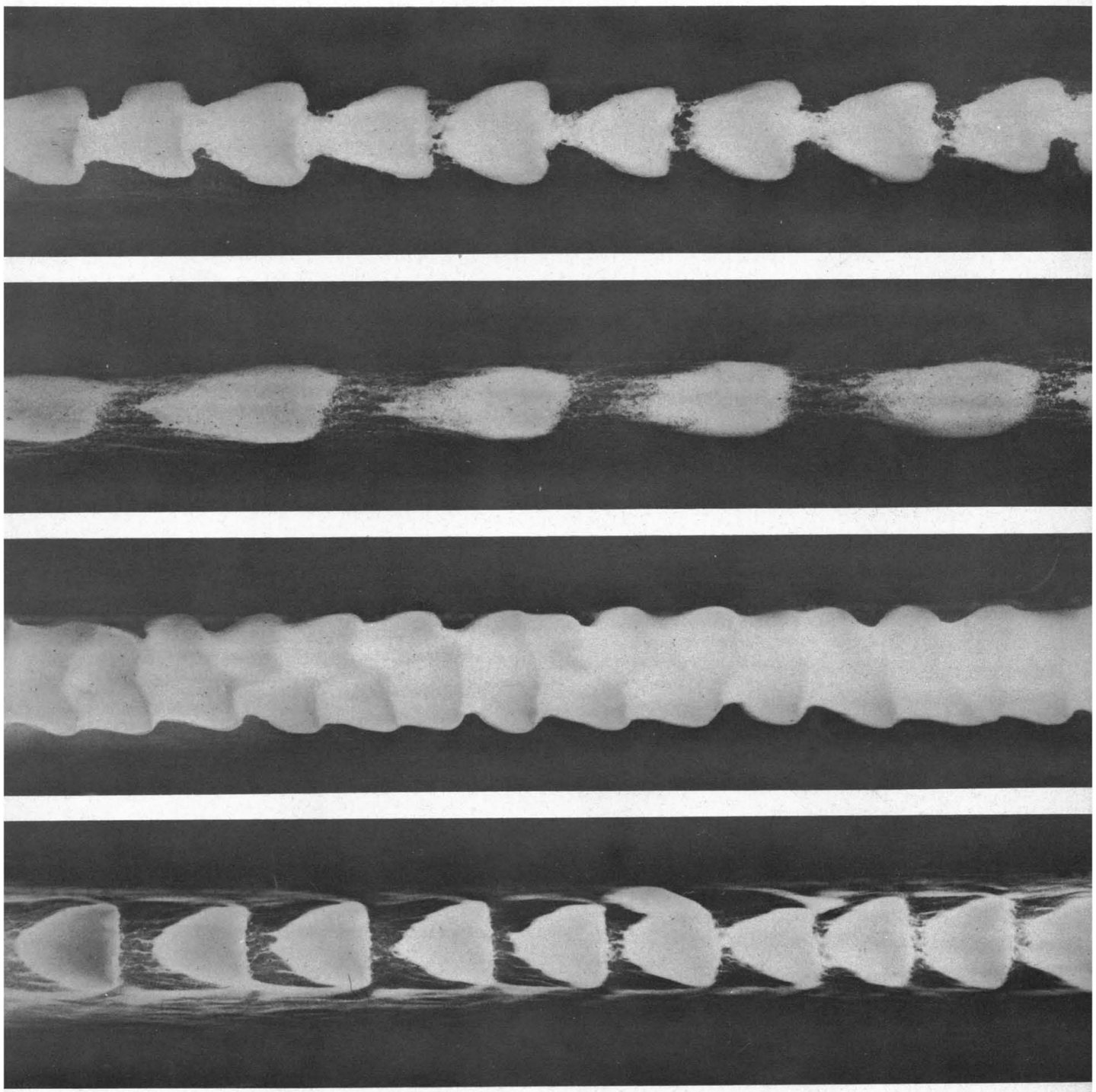
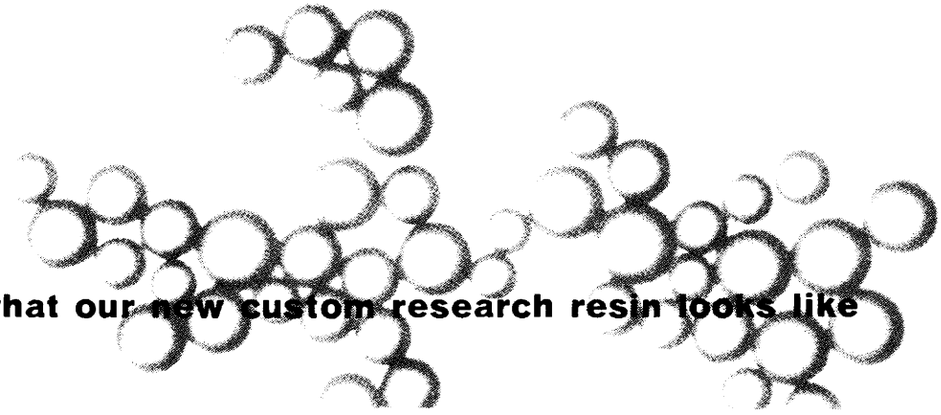
SCIENCE

1 May 1964
Vol. 144, No. 3618

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

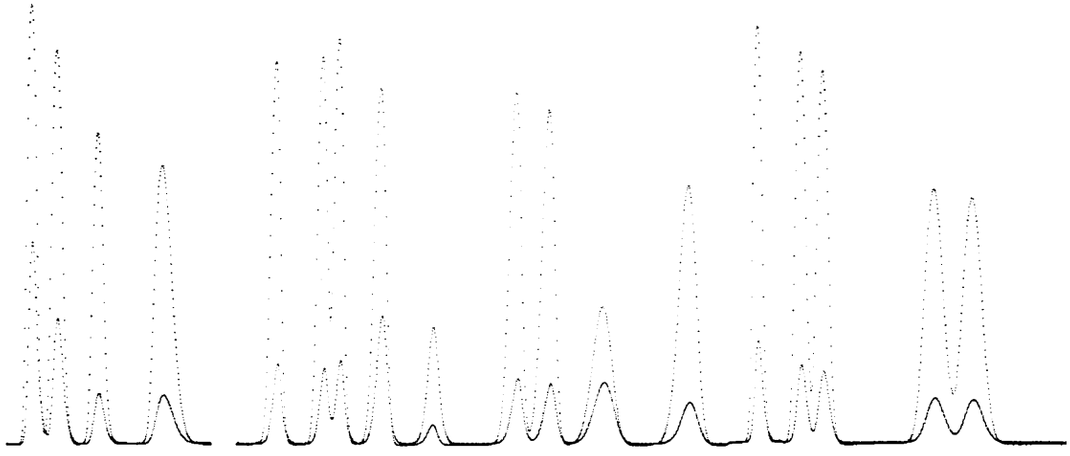


ISLANDS IN A PIPE



This is what our new custom research resin looks like

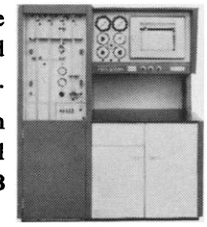
This is what it does for amino acid analysis



You can't really appreciate how good this new Beckman Custom Research Resin is just by looking at it. About all you can tell is that the particles are spherical like other beaded resins, and that there is a significant absence of fingernails, fractures, and fines.

However, as soon as you run an amino acid analysis with the new Beckman resin you'll realize what a major advance it is. First, back pressures are so low that you can greatly increase flow rates and shorten analysis times (we're currently running protein hydrolyzates in 4 hours, and there's no end in sight). Second, the resolution is exceptional (a point we have always stressed with our 120B Analyzer, and with our procedures). Third, you can use smaller samples.

What's our secret? We start with the raw materials, carefully control the polymerization, and form these perfect spheres—all under research conditions. Thus, we can make the chemical composition, the cross linkage, and the sizes of the spheres just the way we want—lot after reproducible lot. And our resin is immediately available, as many bottles as you wish.



A breakthrough? You'll think it is when you see this new resin perform. It comes as standard equipment on every new Model 120B Amino Acid Analyzer. For descriptions of the 120B and Custom Research Resin, ask for Data File 120-5.

Beckman® INSTRUMENTS, INC.

SPINCO DIVISION

PALO ALTO, CALIFORNIA • 94303

International Subsidiaries: Geneva, Switzerland; Munich, Germany; Glenrothes, Scotland; Paris, France; Tokyo, Japan; Capetown, South Africa.

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SCIENCE

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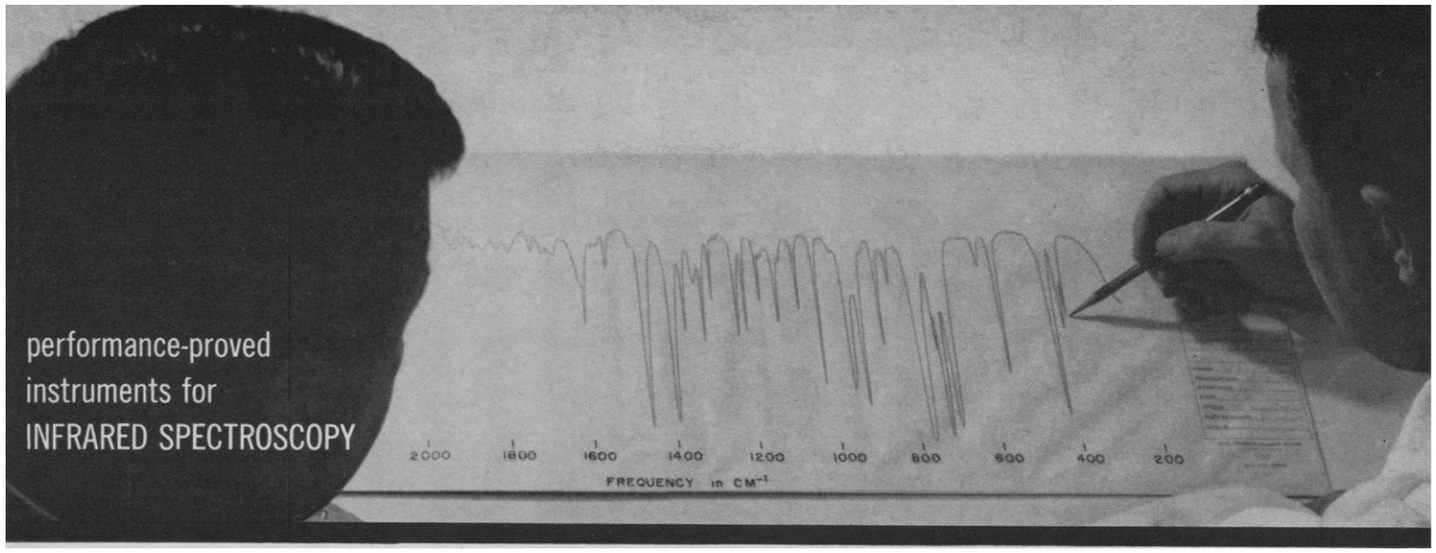
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Islands formed by minute glass beads in running water at the bottom of a horizontal pipe (10 centimeters in diameter). The mean velocity of the water (top to bottom) was 32, 48, 32, and 38 centimeters per second with flow from left to right. The mean diameter of the glass beads was 200, 200, 105, and 50 microns (top to bottom). The island velocity was always less than 5 percent of the mean stream velocity. See page 534.



Spectrum above shows excellent performance of Model 521 beyond 400 cm⁻¹ in a scan of indene.

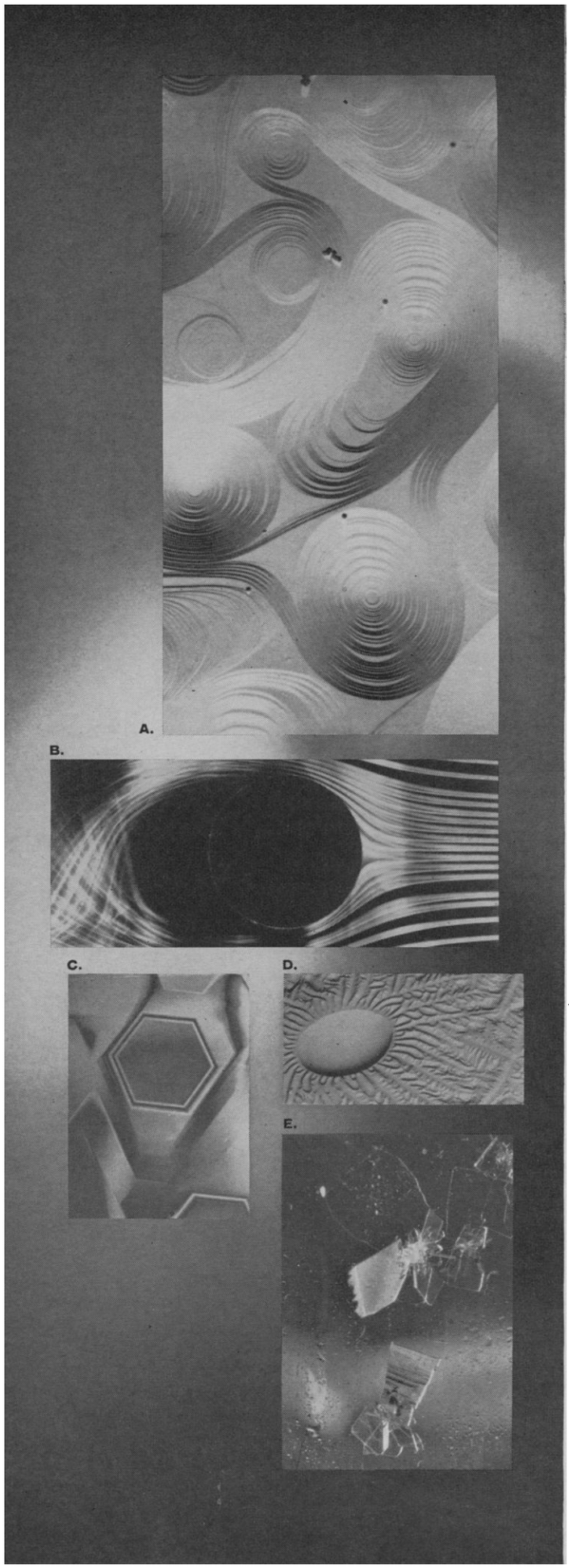
GET THE WIDEST CONTINUOUS SCANNING RANGE AVAILABLE WITH NEW MODEL 521 SPECTROPHOTOMETER

Stretch your analytical spectrum from fundamental to far infrared with Perkin-Elmer's new Model 521 Grating Infrared Spectrophotometer...the latest development in the field. The Model 521 gives a wider continuous scanning range than any other instrument—2.5 to 40μ...4000 to 250 cm^{-1}. Spectra are recorded on convenient-sized chart paper without gaps or overlaps.

The new filter-grating monochromator—a Perkin-Elmer exclusive—has a short-path f4.5 optical system twice as fast as similar instruments. This unique development conserves energy and permits full-range analysis of extremely small samples in low concentrations.

The Model 521's low-frequency coverage gives important analytic information about the presence and nature of many organic bonds and structural groups: ethers, esters, ketones, organic acids, carbon-halogen and out-of-plane aromatic carbon-hydrogen bonds, and many polyatomic inorganic anions. Metal-oxygen, metal-sulfur, sulfur-X and phosphorus-X absorptions also occur in the lower frequencies...well beyond the range of conventional KBr fore-prism instruments.

The Model 521 Interchange is available as a separate unit, and is compatible with Model 221 or 421 Spectrophotometers. For more information, write to Instrument Division, Perkin-Elmer Corporation, **910** Main Avenue, Norwalk, Connecticut.



One of a series on GM's research in depth

Art for science's sake

That's what some of our research scientists got when th photographed what they were seeing close up in their labs: the etched surface of a cadmium sulfide crystal, an oxide film on a single crystal of iron, and many othe

The results were such striking examples of art in resea that we collected the best for a small display at the Laboratories. And that was just the beginning.

Today, several sets of these photos in color are constantly on loan to universities, high schools, art schools, and museums. Even the GM Futurama exhib at the World's Fair will feature some of our collectior in two and three dimensions.

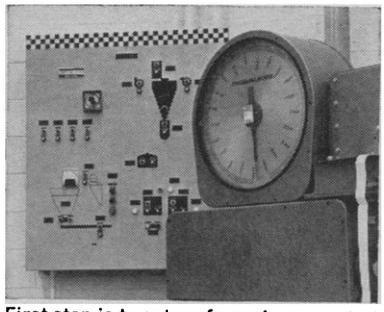
The art in research project is a dramatic example of the beauty and excitement experienced by the researc scientist. Not only that, its success shows that the researcher's delight in the orderly world of science is something that can be shared with the student . . . the artist . . . or the ordinary man.

General Motors Research Laboratories

Warren, Michigan

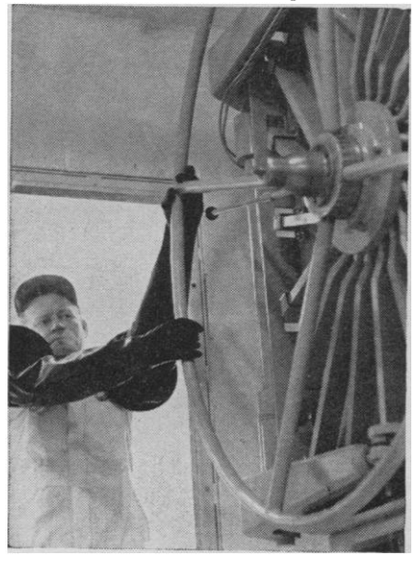
A. From our solid state physics lab (*Oriented surface resulting from reduction of oxide scale on an iron single crystal*) **B.** From our fluid dynamics lab (*Air flow over a cylindrical body*) **C.** From our semiconductor lab (*Etch pit in a cadmium sulfide single crystal*) **D.** From our solid state physics lab (*Thermally etched single crystal iron surface*) **E.** From our chemical separations lab (*Crystalline organic nitrogen compound from vehicle exhaust gas*)

Pur-Pak Chows are packed in polyethylene bags by a man in a sterilized suit operating in a sealed, sterile room.



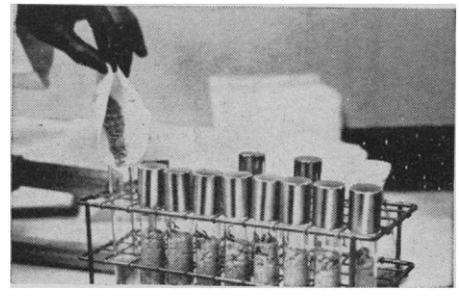
First step is to set up formula on control board. Exact proportioning of ingredients assures uniform, high nutrition.

Polyethylene inner bags are autoclaved before entering sterile packing room.



Sterilized poly inner bags are filled, then double heat sealed. Poly bags later are packed into paper.

Samples are taken continuously and sent in sterile bags to the laboratory for certification.



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a new measure of quality control in laboratory animal feeding...

Purina® Pur-Pak™ Chows

Now, for the first time, research workers and animal breeders can get animal diets pressure-processed to eliminate most microorganisms.

The Ralston Purina Company has built at Davenport, Iowa, a mill with new equipment to make Purina PUR-PAK laboratory diets. They are pressure-processed and sealed in sterile bags. All nutritive qualities are preserved. Texture is improved. *There are two kinds:*

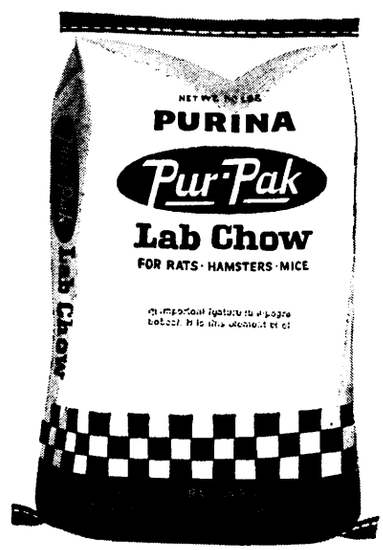
- **PURINA PUR-PAK LAB CHOW for rats, hamsters, mice**
- **PURINA PUR-PAK MOUSE BREEDER CHOW for mouse breeder colonies**

Each will be offered with two types of microorganism control:

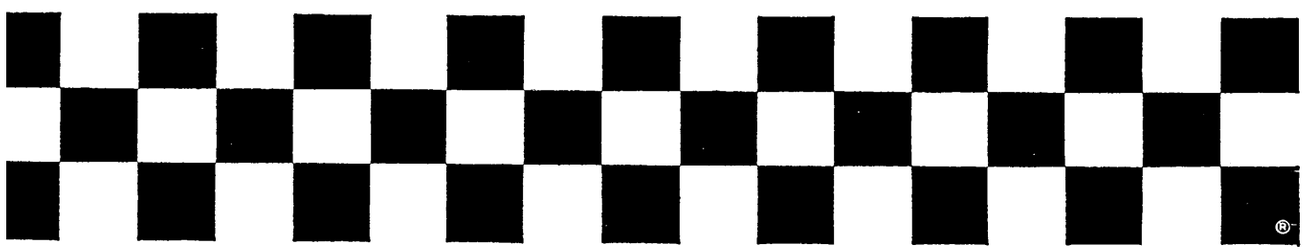
REGULAR—processed under sufficient pressure and temperature to insure that the product, as packaged, has a reduced level of microorganisms.

CERTIFIED—laboratory tested to assure that the diet is free, as packed, of Bacillus anthracis and all other bacteria except gram-positive, aerobic, spore-forming Bacillus species with not more than 1000 of these organisms per gram.

Your Purina Dealer or Salesman has samples, prices and more information about these new products. Call him or write to Mr. H. A. Graff, Ralston Purina Company, St. Louis, Mo., for folder and sample.



URINA...world's leading manufacturer of laboratory animal diets



GME

MODEL M5P MINI-POLYGRAPH

- *Fully modular*
- *2 to 5 channels*
- *Rectilinear recording*
- *Simultaneous 8″ servo and other records on one graph*
- *Compact versatility—up to 4 chopper, ECG, or EEG channels in any assortment —up to 2 servos...for a total of 5 channels*

- Each channel a complete, self-contained interchangeable unit
- One or two servos may be used, writing the full width of 8″ chart. Sensitivity up to 6 millivolts full scale, traverse time approximately 1 second
- Chopper amplifiers, for pressure or force with a Statham transducer, or for temperature with a thermistor bridge. Include Zener diode regulated power supply for bridge. May also be used as stable high gain DC amplifiers
- Time and event markers included
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MODEL M8PM FULLY MODULAR 8-CHANNEL MACRO-POLYGRAPH AVAILABLE

GILSON MEDICAL ELECTRONICS

MIDDLETON, WISCONSIN

On Madison's West Beltline Highway

1 May 1964, Volume 144, Number 3618

SCIENCE

EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Phone: 202-387-7171. Cable: Advancesci, Washington. Copies of "Instructions for Contributors" can be obtained from the editorial office. ADVERTISING CORRESPONDENCE: Rm. 1740, 11 W. 42 St., New York, N.Y. 10036. Phone: 212-PE 6-1858.

Distribution of Federal Research Funds

The allocation of federal research funds is likely to be a continuing source of controversy. In 1962 ten institutions received 38 percent of the total, while 25 received 59 percent. At least two factors contributed to this concentration. First, a number of universities managed large research establishments for the Defense Department, the Atomic Energy Commission, or the National Aeronautics and Space Administration. A second factor is the known excellence of the institutions receiving funds. A few universities have obtained many of the best men, who in turn generate first-rate research proposals.

Policies of government agencies differ with respect to distribution of funds. The Defense Department awards research contracts to those most capable of getting results. Since the principal business of the organization is defense of the nation, such a policy seems in order.

The National Institutes of Health and the National Science Foundation have succeeded in attaining a fairly widespread distribution of their funds. Lumping the two together for simplicity, one finds that, in fiscal 1962, four populous eastern states received $7.0 per capita. Five middle western states obtained $3.4, while eight southeastern states received $2.1. However, considered on the more realistic basis of dollars per *scientist* in these regions, the distribution was roughly even. For the eastern group the figure was $2000; for the middle western group, $1590; and for the southeastern group, $1600. These figures indicate that these two granting agencies have tried to distribute their funds broadly.

Despite such efforts, the fact remains that support is concentrated in a relatively few schools, and that some 700 institutions in this country which award baccalaureate or higher degrees in science receive no research grants from the National Science Foundation.

In considering policies with respect to distribution of funds for academic research we should ask ourselves: What should we be trying to do? What is the bottleneck today? Is it a need to acquire knowledge at a faster rate, or is it a need for more trained scientists? If the bottleneck were new findings, we would be justified in persisting in giving excellence overriding priority in the distribution of funds. The current flood of publications scarcely supports this view. Many believe that adequate training of students should have a priority in the academic world at least equal to that of research results. In the coming decade increasing numbers of students will enter universities, and an additional new group of professors must be prepared to teach them. Our future economic health depends on an adequate supply of first-class scientists for industrial organizations.

We have been told repeatedly, and we believe, that research lends excellence to teaching. The argument is that research keeps professors more alive and abreast of current developments. However, if the scientist at a university does not teach or if he directs only a few graduate students, he serves a limited academic function. With most of the grant money going to a few institutions, the remaining hundreds of schools having little or no funds for modern equipment are falling farther and farther behind in quality of staff and teaching.

Excellence in research productivity should continue to be a primary criterion in the choice of grantees, but agencies such as NSF should give weight to the training aspect in making allocations of funds.—PHILIP H. ABELSON

ARMAC®...
for rapid, accurate measurement of radioactivity

The Packard Model 445 Armac Scintillation Detector is an extremely sensitive, large sample-volume (up to two liters) well-type detector designed for measuring radiation from gamma-emitting isotopes.

Because its high counting efficiency and sensitivity permit shorter counting times, the Armac Detector enables the research scientist to quickly and accurately determine the presence of low levels of radioactivity in bulk samples including meat, milk, water, blood, feces, soil, or tissue with little or no sample preparation.

IDEALLY SUITED FOR *IN VIVO* RESEARCH

The Armac's 4-pi counting geometry and high counting efficiency require that only very small doses of radioactivity be administered to small experimental animals during *in vivo* research on retention and excretion of various gamma-emitting isotopes. Sacrificing is unnecessary and the animal acts as its own control for repeated experimentation.

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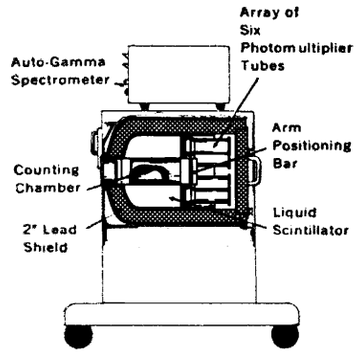
COMPLETE SYSTEMS

An Armac Detector System, comprised of the Model 445 Armac Scintillation Detector and any of several Packard Spectrometers and related control units, recording ratemeters, etc., can be supplied to meet your needs. Any Armac Detector System can be readily modified or expanded to meet changing research requirements.

Ask your Packard Sales Engineer for complete details, or write for Bulletins.

(Photograph) COUNTING LIVE FISH IN FLOWING STREAM WATER. *Photo courtesy of* **Oak Ridge National Laboratory** *operated by* **Union Carbide Corporation** *for the* **U. S. Atomic Energy Commission.**



DIAGRAM—ARMAC
Detector with Spectrometer

Packard

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Report from

BELL LABORATORIES

MICROWAVE RADIO SYSTEM USES NEW FREQUENCY DIVERSITY ARRANGEMENT

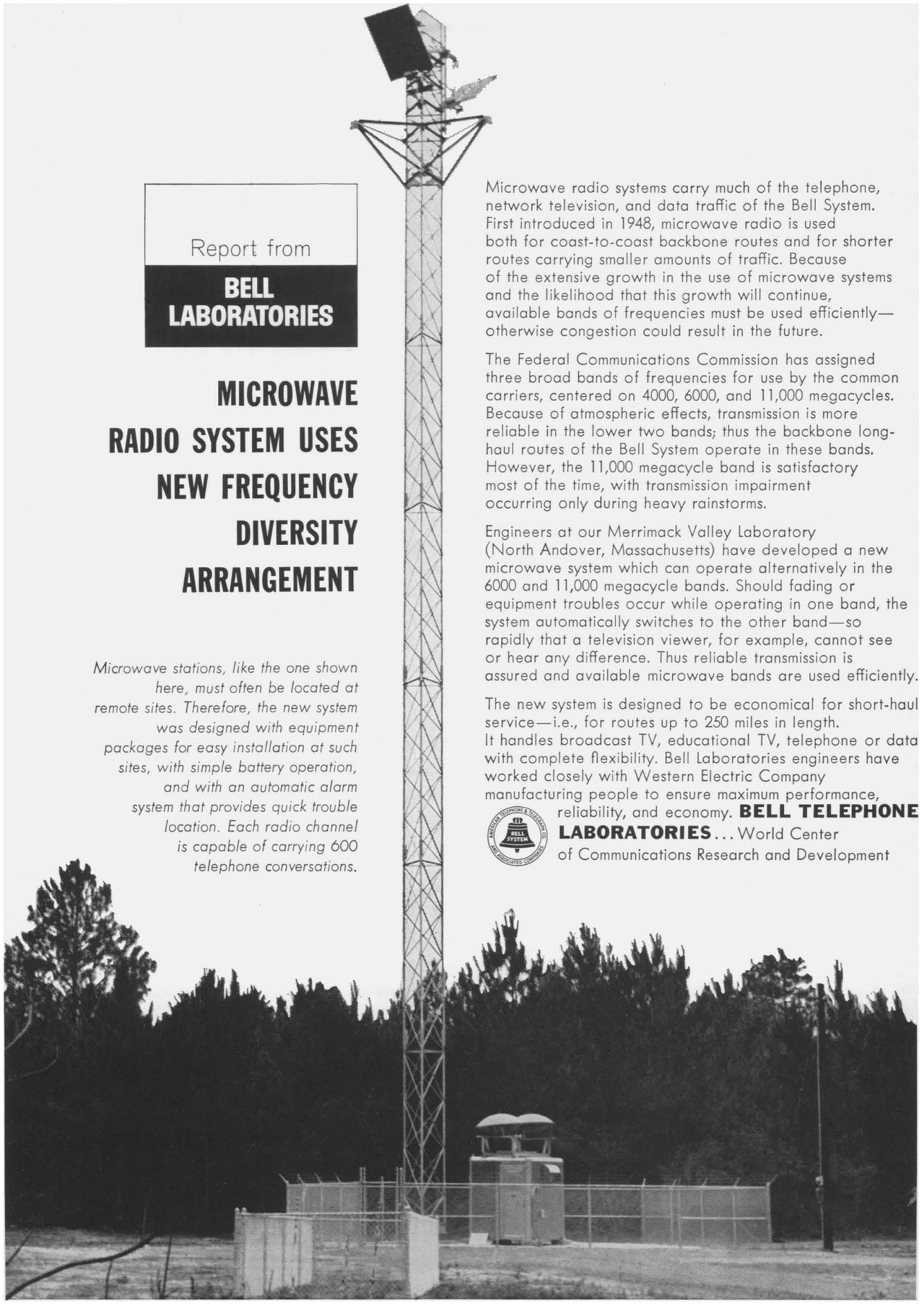
Microwave stations, like the one shown here, must often be located at remote sites. Therefore, the new system was designed with equipment packages for easy installation at such sites, with simple battery operation, and with an automatic alarm system that provides quick trouble location. Each radio channel is capable of carrying 600 telephone conversations.

Microwave radio systems carry much of the telephone, network television, and data traffic of the Bell System. First introduced in 1948, microwave radio is used both for coast-to-coast backbone routes and for shorter routes carrying smaller amounts of traffic. Because of the extensive growth in the use of microwave systems and the likelihood that this growth will continue, available bands of frequencies must be used efficiently—otherwise congestion could result in the future.

The Federal Communications Commission has assigned three broad bands of frequencies for use by the common carriers, centered on 4000, 6000, and 11,000 megacycles. Because of atmospheric effects, transmission is more reliable in the lower two bands; thus the backbone long-haul routes of the Bell System operate in these bands. However, the 11,000 megacycle band is satisfactory most of the time, with transmission impairment occurring only during heavy rainstorms.

Engineers at our Merrimack Valley Laboratory (North Andover, Massachusetts) have developed a new microwave system which can operate alternatively in the 6000 and 11,000 megacycle bands. Should fading or equipment troubles occur while operating in one band, the system automatically switches to the other band—so rapidly that a television viewer, for example, cannot see or hear any difference. Thus reliable transmission is assured and available microwave bands are used efficiently.

The new system is designed to be economical for short-haul service—i.e., for routes up to 250 miles in length. It handles broadcast TV, educational TV, telephone or data with complete flexibility. Bell Laboratories engineers have worked closely with Western Electric Company manufacturing people to ensure maximum performance, reliability, and economy. **BELL TELEPHONE LABORATORIES**... World Center of Communications Research and Development

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200
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200
150
100
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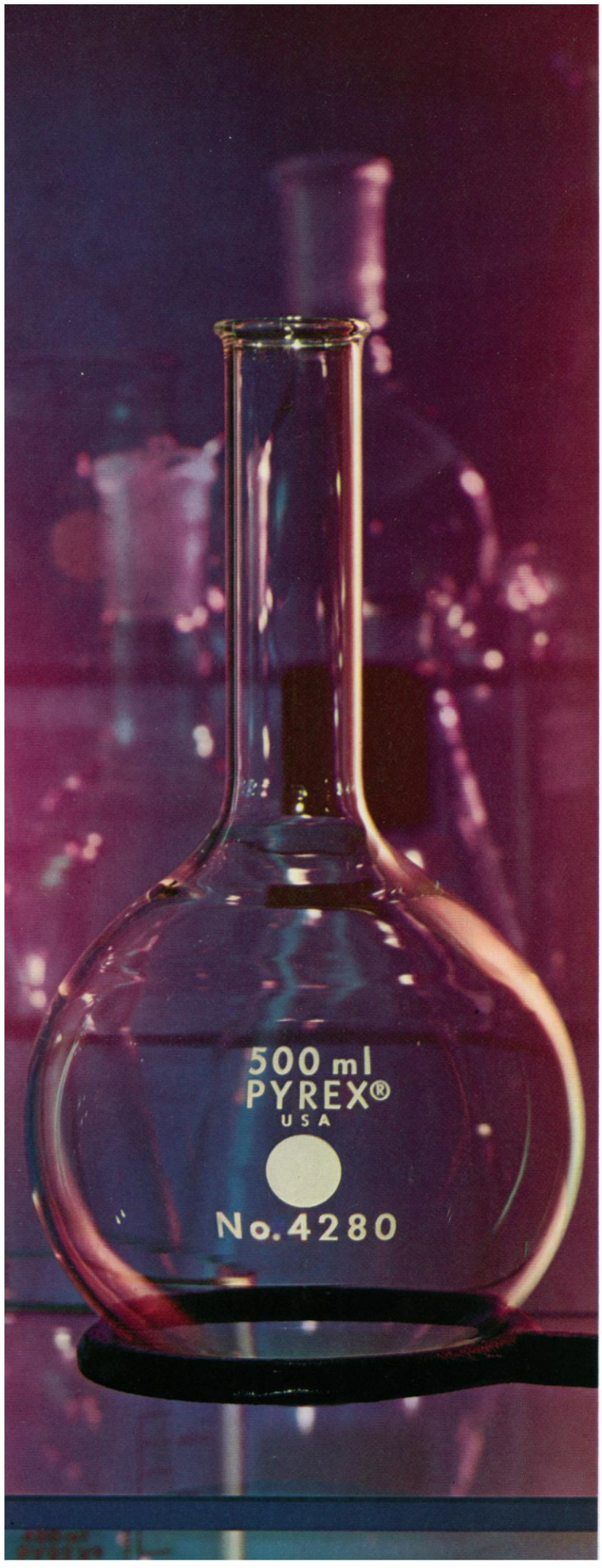


What's new and better in these 1964 PYREX® brand beakers and flasks?

Some of them are all new—like the beaker.

Others, like the flasks, may not *look* much different, but you'll find they *last longer* in your lab. That's because we're making them a new way.

We've improved our glass technology so we can form them even more uniformly to give you even greater strength. And we continue to make certain the glass has the best balance of thermal-shock and corrosion resistance, too.

We've been making improvements in design, production, and raw material every year since we invented PYREX ware back in 1915. These improvements mean more value for you.

Some examples of the new and the better for 1964:

HEAVY DUTY BEAKER—Actual laboratory tests proved this is the strongest beaker you can buy.

Its increased weight of walls, corners and bottom, its tooled-on wedge-shape top give you the service of 3, 4, or even 5 regular beakers for less than you'd pay for two regular beakers.

The convenient graduations add speed to your work. No extra cost for these.

Where beaker breakage is a problem (and where isn't it?), our No. 1003 is the proven answer.

IMPROVED BOILING FLASK—to give you extra strength in the critical neck and shoulder areas and right on through the body, we now blow this No. 4280 flask all at once in one piece. This gives you a flask of more uniform thickness to better resist clamping and handling stress and strain. It also gives you a better looking flask.

See if the improved No. 4280 doesn't give *you* better, longer service.

IMPROVED ERLENMEYER FLASK—you'll appreciate the added value and convenience the improvements in this flask give you.

Flasks with uniform walls are better able to resist heat shock and impact and give you longer service. That's why we flow the glass uniformly into the tricky radii and flats that make an Erlenmeyer.

Reinforced rims resist breakage. That's why we provide this protection.

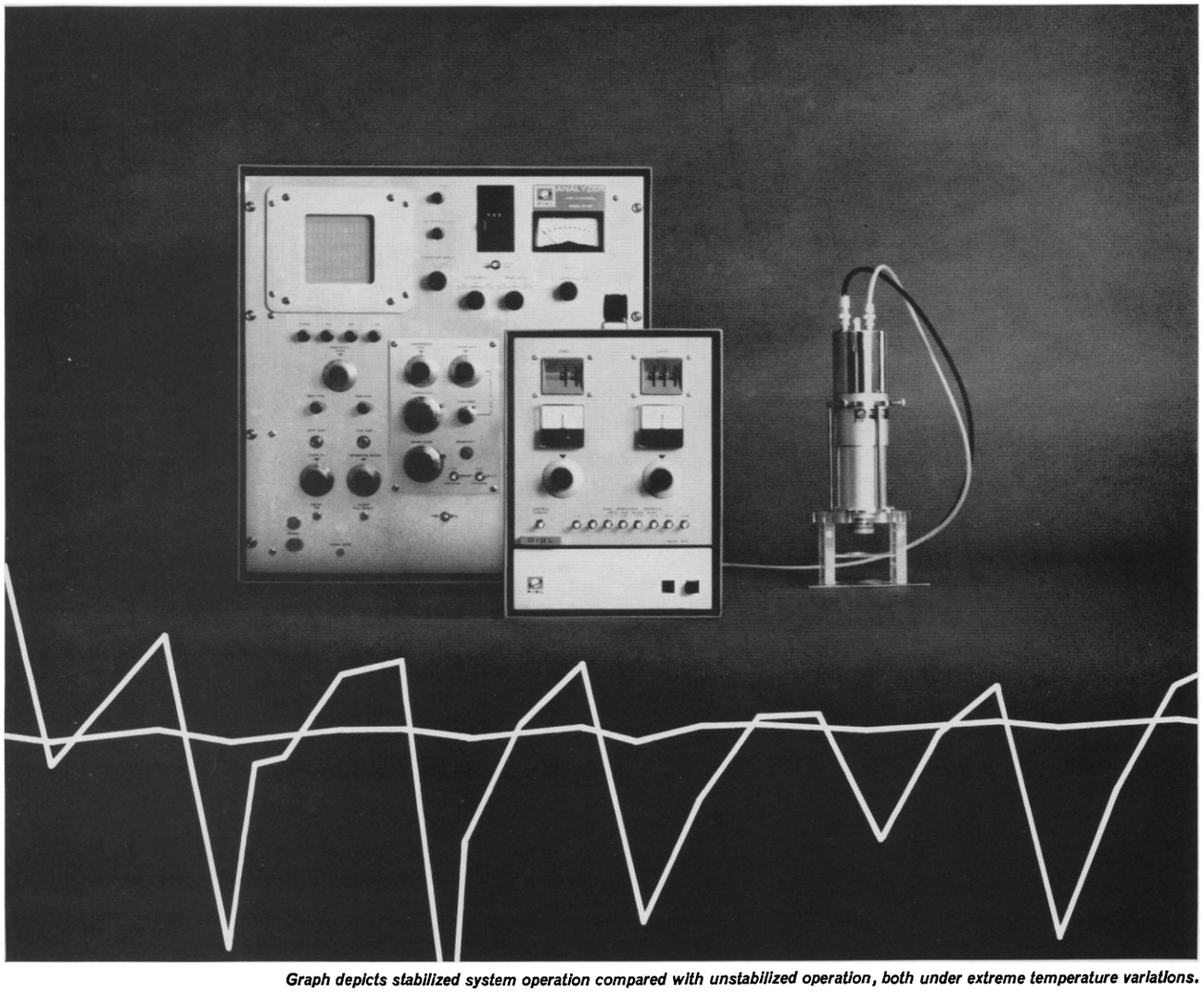
Approximate graduations add speed and convenience. They're yours at no extra cost.

Try our No. 4982 and get the extra value and convenience we've built into this flask for you.

Improvements like these carry right through the 115 other flasks and beakers in four different glasses in the longest and deepest, the oldest and newest, the most tried and trusted line in the world. Laboratory Glassware Dept., Corning Glass Works, Corning, New York.

CORNING

CORNING GLASS WORKS



Graph depicts stabilized system operation compared with unstabilized operation, both under extreme temperature variations.

REPRODUCIBLE CONDITIONS DAY AFTER DAY WITH THIS NEW PULSE HEIGHT STABILIZER

Now you can eliminate multichannel analyzer system gain and zero drift. The new RIDL 39-6 Digital Pulse Height Stabilizer allows you to use an analyzer system without recalibration over an extended period of time regardless of independant drifts in the detector, H. V. supply, amplifier, and ADC. The 39-6 limits drift to 0.1% over the dynamic range of the experiment.

With the 39-6, instrument conditions in the system can be reproduced from experiment to experiment. It can be used with scintillation, proportional, and solid state detectors. Comparison of data from the same system can be made with assurance that the over-all system conditions are identical. Stabilization is effected on experiment peaks stored in the analyzer, or on peaks supplied from external sources such as light, an alpha source imbedded in the crystal, or from a pulse generator. External peaks will not store in analyzer (if desired).

System stabilization is continuous throughout all operating modes of the analyzer. The Model 39-6 monitors the output of the analyzer ADC which functions continuously during Accumulate, Stand-by, and Readout.

The Model 39-6 provides digital selection of two effective channels. The lower channel number, selected with two digital indicating switches, determines the control point for ADC zero intercept correction. The higher channel number, selected with three digital switches, is set to an energy peak (or the pulse generator amplitude); this determines the control point for system gain correction. Both channel selections are obtained easily with a calibration step prior to system operation.

To find out more about the unusual stabilizing capability of the 39-6, and the many ways it can enhance the value of your RIDL analyzer (Models 34-8, 34-12, or 34-12B) see your RIDL sales representative, or write for literature, and specifications. NUC:R-4-228

RIDL

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Forthcoming Events

May

11–13. **Vectorcardiography**, intern. conf., New York, N.Y. (E. Meilman, Long Island Jewish Hospital, New Hyde Park, N.Y.)

11–14. Society for **Industrial and Applied Mathematics**, spring meeting, Washington, D.C. (SIAM, Box 7541, Philadelphia 1, Pa.)

11–14. American **Urological** Assoc., annual, Pittsburgh, Pa. (AUA, 1120 North Charles St., Baltimore, Md.)

11–16. Assessment of **Radioactive Body Burdens** in Man, symp., IAEA, Heidelberg, Germany. (IAEA, Div. of Public Information, Kärntnerring 11, Vienna, Austria)

11–14. **Aerospace Medical** Assoc., 35th annual, Bal Harbour, Fla. (W. J. Kennard, c/o Washington Natl. Airport, Washington, D.C. 20001)

11–14. **Biological Editors**, conf., Ann Arbor, Mich. (R. L. Zwemer, Committee on European Editors, c/o American Physiological Soc., 9650 Wisconsin Ave., Bethesda, Md. 20014)

11–16. International College of **Surgeons**, 14th intern. congr., Vienna, Austria. (S. E. Henwood, 1516 Lake Shore Dr., Chicago, Ill. 60610)

12. American Inst. of **Chemical Engineers**, tri-sectional symp., Newark, N.J. (R. H. Dodds, Gibbs & Hill, Inc., 393 Seventh Ave., New York, N.Y.)

13–14. Society of **Plastics Engineers**, plastics in space, conf., Garden City, N.J. (D. Hassel, Grumman Aircraft Engineering Corp., Bethpage, L.I., N.Y.)

13–15. **Biomathematics and Computer Science** in the Life Sciences, 2nd annual symp., Houston, Tex. (Univ. of Texas Graduate School of Biomedical Sciences, 102 Jesse Jones Bldg., Texas Medical Center, Houston 77025)

13–15. Society of Professional **Well Log Analysts**, 5th intern. symp., Midland, Tex. (F. Wheeler, SPWLA, P.O. Box 4713, Tulsa 14, Okla.)

14–15. **Radiochemical Processing** Symp., Buffalo, N.Y. (R. F. Lumb, Western New York Nuclear Research Center, Power Drive, Buffalo 14214)

14–15. **Scandinavian Biochemistry** Meeting, Stockholm, Sweden. (Sveriges Biokemiska Förenig, Karolinska Inst., Stockholm 60)

14–16. American Inst. of **Industrial Engineers**, 15th annual conf., Philadelphia, Pa. (W. J. Jaffe, Dept. of Management Engineering, Newark College of Engineering, Newark, N.J.)

14–16. Central States **Anthropological** Soc., annual, Milwaukee, Wis. (N. O. Lurie, Dept. of Anthropology, Univ. of Wisconsin, Milwaukee 11)

14–16. Society of **Technical Writers and Publishers**, 11th annual convention, San Diego, Calif. (C. M. Johnson, U.S. Navy Electronics Laboratory, San Diego 92132)

..16. **Southern California Acad. of Sciences**, annual, Northridge. (R. B. Loomis, Dept. of Biology, Long Beach State College, Long Beach, Calif.)

16–2. European **Energy** Conf., Paris, France. (H. Perdon, Institut Français des Combustibles et de l'Energie, 3, rue Henri-Heine, Paris 16°)

17–20. American Inst. of **Chemical Engineers**, natl. meeting, Pittsburgh, Pa. (F. J. Van Antwerpen, 345 E. 47 St., New York, N.Y. 10017)

18–20. **Radiation Research** Soc., 12th annual, Miami Beach, Fla. (G. D. Adams, Radiological Laboratory, Univ. of California Medical Center, San Francisco 22)

18–20. **Water**, 2nd conf., Technical Assoc. of the Pulp and Paper Industry, Green Bay, Wis. (H. O. Teeple, TAPPI, 360 Lexington Ave., New York, N.Y.)

18–21. Society of **Economic Paleontologists and Mineralogists**, Toronto, Ont., Canada. (R. H. Dott, Box 979, Tulsa 1, Okla.)

18–21. American Assoc. of **Petroleum Geologists**, 49th annual conv., Toronto, Ont., Canada. (R. E. King, American Overseas Petroleum, Ltd., 485 Lexington Ave., New York, N.Y. 10017)

19–20. Council on **Medical Television**, 6th annual, Atlanta, Ga. (S. A. Agnello, Duke Univ. Medical Center, Box 3163, Durham, N.C. 27706)

19–21. **Microwave** Theory and Techniques, intern. symp., New York, N.Y. (H. L. Browman, Airborne Instruments Laboratory, Deer Park, N.Y. 11729)

19–22. **German Metallurgical** Soc., general assembly, Bremen. (Deutsche Gesellschaft für Metallkunde, An der Alteburger Mühle 12, Köln-Marienburg, Germany)

19–22. German Soc. for **Applied Optics**, 65th, Gmünden am Traunsee. (H. Volkmann, Deutsche Gesellschaft für Angewandte Optik, Zeppelinstr. 23, 7920 Heidenheim, Germany)

19–23. **Energy Metabolism**, 3rd symp., Ayr, Scotland. (European Assoc. for Animal Production, Corso Trieste, 67, Rome, Italy)

19–30. International **Electrotechnical** Commission, general meeting, Aix-les-Bains, France. (American Standard Assoc., 10 E. 40 St., New York 16)

20. Memorial Hospital of Long Beach, **medical staff** symp., Long Beach, Calif., (G. X. Trimble, 2801 Atlantic Ave., Long Beach 6)

20–23. Canadian Assoc. of **Geographers**, 14th annual, London, Ont. (CAG, P.O. Box 421, Ottawa, Ont., Canada)

20–28. Modern Methods for **Analysis of Organic Compounds**, symp., Eindhoven, Netherlands. (Gesellschaft Deutscher Chemiker, Postfach 9075, Frankfurt-am-Main, Germany)

21–22. American **Geological** Inst., Toronto, Ont., Canada. (D. M. Kinney, U.S. Geological Survey, Washington, D.C.)

21–22. Southern **Textile Research** Conf., Hilton Head Island, S.C. (American Assoc. of Textile Chemists and Colorists, P.O. Box 886, Durham, N.C.)

21–23. **Minerals**, 9th annual symp., Moab, Utah. (J. C. Fox, Soc. of Mining Engineers, 345 E. 47 St., New York, N.Y.)

21–23. California Soc. of **Professional Engineers**, annual, Palm Springs, Calif. (J. C. Huisking, 970 Hillcrest Dr., Pomona, Calif.)

23–24. **Radiosensitizers and Radioprotective Drugs**, 1st intern. symp., Milan, Italy. (R. Paoletti, Pharmacology Inst., Via A. del Sarto, 21, Milan)

24–28. Near and Middle East **Medical** conf., Istanbul, Turkey. (P. Ponthus, Institut de Radiologie et de Lutte Contre le