enclosure. Transmission is 0.2 to 0.6 percent, and corresponding resolutions are 0.3 and 0.8 percent. The sector-type pole pieces of the magnet and the water-cooled field coils are enclosed in a pure-iron yoke tank that acts as a magnetic shield. The tank is evacuated. Sources to be studied are inserted through an air lock that permits quick change of sample. The field can focus beta rays of energies up to 5.5 Mev.—J.S. (Fisher Scientific Co., Fisher Building, Pittsburgh 19, Pa.)

(Circle 19 on Readers' Service card)

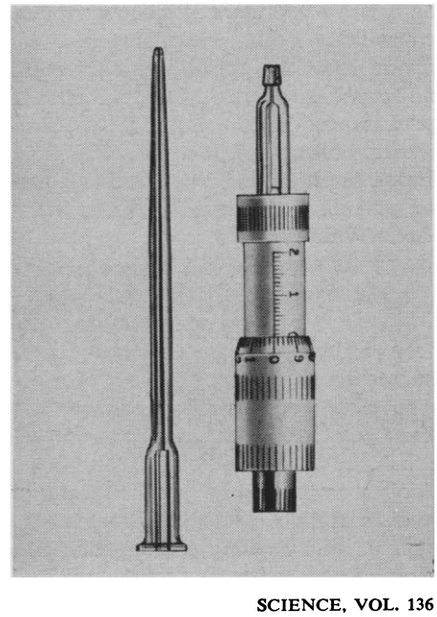
Recording thermograph provides continuous film records of deep-sea temperatures. Readings are recorded on 70-mm film at any preset rate from one reading in 10 minutes to one reading



in 24 hours. It will continue to operate up to 100 days without replacement of battery or film. The recorder photographs the position of a mercury column with accuracy said to be ±0.25°C over the range −2° to +23°C. The instrument container is an anodized aluminum cylinder designed for use at depths to 200 m. Cases suitable for greater depths are available.—J.S. (Braincon Corp., P.O. Box 312, Marion, Mass.)

(Circle 20 on Readers' Service card)

Micrometer syringes and burets, constructed of precision bore glass and having Teflon plungers which are moved by an all-plastic micrometer, provide high-precision measurements and complete corrosion resistance. The liq-



uid comes in contact with only glass and Teflon, and a fluoroelastomer (Viton) O-ring gives a vacuum tight seal. The low-cost instruments fill and deliver liquids with micrometer control. They are available in two sizes, 0.2 ml in 0.0002-ml divisions and 2.0 ml in 0.002-ml divisions, and in Luer-tip-syringe or capillary-tip-buret forms. —R.L.B. (Roger Gilmont Instruments, Inc., 1 Great Neck Rd., Great Neck, N.Y.)

(Circle 21 on Readers' Service card)

Ruby laser has a nominal output of 30 joules per pulse and peak spike power of approximately 100 kw. The laser uses a six-turn helical flash tube for excitation. The rod is a 4-inch-long, ½-inch-square ruby with total internal reflection, or roof-top, geometry, and completely unsilvered. Liquid nitrogen circulated around the rod cools it to 80° to 100°K. Recycling time is 15 seconds at 8000-joule input. Maximum energy input per pulse is 10,000 joules. —J.S. (Trion Instruments, Inc., 1200 N. Main St., Ann Arbor, Mich.)

(Circle 22 on Readers' Service card)

Rotary measuring tables are available in diameters of 4, 6, 9, 12, and 18 inches and with accuracies said to be 1, 3, and 6 millionths inch. Wobble error is said to be less than 0.10-second deviation from a plane perpendicular to the axis, or 0.000005 inch in 10. The top and/or bottom are flat and square to the axis, and faces are parallel to each other within 10^{-6} inch per inch of diameter. Surface finish is 1 μinch or better. Tables of up to 12-inch diameter can be made to tilt. Motorized drives as well as a horizontal position table can be supplied. The tables are designed to check concentricity, squareness, parallelism, flatness of cylindrical shapes, and pitch diameter of gear teeth, as well as to calibrate glass dials. They can be used with an autocollimator for calibrating resolvers and as an integral part for aligning guidance systems.—J.S. (Pierce-West, Inc., 3116 S. Andrews Ave., Fort Lauderdale, Fla.)

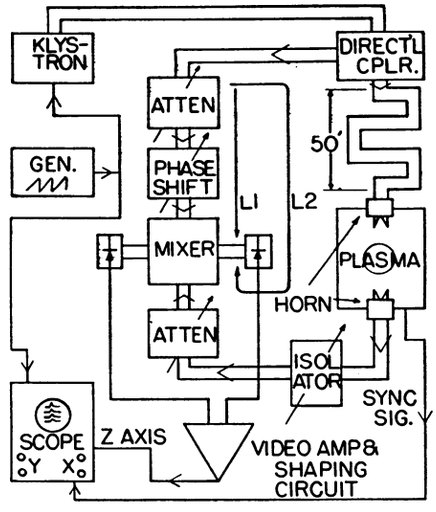
(Circle 23 on Readers' Service card)

Fourier analysis computer is an analog instrument that performs a Fourier analysis in 3 minutes, giving the d-c offset and the magnitude of the first, second, third, and fourth harmonics of a wave form that can be plotted. It is designed for desk-top operation and is portable. The analysis is performed by plotting one cycle of the wave form to

be analyzed and dividing it into 18 equal parts. Each abscissa is represented by a dial on the face of the computer. When these dials have been set to indicate the amplitude of each abscissa, the d-c offset and the coefficients of the sine and cosine terms for each harmonic can be read from a meter on the computer.—J.S. (IMM Industries Systems Division, 14761 Califa, Van Nuys, Calif.)

(Circle 24 on Readers' Service card)

Microwave interferometer for determination of electron densities in plasma as a function of time, permits measurements in plasmas at temperatures so high as to preclude the use of optical or probe techniques. The interferometer, which has as its output an oscilloscopic

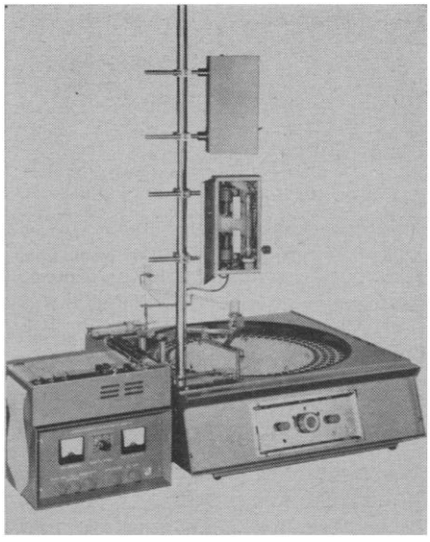


BLOCK DIAGRAM
MICROWAVE INTERFEROMETER

display of a fringe pattern, is self-calibrating and self-zeroing so that only relative fringe shifts need be observed. Operating range of electron densities is 3×10^{11} to 6×10^{13} per cubic centimeter.—J.S. (Princeton Applied Research Corp., Princeton, N.J.)

(Circle 25 on Readers' Service card)

Universal ratio recording ultraviolet analyzer (model 254) for use with an automatic fraction collector now makes it possible to continuously analyze fractions absorbing between 254 and 340 $m\mu$. Interchangeable sharp cut-off filters select any wavelength, and the ratio signal compensates for buffer systems with significant absorption. Teflon flow cells with quartz windows coupled with a cold-cathode ultraviolet lamp source give the widest form of versatility and interchangeability with any make of fraction collector. The ratio amplifier



provides a built-in integrator and event marker; the trace recorder has a 6-inch chart width. Single or double tandem diverter for dual column flow offers four-wavelength recording at 254, 260, 280, and 340 mμ. This device analyzes fats, proteins, nucleosides, serum, plasma, bile, amines, glycogens, gromatics, dyes, steroids, drugs, and biologicals. — R.L.B. (Chromatography Corporation of America, 7736 Lake St., Morton Grove, Ill.)

(Circle 26 on Readers' Service card)

Gamma ray counter and computer (Gammacord) for routine measurements of all gamma-emitting samples has many uses in medicine and industry. It offers advantages of simple operation, automatic background subtraction, automatic normalization, direct indication of reading, and outstanding stability and reliability. The instrument is applicable in medical studies involving measurement of low-level radiation, as well as in industrial radiation measurement. Typical of the former are measurement of in vitro thyroid function, excretion, gastrointestinal bleeding, metabolism, circulatory studies, and dilution determinations. Industrial uses include wear and corrosion studies, measuring of trace impurities, and various tracer techniques.—R.L.B. (Perkin-Elmer Corp., Norwalk, Conn.)

(Circle 27 on Readers' Service card)

The model 200 **synchronized frequency standard** and the model 100 **frequency comparator** are said to permit frequency calibration to a few parts in 10^{10}. The frequency standard is comprised of a narrow-band receiver, a phase comparator, and a highly stable, controlled 1-Mcy/sec oscillator. The re-

ceiver is switch tuned to either WWVL (20 kcy/sec) or NBA (18 kcy/sec). Additional channels can be added on special order. The output of the receiver is doubled in frequency and fed into a phase detector. The output of the 1-Mcy/sec generator is synthesized through regenerative dividers to either 36 or 40 kcy/sec and is applied to the phase detector. The output of the phase detector is processed through a low-pass filter adjusted to optimize performance under local operating conditions. Output of the phase detector controls the frequency of the oscillator to maintain synchronism with the received signal. Audio output for received keyed information is provided by heterodyning the received signal with an internal beat-frequency oscillator. During sunrise and sunset between the receiver and the transmitter, the shift in propagation path may cause a temporary frequency deviation of a few parts in 10^9. If this is objectionable, a manual disable switch can be used to free the oscillator from control by the received signal. This will not affect short-term accuracy which is stated to be ± 1 part in 10^9. Long-term stability is controlled by the transmitted signal, typically a few parts in 10^{12}. The model 100 frequency comparator, through frequency difference multiplication, reduces the time required to make frequency comparisons. A front-panel control selects difference-frequency multiplication of 1, 10, 100, or 1000. An indicator-recorder is available as an optional companion unit to provide a permanent record of magnitude and sense of the frequency difference. Comparison to 1 part in 10^{11} is said to be obtainable in a few minutes. —J.S. (Montronics Inc., 1212 West Main, P.O. Box 135, Bozeman, Mont.)

(Circle 28 on Readers' Service card)

Variable thickness spreader for thin-layer chromatography may be set to give absorbent layers from 50 to 3000 $m\mu$ in depth on glass plates. The new spreader does not clog. Simplicity of design makes it convenient to set up, operate, and clean, since it consists of only two main parts held together by a pair of knurled set screws. Two spacer gauges supplied with the spreader accurately measure the opening of the outlet slit when its setting is being changed. They permit precise measurement of settings in increments of 50 μ.—R.L.B. (Research Specialties Co., 200 S. Garrard Blvd., Richmond, Calif.)

(Circle 29 on Readers' Service card)

Ultra-high vacuum system (type 1460) achieves pressures of 10^{-9} mm-Hg or lower. The system is moderately baked and elastomer sealed, avoiding heavy bolted flanges. The standard unit has a vertical stainless-steel bell jar with an unobstructed work space 24 inches in diameter and 24 inches high. The pumping system utilizes a high-speed diffusion pump with one stage of mechanically refrigerated baffle and two stages of liquid-nitrogen trapping. Anti-migration shields are said to prevent migration of hydrocarbon vapors into the vacuum area.—J.S. (General Vacuum Corp., 82 Hicks Ave., Medford 55, Mass.)

(Circle 30 on Readers' Service card)

Aerosol generator (model 255/256) produces over a 90-minute period an aerosol cloud containing particles of a predetermined size or mixture of sizes. A standardized suspension of particles is introduced into a nebulizer chamber.

A second supply of dry filtered air impinges on the first stream tangentially, drying the particles in the dispersoid. Finally, the required sample flow is obtained from a concentric tap at the output of the instrument and may be conducted by tubing to the desired location. Model 235 versions include a separate air pump; Model 256 is operated directly from an existing air supply ranging from 60 to 125 lb/in^2. Aerosol output is 1 ft^3/min, and particle size ranges from 0.1 to 5 μ.—J.S. (Royco Instruments, Inc., 440 Olive St., Palo Alto, Calif.)

(Circle 31 on Readers' Service card)

Oceanographic data recording capsule is able to record data from as many as a dozen instruments at ocean depths. Output signals from instruments used in conjunction with the capsule are fed into a meter in the end cap of a camera. Each signal is photographed as it appears, together with the time, date, and other relevant information. After each exposure, the camera automatically selects the next instrument to be read and photographs its signal. A set of flashing lights is also photographed to identify the instrument being read. Capacity of the recorder is 4000 data pictures. Manual controls can be used to trigger the camera from the surface, or it can be equipped with a timing motor for automatic operation. The recorder will withstand pressures up to 10,000 lb/in^2.—J.S. (Edgerton, Germeshausen & Grier, Inc., 160 Brookline Ave., Boston, Mass.)

(Circle 32 on Readers' Service card)

Paper-tape recorder (model ETR-7) performs the function of a mechanical tape punch but with greater speed. Instead of punching, the device uses an electrostatic recording process that fixes black powdered-ink spots on the tape in a code configuration identical to that used with punched tape. The resulting chadless tape may be visually interpreted, or it may be read by a reflected-light tape reader. Information packing density is said to be as much as twice that possible on punched tape. In operation, a high-resistivity plastic-coated paper tape with conductive backing is passed through the writing head. The latter consists of two sets of closely separated electrodes. Pulsing the electrodes leaves an electrostatic charge on the surface of the tape to which powdered ink adheres. Tape speed is up to 60 in./sec. The recorder accepts standard data pulses for from five to

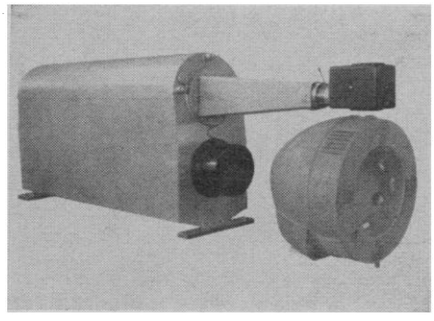
eight channels plus sprocket channel, using tape widths of 11/16 to 1¼ inches.—J.S. (Omnitronics, Inc., 511 N. Broad St., Philadelphia 23, Pa.)

(Circle 33 on Readers' Service card)

Portable oscilloscope (model 3015) covers the frequency range from d-c to 15 Mcy/sec at the 3-db-down point. Horizontal sweep range is 0.5 sec/div to 20 nanosec/div. The instrument is transistorized and operates on 15 watts at 105 to 125 volts, 60 to 400 cy/sec. Vertical deflection factor is 10 mv to 20 v/div with deflection of accuracy ± 3 percent. Input attenuation has a dynamic range of 10 mv to 50 v/div with provision for a-c or d-c coupling of the input signal. A self-contained voltage standard provides a square-wave signal for amplitude calibration purposes. The horizontal amplifier can be connected to the external horizontal input by a selector switch for *x-y* display.—J.S. (Galaxy Laboratories, Inc., 3606 Midway Dr., San Diego 10, Calif.)

(Circle 34 on Readers' Service card)

Wide angle collimator is designed for the testing and evaluation of precision image forming equipment. A broad spectrum model, the instrument permits testing of special vidicon and orthicon tubes and telescopes in ultraviolet and infrared applications. In the visible and near infrared regions, the collimator



projects a 1.5-deg field with diffraction-limited resolution. Spectral range is 2350 A to 2.65 μ. Object surface of the collimator is flat, and clear aperture diameter is 8.5 inches.—J.S. (TE Company, 415 E. Montecito St., Santa Barbara, Calif.)

(Circle 35 on Readers' Service card)

Air contamination analysis kit is especially suitable for use in hospitals where airborne, antibiotic-resistant organisms are causing outbreaks of infection. An all-glass impinger is provided to help assure organism viability during aerosol sampling. The analysis

kit provides materials and equipment sufficient to conduct about 50 bacteriological analyses of air, liquids, or solid surfaces. Tubes, nutrients, and detailed instructions for many applications are supplied. — R.L.B. (Millipore Filter Corp., Bedford, Mass.)

(Circle 36 on Readers' Service card)

Continuous metabolic respiration analyzer system (model 1800) measures carbon-14, carbon dioxide, and oxygen in the exhaled respiratory gases of humans. The output levels are presented on chart recorders, and the integrated quantities are printed on paper tapes. In addition, specific activity (C^{14}/CO_2) and respiratory quotient (CO_2/O_2) are presented on chart recorders. Environmental factors—such as pressure, temperature, humidity, and flow rate—are controlled in all of the primary detectors. This eliminates the necessity of data reduction to standard conditions, either biological or physical, by time consuming calculations.—R.L.B. (General Measurements, Garnerville, N.Y.)

(Circle 37 on Readers' Service card)

Polyethylene tanks are available in heavy types, in rectangular or cylindrical form, with 10- to 350-gallon capacity. Lightweight cylindrical tanks with capacities of 5, 15, 30 and 55 gallons are available; other sizes are also available. These tanks are said to be very strong and free from the stresses produced in other thermoplastic forming methods. The tanks can safely hold corrosive materials because they are chemically inert and unbreakable.—R.L.B. (American Agile Co., 5461 Dunham Rd., Cleveland 37, Ohio)

(Circle 38 on Readers' Service card)

Magnetic-field measuring system uses nuclear magnetic resonance to determine magnetic field strength from 0 to 100,000 gauss. The field probe of the instrument is ¾ inch wide for use with most laboratory magnets. Units are generally calibrated with proton resonance for the 2000- to 4000-gauss range, but will be specially modified and calibrated for any range up to 100,000 gauss upon request. The system is said to be sufficiently stable to permit measurements of magnetic field to at least 1 part in 100,000. The instrument is supplied with or without an oscilloscope display unit.—J.S. (Alpha Scientific Laboratories, P.O. Box 333, Berkeley 1, Calif.)

(Circle 39 on Readers' Service card)

Very-high-frequency preamplifiers are designed for receiving signals from satellites and space vehicles. These devices, the series 2000 vacuum-tube models and the series 3000 solid-state models, incorporate complete operating spare circuits to provide redundancy reception; switching between the circuits is by coaxial relays at input and output. The series 2000 can be supplied with center frequency anywhere between 50 and 250 Mcy/sec, and the series 3000 with center frequency anywhere between 50 and 500 Mcy/sec. Bandwidth can be between 0.7 and 7 percent as required. Operating-power requirement for the electronic part of the circuit is 25 watts for the vacuum-tube version and less than 1 watt for the solid-state model; 100 watts are required instantaneously for switching.—J.S. (ITT Federal Laboratories, 330 Park Ave., New York 22, N.Y.)

(Circle 40 on Readers' Service card)

Temperature differential indicator (model 6040) is designed to measure small temperature differentials over a range from 0° to 1800°F. Input is from two matched platinum-resistance thermometers. The temperature differential output is indicated on a self-contained meter, or it can be displayed on a recorder or by a galvanometer.

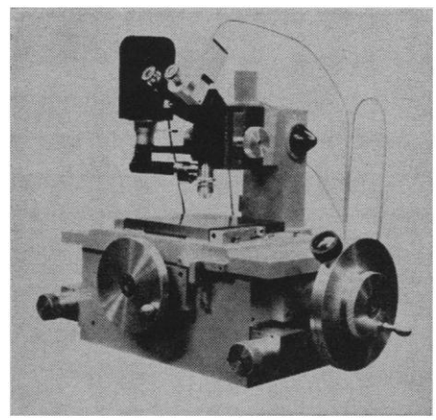
The instrument includes a power supply and plug-in bridge circuitry. Temperature differentials as small as 0.1°F are measured over a span of 500°F.—J.S. (Winsco Instruments & Controls Co., 1533 26 St., Santa Monica, Calif.)

(Circle 41 on Readers' Service card)

Frequency multiplier and amplifier multiplies by 10 frequencies between 3 and 30 Mcy/sec. Multiplication is performed without ambiguity since multiplication factors other than 10 are excluded. Amplitude of the signal is indicated on a panel meter and is adjustable by means of an attenuator. As a free-running very-high-frequency generator, the equipment operates over the frequency range 30 to 300 Mcy/sec. The instrument is also equipped for frequency measurement in the very-high-frequency range, frequencies between 30 and 300 Mcy/sec being covered without band switching.—J.S. (Rohde and Schwartz, 111 Lexington Ave., Passaic, N.J.)

(Circle 42 on Readers' Service card)

Measuring microscopes, available in two models, are said to deviate no more than 4 μinch from true straight line stage travel. A 3-by-2-inch model reads out in 50-μinch intervals on the x-axis and in 100 μinch intervals on the y-axis. In metric instruments the corresponding readouts are 1 and 2 μ. The z-axis (vertical) is also read through remotely controlled optics. Range of measurement on the z-axis depends upon the optics supplied. Accuracy of z-axis measurement may be as high as $\pm$ 0.2 μ. A 4-by-6-inch model offers accuracy of $\pm$ 1 μ on both axes. Two other models, a 28-inch throat instrument and a nuclear emulsion microscope, are available on special order.—J.S. (Yosemite Laboratory, P.O. Box 11364, Palo Alto, Calif.)



(Circle 43 on Readers' Service card)

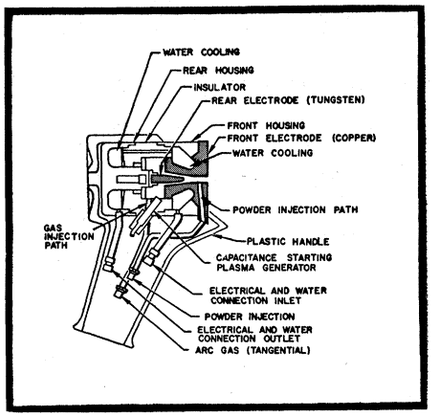


Fig. 2. Diagram of helium plasma jet.

Helium plasma jet (Fig. 2) provides a 20-inch long, narrow flame that is said to have a stable reproducible operating regime. Energy content of the helium arc is 50,000 Btu/lb or greater. Dwelling time in the flame is increased by a factor of 1000, and operation is silent. Heat distribution through the flame is even, and nozzle exhaust is at atmospheric pressure.—J.S. (Plasmadyne Corp., 3839 S. Main St., Santa Ana, Calif.)

(Circle 44 on Readers' Service card)

Oxygen saturation of blood samples is measured in the Brinkmann hemoreflector by the intensity of reflected light between 600 and 700 mμ. In principle, the wavelength used is strongly absorbed by hemoglobin and to a lesser extent by oxyhemoglobin. In this spectral region, the quantity of light reflected by a blood sample is a function of oxygen saturation. A built-in light spot galvonometer indicates the output from a photo cell to measure the percentage of oxygen saturation. Measurements are made by setting the instrument against reference samples, and results said to be within 1 percent are read from a calibration curve. The determination requires only 0.5 ml of whole blood and can be completed in 3 minutes. The instrument is ordinarily supplied for operation on 50-cy/sec alternating current, but terminals are available for operation on a 6-volt battery. Sixty-cycle instruments are available on request.—R.L.B. (James G. Biddle Co., 1316 Arch St., Philadelphia 7, Pa.)

(Circle 45 on Readers' Service card)

Solar simulator is designed to reproduce the sun's spectral distribution at zero air mass within the limits set forth in the AIEE specification and uniformly illuminate 20 cm^2 with full-sun

intensity. The simulator is compact and portable, uses no liquid or absorption filters, and operates with low power input.—J.S. (Optical Coating Laboratory, Inc., 2789 Giffen Ave., Santa Rosa, Calif.)

(Circle 46 on Readers' Service card)

Microprojector, (Tri-Simplex) has an improved internal condensing system for brighter illumination and greater magnification. A high power model, with 43× objective and supplementary swing-in light condenser, extends applications in both the classroom and laboratory. The microprojector incorporates a special heat-absorbing glass to protect the specimen, whether it is alive or fixed. Rack-and-pinion focusing is provided. The instrument has the necessary stability for both wall-screen and table-top projection. Supplementary condenser and 43× objective can be added to basic models of the Tri-Simplex manufactured after 1 February 1962. Optional equipment includes polarizing accessories, 5× and 2.7× achromatic objectives, body tube, and 3× and 5× eyepieces. Instrument meets CCSSO purchase guide requirements. For more information request bulletin No. E-254.—R.L.B. (Bausch and Lomb, Inc., Rochester 2, N.Y.)

(Circle 47 on Readers' Service card)

Microporous polyethylene granules (MIPOR 14PN-G) have interconnecting pores that can imbibe and immobilize organic liquids to provide a stationary polar phase for chromatography of hydrophobic substances. In this form of chromatography the stationary phase is less polar than the moving liquid phase in contrast to the usual situation. This reversed-phase partition chromatography technique makes it possible to fractionate steroids, drug intermediates, fat soluble vitamins, and other hydrophobic substances. Good mechanical strength and high porosity makes the granules easy to handle even when they contain a high percentage of immobile solvent. They may be washed out completely with solvents and completely recovered for reuse so that large volumes of material may be fractionated economically. The granules may also be used for stationary phase in gas chromatography at temperatures up to about 65°C. The product is available in 1-liter packages at about $20 per liter.—R.L.B. (ESB-Reeves Corp., 323 West Glenside Ave., Glenside, Pa.)

(Circle 48 on Readers' Service card)

Differential voltmeter measures a-c and d-c voltages with accuracies of ±0.1 percent for a-c measurements and ±0.01 percent for d-c measurements, (accuracies given are the percent of reading and not of full scale). The voltmeter incorporates Zener references and six-digit readout for both a-c and d-c operation. Ranges are 0.5 to 1000 volts a-c and 0.0 to 1000 volts d-c. The instrument operates on 105 to 125 volts a-c, 50 to 60 cy/sec at 8 watts. Regulation is said to be ±0.001 percent for a ±10 percent change in line voltage. Temperature effect is 2 ppm per degree Centigrade over an ambient temperature range of +10° to +40°C.—J.S. (Calibration Standards Corp., 1031 Westminister Ave., Alhambra, Calif.)

(Circle 49 on Readers' Service card)

Subminiature displacement transducer is a differential transformer 0.275 inches long and 3/16 inch in diameter. When loaded with 0.5 megohm and furnished with 3-volt, 1000-cy/sec excitation, the transformer develops an output of 0.92 mv per 0.001 inch deflection per volt excitation over a linear range of ±0.01 inch. The core slug is 0.18 inch long and has an outside diameter of 0.052 inch and a bore of 1/32 inch.—J.S. (Bulova Watch Co., Inc., 40–01 61 St., Woodside 77, N.Y.)

(Circle 50 on Readers' Service card)

absolute difference between the data for these latter groups is greater than that between the data for the cold-exposed and the cold-control animals, and there is considerably less variability and overlap between the cold-control and the nonhandled animals. A difference in results for these latter groups, neither of which had been previously exposed to cold, would be difficult to explain on the basis of a hypothesis which places emphasis on prior experience with cold.

The main difficulty, however, lies in the fact that only *depletion* scores are presented. In this the authors are apparently following an unfortunate precedent (*2*), but a depletion score is a poor substitute for the actual values observed in stressed and nonstressed animals, since the same depletion score may be a resultant of a variety of actual values. Also, the graphic presentation of depletion scores rather than of actual values for adrenal ascorbic acid in stressed and nonstressed animals provides the reader with insufficient information for making his own interpretation of the results. In any case, since one cannot prove the null hypothesis, even if the authors had compared the data from handled and cold-exposed animals and had found no significant difference, they would not be justified in stating that exposure to cold effects the *same* response to cold stress that handling does. That both handling and exposure to cold during the first week of life can result in a significant depletion of adrenal ascorbic acid in response to cold stress at 12 days of age has been established. That the effect of exposure to cold and handling effect the *same* change in the level of adrenal ascorbic acid remains to be determined. In this respect the authors, in presenting depletion scores rather than the stress and nonstress values for all animals, may have been doing an injustice to their own data.

One final point requires comment. There is no logical justification for the authors' contention that, because handled and cold-exposed animals show a significant depletion of adrenal ascorbic acid in response to cold stress, the essential variable in the handling procedure is a decrease in environmental temperature. Merely because event *B* produces the same effects as event *A* (this was not demonstrated by the data presented), it does not necessarily follow that the effects of *A* are therefore mediated by *B*, as the authors have implied.

In these comments I do not mean to

deny that reduction in environmental temperature may be a contributing factor in the behavioral and physiological changes effected by handling. However, the data presented by Schaefer *et al.* hardly warrant the conclusions that change in environmental temperature is the basic variable in the early handling phenomenon. As Schaefer *et al.* and others (*3*) have pointed out, what is really required in approaching this question is the direct measurement of a variety of physiological changes concomitant with handling and other types of early manipulation.

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1. T. Schaefer, Jr., F. S. Weingarten, J. C. Towne, *Science* **135**, 41 (1962).
2. S. Levine, M. Alpert, G. W. Lewis, *J. Comp. Physiol. Psychol.* **51**, 774 (1958); S. Levine and G. W. Lewis, *Science* **129**, 42 (1959).
3. R. Ader, *Psychol. Monographs* **73**, Whole No. 472 (1959); E. W. Bovard, *Psychol. Rev.* **65**, 257 (1958).

The interesting results notwithstanding, the thesis and the conclusions drawn in the recent study by Schaefer, Weingarten, and Towne (*1*) are not convincing. Several points raise serious doubts about the validity of considering decrease in temperature *the* variable in studies of early handling phenomena, and about the applicability of this experiment in particular.

1) The effects of handling in infancy have been noted even in those instances in which a split-litter technique was employed, with removal of the mother at the time of experimental treatment (*2*).

2) The stipulation that vision and hearing are nonfunctional during the first postnatal week in the life of a rat is tenuous at best. A similar belief prevails for the cat, yet data that I have collected indicate that electroencephalographic and electromyographic responses to visual and auditory stimuli can be recorded from birth. Although visual and auditory stimulation may not be the most promising of the potential variables in the early experience phenomena, they have not been decisively excluded.

3) In view of the recognition given the view that "any of several modes of extra-stimulation" will induce the handling phenomena (*3*), the failure to expose a group of subjects to an increase in temperature is difficult to comprehend. The results reported would have

been much more impressive had such an experimental group been included.

4) Even when one grants the uniqueness of some of the early experience phenomena or the possibility of species specificity, the critical experimental condition of this study is not a reasonable one. A temperature of 7° to 10°C is hardly one that would be found in any of the laboratories in which handling phenomena have been investigated. I concede that exposure to this temperature is justifiable to show that temperature is *a* variable, but such a condition is preposterous as a means of showing that temperature is *the* variable in the handling phenomena.

5) Finally, what was the mother animal doing while she and her litter were in the cold environment? Could her reaction to the pups be such that tactile stimulation was increased, and a "normal" temperature for the pups thus maintained? Studies of other animals under even more extreme conditions indicate that, in this case, parental behavior may have constituted a homeostatic mechanism.

On the whole, the study and the investigators widely miss their mark.

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1. T. Schaefer, Jr., F. S. Weingarten, J. C. Towne, *Science* **135**, 41 (1962).
2. G. W. Meier, *J. Comp. Physiol. Psychol.* **54**, 223 (1961).
3. S. Levine and G. W. Lewis, *ibid.* **52**, 368 (1959).

It should have been clear from our report that we considered our work only "an initial test of the hypothesis that the effects of handling are due to lowered skin or body temperature." The experiment was an attempt to demonstrate the importance of temperature change without making direct measurements. The investment in equipment and time needed to perfect techniques for such measurement did not seem warranted unless it could be shown that the temperature variable was worth investigating further. Both the title of our report and our conclusion that temperature change is a basic variable in the early handling phenomenon were presented tentatively. We stated that "direct measurements of skin or body temperature, and of neurologic, metabolic, or physiological changes concomitant with handling, would be needed to verify these speculations," and that "it re-

mains to be demonstrated that handling does, in fact, affect skin or body temperature in infant rats, and that such a change has the same effects on later behavior as handling."

More recently we have determined that lower body temperature does result when rat pups are removed from the nest. In addition, the magnitude of the temperature changes in the handled, refrigerated, and refrigerator-control animals is proportional to the magnitude of the depletion effects we found in using these treatments. During the first week of life the oral temperature of the rat pup drops approximately 2°C within the first 2 minutes after removal from the nest and about 5°C during 10 minutes of exposure to room temperature (23°C). By comparison, the temperature of pups left in the intact nest after the mother is removed declines less than 1°C in 20 minutes. However, placing the nest cage containing the mother and pups into a refrigerator at 10°C causes the pups' temperature to fall, on the average, 1.75°C, whereas the temperatures of control pups in cages similarly placed in the nonfunctioning refrigerator at 23°C drop less than 1°C within the 10-minute period. The slight temperature drop in the controls may be attributed to the failure of the mother to return her pups to the nest promptly after they have been scattered by her excited activity during the movement of the cage to the refrigerator. In contrast, the mothers placed in the refrigerator at 10°C gather their pups into the nest as soon as they enter the cold environment.

We have also extended the parallel that we found between the results of handling and of exposure to lower temperature by comparing the behavior of handled, nonhandled, and cold-treated animals in studies of lever-pressing for water and of conditioned avoidance. We found a curvilinear relationship between severity of treatment and behavioral effect which is similar to the relationship between severity of treatment and handling effects. In these studies we exposed the pups to cold in a different way, placing them in metal containers maintained at various temperatures.

In the light of these new data it seems unnecessary to discuss several of Meier's and Ader's criticisms. Ader's concern about our analysis of the data would be justified, perhaps, if adrenal function were the issue. It is not. We merely used a technique [adrenal ascorbic acid (AAA) depletion as a response to stress] and a simplified statistical analysis

which have evolved as a measure of the effectiveness of early treatment; these have been described in at least four published papers by Levine *et al.*, cited in our report. We chose this measure because of its demonstrated sensitivity and reliability, and because it permits early determination of the effects, making it unnecessary to keep the animals until they are adults. Our very close replication of Levine's values for AAA depletion in 12-day-old handled animals further supports the validity of this technique as a measure of the effectiveness of early treatment. However, we certainly agree with Ader's general criticism that the hypothesis was not *proved* by our study. Our continued work along the lines he recommended is evidence of this.

The results of our temperature determinations are more directly pertinent to Meier's criticism. As to Meier's point 1, his demonstration that cats did not show an effect when the mother was removed from the nest, possibly subjecting the kittens to lower temperature, does not vitiate our suggestion. Our temperature measures show that the control pups do not necessarily undergo a temperature loss when the mother is absent if the control pups are left in an intact nest. Perhaps this would be as true for the kittens Meier used in his experiment as it is for rats, though we feel less ready to generalize from our rats to his cats than Meier is to draw analogies between his split-litter cats and our rats. Yet, for hypothesis making, such analogizing may be valuable. In fact, Meier's finding (*1*) that early-handled Siamese kittens developed pigmented fur sooner than nonhandled littermates was one of the considerations which led to our hypothesis. In the Siamese cat, as in the Himalayan rabbit, pigmentation of the fur is known to be thermolabile (*2*), the differential development of pigmentation being very sensitive to slight differences in environmental or skin temperature. When Meier's findings first appeared we considered the possibility that this thermolabile pigmentation mechanism might explain the darker pigmentation in kittens which had been removed from the nest daily for 10 minutes of handling. Although Meier concluded that the pigmentation was evidence of hastened maturation resulting from early stimulation, Iljin's work (*2*) indicates that even so mild an exposure to lower temperature might be sufficient to produce the thermolabile effect of darker pigmentation in Siamese kittens.

Our temperature determinations suggest that the 7° to 10°C environment for cold-treatment was not so preposterous as Meier suggests in his point 4. We selected this extreme temperature because we had observed the mother's behavior as "a homeostatic mechanism" (Meier's point 5) and sought to maximize the likelihood of producing a temperature effect in spite of the mother's attempt to keep her litter warm. We did not include a group of animals subjected to higher temperature, as Meier suggested in his point 3, because it did not occur to us that handling, as typically carried out, could possibly raise temperature in the pup. Again, direct measurement of body temperature during various early treatments has supported this assumption.

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References

1. G. W. Meier and J. L. Stuart, *Psychol. Rept.* **5**, 497 (1959).
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Pay and Promotion

Concerning the item in "News and comment" [*Science* **135**, 713 (1962)] on the urgently needed federal pay reform, it should be emphasized that the term *federal service* is limited to service performed by civil servants and does not apply to the equally well trained, experienced, and responsible scientists in the military. Although the staff of several government research and development establishments is as much as 80 percent civilian, it should be realized that the presence of this staff is, in many cases, the direct result of the prior and continuing existence of a military nucleus. If this bill is passed, and it *must* be for the very reasons you indicate, the scientific and engineering colleagues of the civil servants who are in uniform will be three pay reforms in arrears.

Scientists in the military must await separate pay and promotion legislation. The latter is keyed to the military population as a whole. Military pay and benefits for the average officer (55 percent or more, depending upon the

branch of military service, are college graduates) often provide an equitable income. However, men with advanced degrees are in many cases receiving less credit for pay and promotion purposes than officers of the same age who received a bachelor's degree in the same year but who, immediately upon graduation or soon thereafter, entered on active duty. Contrary to popular belief, a very small percentage of officers obtain advanced degrees at government expense. Thus, the majority obtain their additional degrees through their own initiative, only to be penalized by the system when they enter on active duty.

With the exception of the officers in the Medical and Dental Corps, who receive additional pay and promotion credit, and the officers in the Veterinary and Nursing Corps, who receive promotion credit, the young Ph.D. on active duty is, in addition to his military duties, performing the same job as his civilian counterpart, at an income one would expect with a bachelor's degree.

If it is difficult for the government to retain its civilian scientists in the federal service, it is obvious that the number of individuals of the same caliber retained in the military service will remain negligible until the discrepancy in pay and promotion is reduced by action, rather than words, and professional recognition becomes routine rather than a statistic on file.

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Collision Course

I struggled through the news article "The civil defense debate: Neither side is talking the other's language" by H. Margolis [*Science* **135**, 776 (1962)], and I wondered what sort of language the author was talking. His reasoning was so labored, his suppositions so resplendent, his mood so subjunctive, his use of the passive voice so unrestrained that he himself apparently had trouble, so that in paragraph 5, for example, we find either a unique construction or an adjective modifying a nonexistent noun. Of course, he *did* have a difficult job. He had somehow to present "all" the arguments on "shelters" with meticulous objectivity. It would appear that he failed.

Nonetheless, I am grateful for his discovery of a means of quantitating the sincerity of a politician on any particular issue by use of what might be called the Coffee Confidence Test (CCT). One has only to determine the ratio of volume of coffee dispensed to number of pickets. Perhaps a refinement would include a colorimetric analysis of the coffee to determine the depth as well as the breadth of this sincerity. One can only guess, for example, how much coffee the President might dispense to pickets demanding executive action in discrimination in federally supported housing.

While I am a strong believer in quantitating everything, I will, however, go on, as I have, placing a null premium on sincerity, as history has done in its evaluations.

One gathers that the *main* point H.M. makes is: "Why pick on shelters? They are no worse than the whole damn arms race and probably better than many aspects of this deadly business."

Ah yes, but "shelters" are worse. No one I know has ever seen or heard a missile or a nuclear explosion, but if such a "shelter" program were to come

into being we would not only see these "shelters," we would undoubtedly before long be forced, under threat of imprisonment, to enter and remain in them during public participation drills. In a word, then, this would bring nuclear war home; way home. H.M., in a lesser point, argues that this may be good; perhaps it will alert people to the horror. Strange then, is it not, that precisely those newspapers and politicians undistinguished in their advocacy of peace are pushing "shelters" with something akin to panic.

Speaking of distinguished advocacy and of the arms race in general, which appears to be what H.M. wants to do, as a latter-day romantic I am easily stirred to passion, yet I find in all the issues of *Science* I have read in the past several years no clarion calls on *any* particular facet of the arms race. I do find bemoaning aplenty and cynical denigration of the efforts of some frequent (as in the editorial on the Report of the Committee on Science in the Promotion of Human Welfare).

As for the analogy H.M. presents in his final paragraph, I too, along with other irrational folk, would be vastly disheartened if, in addition to seeing the extensive lifeboat preparations, I knew that for some time this ship had been steering a course, with increasing speed, that would lead it to collision with another ship and that the "rational" passengers on both liners were doing nothing to force their captains to change course.

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General-Purpose Computer

The issue between Reitman and those he represents and certain statements in *Computers and Common Sense* which he says "are simply untrue" [*Science* **135**, 718 (2 Mar. 1962)] can be summed up in Reitman's reiteration that "it [the General Problem Solver machine] does in fact exist, even as you and I." Since "you and I" certainly exist as something other than a program in a general-purpose computer (or the mind of God), the question, "Whose statements are untrue?" resolves itself.

To bring this point home, let me say that we are prepared to buy a general problem solving machine and are most anxious to secure the franchise for

Washington, which we think needs such machines very much. I hope Reitman can quote us a price and delivery date.

The definition of learning to which Reitman objects is based on Sherrington's physiological distinction between habit and reflex, a matter which has lately been discussed in the pages of *Science* [**132,** 555 (1960)].

I plead guilty to having missed the important scientific journal *En Passant*, published by the Pittsburgh Chess Club; but Reitman should also plead guilty to having missed or disregarded Richard Bellman's charge in *Operations Research* (May–June 1958) that his colleagues, Simon and Newell, have made claims which are both unscientific and irresponsible.

Finally, since Simon is dean of the Graduate School of Industrial Administration at which Reitman is employed, I question the scientific objectivity of the review. An attorney or judge in similar circumstances would disqualify himself, but I seem to have heard recently that American scientists are growing more and more insensitive to the problem of conflict-of-interest.

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Since Taube's letter provides four quite representative illustrations of the techniques he uses in his book to support his theses, it will be helpful to consider his comments in some detail.

On the face of it, one might suppose it sufficient to reply to his first two paragraphs by noting that the sense in which the General Problem Solving Program (GPS) exists is exactly the same as the sense in which the production scheduling, inventory control, and data processing programs of the business world exist—as sets of instructions for general-purpose digital computers. If Taube wants his own GPS, he has only to request the program from Newell, Shaw, or Simon, rent time on an IBM 7090, and run to his heart's content.

Actually, Taube's little discussion of the varieties of existence is something of a red herring, which he waves before us while he beats a quick retreat from the position he took in his book. There (pp. 59–60), far from admitting that GPS and the Chess Player exist as programs for a general-purpose computer (which is all Newell, Shaw, and Simon claim for them), Taube asked his readers to believe that "all the great

mechanical brains, translating machines, learning-machines, chess-playing machines, perceiving machines, etc., accounts of which fill our press, owe their 'reality' to a failure to use the subjunctive mood. The game is played as follows: First, it is asserted that except for trivial engineering details, a program for a machine is equivalent to a machine. The flow chart for a program is equated to a program. And finally, the statement that a flow chart could be written for a nonexistent program for a nonexistent machine establishes the existence of the machine. In just this way . . . Simon, Shaw, and Newell's 'General Problem Solver,' and many other nonexistent devices have been named in the literature and are referred to as though they existed."

In my review I noted that Taube simply denied the existence of these and many other running programs which disproved his charges. The citation given above demonstrates this. Since Taube now apparently admits the existence of these programs, it seems reasonable to suggest that he might reexamine his previous conclusions about the status of research on artificial intelligence.

Taube's third paragraph—a good example, incidentally, of the "Emperor's new clothes" technique he outlines in his book (p. 120)—is perhaps the most disingenuous of the five. The reader should consult the reference Taube cites to substantiate the acceptance he claims for his definition of learning. It consists of exactly one paragraph in, of all things, still another letter to the editor of *Science* from Taube. Better yet, even this one paragraph contains no reference to learning as a "change from conscious to unconscious (habitual) activity to attain a desired goal," or to anything remotely related to this definition. The word *conscious*, the heart of Taube's definitional distinction between human and computer learning, is nowhere to be found in the letter.

The key to Taube's fourth paragraph, as is the case with the third, again is to be found in what he neglects to say. Bellman is protesting four *predictions* by Simon and Newell of developments they anticipate over a 10-year period. Nowhere in his note does he suggest, as Taube does, that GPS or the chess-playing program "owe their 'reality' to a failure to use the subjunctive mood," or that Newell, Shaw, and Simon are in any way claiming to have done more than they actually have. This distinction between what Bellman charges and

what Taube implies he charges is fundamental. It is only by ignoring such distinctions that Taube can ask his readers to believe that the whole field of artificial intelligence resembles nothing so much as a 19th-century hoax.

All in all, the first four paragraphs of his letter provide a fair sample of the ways in which Taube constructs arguments out of the appearances of evidence. They are worth some reflection when the reader of *Computers and Common Sense* encounters (p. 127) Taube's statement that "this book is soundly based on the maxim that 'Ye shall know the truth, and the truth shall make you free'; and on an abiding faith that the process of rational inquiry and the increase and diffusion of knowledge are the noblest ends of man." As for the fifth paragraph, in view of the foregoing discussion, I find it difficult to be moved by Taube's lament at the corrosion of my virtue by the conditions of my employment. For, despite his concern with the scientific objectivity of everyone else in this area, it seems rather evident that somehow or other he has pretty much lost sight of his own.

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Financing of Medical Care for the Aged

I have just finished reading the news item entitled "Medical care: changes in the political terrain" [*Science* **135**, 90 (12 Jan. 1962)].

At the bottom of column 2 is a sentence which states, "Last week, the Hospital Association's House of Delegates voted to approve the Social Security financing of care for the elderly, provided that the program would be administered through Blue Cross."

This statement is not accurate. In a statement of "Actions Taken—January 4, 1962—in Chicago, Illinois" by the American Hospital Association House of Delegates and by Blue Cross Association Member Plans, point 3 under the heading "American Hospital Association House of Delegates" reads as follows: "We recognize that government assistance is necessary to effectively implement this national Blue Cross proposal in order to enable many retired aged persons to purchase this health protection through the voluntary

prepayment system. Conditional upon the administration of this proposed plan by the voluntary nonprofit prepayment system, the tax source of the funds is of secondary importance to us."

Following point 3 there is an additional sentence of clarification which reads as follows: "(The last sentence of the above statement was interpreted to mean that the source of funds is of secondary importance to us provided the proposed plan is administered by the voluntary nonprofit prepayment system and not by the Social Security Administration.)"

JOHN R. KINSEY
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The ambiguities of the Hospital Association's statement have inevitably beclouded the significance of the AHA's shift in position. I think my description of the AHA position was accurate. The association in the past was opposed to the Social Security approach. At its last meeting it shifted its position to favor Blue Cross administration of a medical care program, with secondary importance attached to the source of the funds. This, in effect, is a shift away from the previous opposition to Social Security financing. Since Social Security financing is the principal type of federal financing for medical care now under consideration, it is pure evasion to say that this shift was not actually an endorsement of the Social Security approach.—D.S.G.

Keeping up with Soviet Research

On 22 February, when asked by a reporter whether the Soviets were giving us directly any results from their manned satellite flights, President Kennedy (after asking his press staff for the latest information) replied that, except for medical data, they weren't.

As subsequent events rapidly revealed, more accurate information to the President would have been: "They don't tell us privately—they just publish their findings; but we are too busy to read!"

On 26 February the following dispatch from Moscow appeared in the New York *Times*:

Reacting to the announcement last month that the United States Explorer XII satellite had . . . recorded a third radiation belt with what was described as an

"unexpected boundary" at 40,000 miles . . . Dr. K. Gringauz, one of the Soviet Scientists working in this field, wrote . . . in *Izvestia*, the Soviet Government newspaper: "It is difficult to understand what was unexpected about the discovery, because it is impossible to assume that United States scientists do not read Soviet literature on space research."

Dr. Gringauz noted, moreover, that one of the journals in which Soviet findings had been published, the *Doklady* (Proceedings) of the Soviet Academy of Sciences, was being translated from cover to cover in the United States. . . . Such findings were reported in the February and April [1960] issues of the Academy of Sciences Proceedings.

The statement checks out. The respective issues of the American Institute of Physics' translation journal (*Soviet Physics—Doklady*) appeared in July and September 1960. And in January 1961 the AIP translation of the Soviet *Astronomical Journal* (issue of July 1960) contained the clear statement: "A new radiation belt surrounding the earth at heights of 55,000 to 75,000 km has been discovered."

This evidence that U.S. scientists do not keep abreast of Soviet research is at best embarrassing. Coupled with the financial investment (and the risk of life) we are making as we play leapfrog with the Russians in space, it is rather terrifying. And this is one case where the "buck" doesn't stop at the desk of any President, past or present. These translation journals have been subsidized by the National Science Foundation since 1956. Their prices are such that there is no shred of excuse for not having them in any library serving a group of scientists even remotely concerned with space research.

It's easy (and cheap) to blame the library staff involved. But it is probably true that scientists get library staffs of the kind and size they demand and educate their managements to pay for.

Nor is this a case of that latest cause for scientific hand-wringing, "inadequate information retrieval," for the information that there is a third radiation belt around this planet should never have been "lost" in the first place, much less overlooked.

How can members of the U.S. scientific community be guilty of such a blatant oversight? Easily. Approach almost any American scientist with the query, "Do you keep up on the latest Soviet research in your specialty," and he's apt to rasp back: "Russian research! I can't even keep up with the latest *American* journals in my field." The *a priori* assumption is that if there's

not enough time to read everything, the Russian translation journals are not even to be scanned.

How is it we never hear of a researcher in Boston who didn't know for years of some significant publication by a colleague in San Francisco? Because Dr. X and Dr. Y also communicate personally—by phone, by letter, by the grapevine, or by osmosis in the hotel lobby at meetings they both attend. And Dr. Y probably forwarded Dr. X a reprint as soon as the paper appeared.

If such intimate exchange of information ever occurs between top Soviet and American researchers, there may be little need for translation journals. But so long as it is a bibliographic rarity to see the name of a Soviet worker followed by "private communication," it behooves our scientists to use an *a posteriori* approach to the problem —to get themselves into the library once or twice a month, place the old *posteriori* firmly in a chair, and devote a couple of hours to browsing through the latest issues of the pertinent translated Soviet journals.

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Suggestion and Sensory Deprivation

In a recent report entitled "Influence of suggestion and subjects' prior knowledge in research on sensory deprivation" [*Science* **135**, 211 (1962)], Jackson and Kelly end with the following statement: "it is essential that the possible influence of suggestion be allowed for in the design of, and in interpreting the results of, future studies of sensory deprivation." I do not wish to quarrel with this statement; on the contrary, I believe this is one of the prime considerations of workers in this area. I do wish, however, to question the design and interpretation of the research reported.

Fourteen paid subjects were told that, during the course of an experiment like that in which they were about to participate, previous subjects had experienced peculiar cognitive and perceptual feelings. The 14 subjects were then given (placebo) pills to help bring on the hallucinations. Twelve of the 14 subjects reported peculiar sensations during the 1-hour sensory-deprivation situation. However, there is no mention of control groups. It would have

been interesting to observe the experiences of a group of subjects placed in the same situation for 1 hour without having received any suggestions as to anticipated results. Another possible control group would be a group that received the suggestion but no sensory deprivation, or a different degree of deprivation.

Jackson and Kelly draw the following conclusion: "Since 1 hour is so much shorter than commonly used deprivation periods, the effects reported by our subjects are considered to be due primarily to the subjects' prior knowledge of the anticipated results and to the creation of the attitude 'it is appropriate to experience hallucinations in this situation.' " On the assumption that 1 hour *is* a much shorter period than usual, does the above conclusion necessarily follow? I think not. In the absence of control groups, who is to say why the subjects experienced peculiar sensations? To my mind, this research is a demonstration of one method of causing subjects to report hallucinatory experiences. However, nothing can be said about specific causes, such as suggestion, sensory deprivation, and placebo.

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The study about which Stern comments was the first in a series of related experiments conducted by a group of investigators at the University of Michigan. Although we agree with Stern that additional comparison or control groups would be interesting and worth while, we do not agree that "nothing can be said about specific causes." The two principal alternative explanations are that the reported effects were due to 1 hour of sensory deprivation per se or that they were due to what is broadly called "suggestion"—that is, the subjects' previous knowledge, expectations, sets, and so on.

With very few exceptions, the length of time people have been deprived in experimental sensory deprivation has varied from about 8 hours to a week or more. Most investigators have indicated that only some of their subjects reported unusual effects, in some studies a small proportion of the total groups. Moreover, in at least one study (*1*), in which as much as a week of sensory deprivation was employed, hardly any unusual effects were elicited. By contrast, all 14 of our experimental subjects

(subjected to suggestion plus 1 hour of sensory deprivation) reported auditory, somesthetic, and cognitive experiences, and 12 reported visual effects and emotional reactions. Some of these subjects described very peculiar effects within the first few minutes of deprivation. Consequently, it did not seem to us that the quality and quantity of experiences reported by our subjects could reasonably be attributed to 1 hour of sensory deprivation per se.

Stern suggests using control subjects "who received no suggestion as to anticipated results." We understand, of course, that he is referring to the deliberate suggestions which we gave to the experimental subjects. We contend, however, that it is almost impossible to select, screen, instruct, and place in situations of experimental sensory deprivation normal, bright subjects, particularly college students or professional personnel, without creating a wide variety of anticipations, expectations, and sets through which experimental effects may be suggested. This view is elaborated elsewhere (*2*).

It is possible, of course, to vary the amount of suggestion, and we have done this in a more recent study (*3*). Subjects with 3 hours of sensory deprivation plus suggestion reported significantly more effects, and much more unusual effects, than subjects who received relatively neutral instructions plus 3 or even 8 hours of sensory deprivation. These findings support the conclusions drawn from our initial study.

Stern also suggests using a control group which receives suggestion but no sensory deprivation. This too would be interesting, but to accomplish this and still maintain a genuine control for our experimental group would be rather difficult. First, the suggestion that the subjects would have hallucinations within the next hour for no apparent reason probably would be rejected by them as absurd. In other words, we firmly believe that an experimental sensory-deprivation situation contributes considerably to an appropriate set for reporting unusual experiences, and that differences in experimental situations and experimental "atmospheres" partially account for differences in results from different studies. Secondly, even if it were feasible to use such a control group, without any form of deprivation or isolation, the normal environment is sufficiently engaging to divert the subjects' attention from the experimental task. Seeing real objects would lessen and probably eliminate any tendency to see hallucinations, thus impairing the usefulness of this comparison group as an experimental control.

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Patent Protection and New Drugs

A recent news item on the Kefauver hearings [*Science* **134**, 1349 (1961)] contains the following statement: "The American Institute of Chemists warned that federal regulation would delay the discovery of remedies for heart disease and cancer and added that the research

laboratories of pharmaceutical firms are the 'last havens' for professional chemists seeking solutions to numerous maladies. This last view no doubt comes as a surprise to chemists at universities, government laboratories, institutes, and other nonindustrial research facilities."

The fact is that of 79 products patented in the United States, as listed in Table 38 ("Listing of drugs according to place of discovery") of *Senate Report No. 448* (27 June 1961), the vast majority originated in the laboratories of the pharmaceutical industry. One, bacitracin, resulted from work done under a government military contract; so far as we have been able to ascertain, none resulted from government nonmilitary health research.

This seems to support our contention that the most congenial climate for the creative development of new remedies exists in the laboratories of the pharmaceutical industry, while the universities very properly have emphasized other aspects.

The central point of the stand taken by the American Institute of Chemists, however, is this: any weakening of patent structure will reduce the monetary value of what the chemist creates; therefore, it is bound to reduce funds available for research and for the remuneration and reward of creative chemists. For this reason, any reduction of patent protection is contrary to the interest of the membership of the American Institute of Chemists and, we submit, also contrary to the interest of other creative scientists.

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My intention was not to deprecate, in any way, the considerable achievements of the pharmaceutical laboratories, but rather to point out that it was perhaps inaccurate to describe them as the "last havens" for chemists interested in drug research.—D.S.G.

Newton and the Spectral Lines

Bisson and Dennen [*Science* **135**, 921 (16 Mar. 1962)] wonder why Newton did not see and report the absorption lines in the prismatic solar spectrum, since they find the lines reasonably clear in a duplication of his apparatus. They suggest that Newton might have thought of the lines as separating the different colors. That

could indeed be a reason for ignoring the lines, for (i) Newton did not place great confidence in his own ability to see correctly the extent of the different colors, and (ii) he was so predisposed by his conviction that, after the analogy of the musical scale, there should be seven colors that he was able to interpret the observations of a friend (a more "critical" observer) as indicating that the positions of the colors correspond closely to the positions of the notes of the octave. It is interesting that so good an observer as Newton could have made so wrong an observation, one in line with his predilection.

The relevant account is not in the *Opticks* but is quoted by Thomas Birch [*History of the Royal Society of London* (1757), vol. 3, p. 262 ff.]:

> And possibly colour may be distinguished into its principal degrees, red, orange, yellow, green, blue, indigo, and deep violet, on the same ground, that sound within an eighth is graduated into tones. For, some years past, the prismatic colours being in a well darkened room cast perpendicularly upon a paper about two and twenty foot distant from the prism, I desired a friend to draw with a pencil lines cross the image, or pillar of colours, where every one of the seven aforenamed colours was most full and brisk, and also where he judged the truest confines of them to be, whilst I held the paper so, that the said image might fall within a certain compass marked on it. And this I did, partly because my own eyes are not very critical in distinguishing colours, partly because another, to whom I had not communicated my thoughts about this matter, could have nothing but his eyes to determine his fancy in making those marks. This observation we repeated divers times, both in the same and divers days, to see how the marks on several papers would agree; and comparing the observations, though the just confines of the colours are hard to be assigned, because they pass into one another by insensible gradation; yet the *differences* of the observations were but little, especially towards the red end, and taking means between those differences, that were, the length of the image (reckoned not by the distance of the verges of the semicircular ends, but by the distance of the centres of those semicircles, or length of the strait sides as it ought to be) was divided in about the same proportion that a string is, between the end and the middle, to sound the tones in the eighth.

Newton may have believed that he had not communicated his thoughts about this matter to his friend; nevertheless he had told him to look out for seven colors and to bound them. To the observing scientist, hypothesis is both friend and enemy.

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