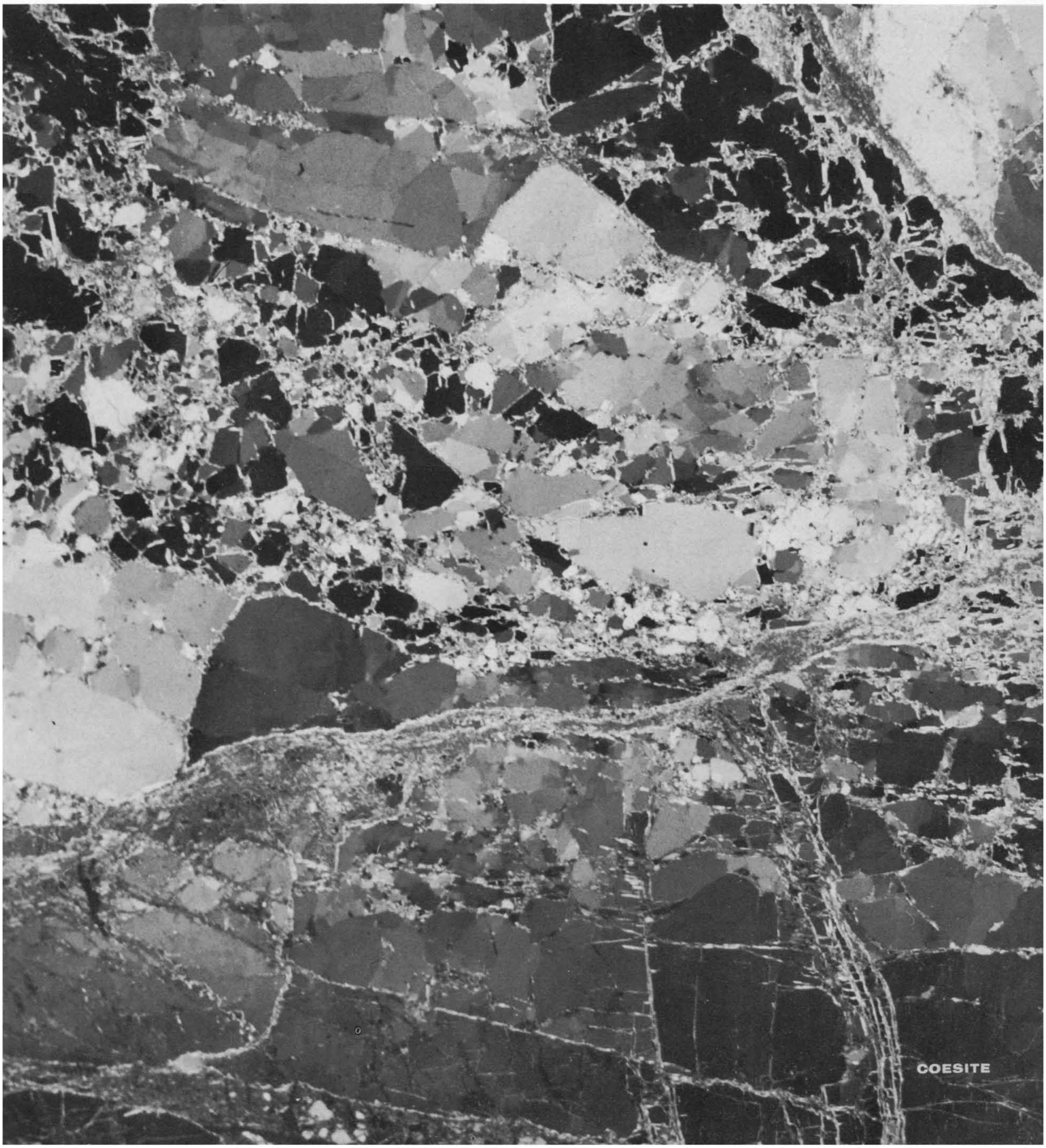
SCIENCE

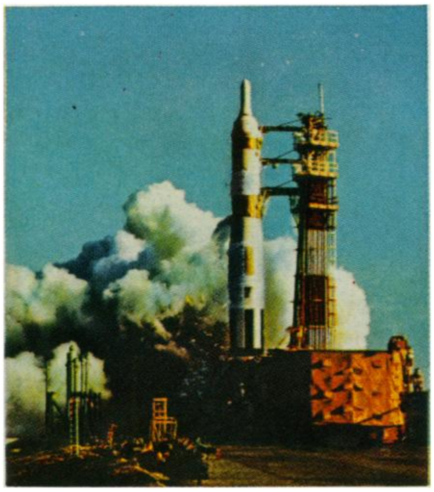
18 October 1963

Vol. 142, No. 3590

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



IBM computers, science and you:



Digital trouble shooter for Titan

At Martin Company, systems engineers help assure success in operational missiles by continually checking product performance with the help of an IBM 7090 system.

Martin engineers have processed 200 miles of paper and 2 million punched cards through the 7090—a complete and continuous case history on the performance of every part in every missile built at Martin's Denver Division.

Take the Titan for example.

Once a month, the manager of systems engineering receives an 8-month record of Titan performance. A curve drawn by the computer pinpoints potential trouble areas, alerts Martin engineers to parts that have started to drop in reliability.

The "trouble" might be just a loose wire, a minor drop in voltage or just a tired resistor. The point is they find and correct trouble before it aborts a mission.

That's pretty important—Titan II will boost Project Gemini into orbit, with a couple of astronauts aboard.

Reliability is pretty important in your product, too. It is to your customers anyway. And you can perform this type of quality control in your products, if you have an IBM computer handy. It doesn't always take a big 7090. Sometimes an inexpensive 1620 system is all you need.

Automatic maps help find oil

Geologists and geophysicists collect core samples and pressure readings and seismic data and dipmeter readings and other technical data.

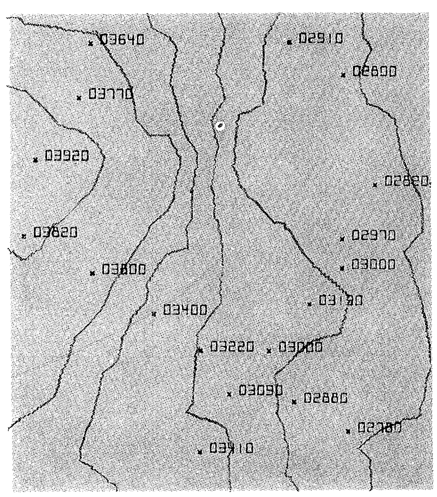
Then what? That's the rub.

Like most scientists, their problem is finding time to sift through it all...analyze it...and make it useful.

But not any more.

Now, a set of new IBM computer programs helps them process and analyze their data. The programs are tailored to oil exploration and production problems and the capabilities of the small, low-cost IBM 1620 computer.

The programs automatically stamp out quick contour maps that help petroleum experts avoid unpromising fields and concentrate on fields that look like winners.



The new IBM programs also guide economic forecasts, casing design, waterflooding patterns and other activities.

You can handle all these problems on a 1620 with 20K core storage and automatic divide, a card read-punch and a paper tape reader adapter to handle an X-Y plotter (for the contour maps).

The programs, of course, are free. And so is the help of our petroleum industry specialists.

Our programs help cut the cost of operating the computer.

This is worthwhile if it helps geologists and geophysicists eliminate just one million-dollar dry hole a year.

Computer programs speed lens design

If you've ever designed a lens system—even a simple one—you know it's no snap assignment.

It can take several months if you're working on a complex system and doing all the work by hand.

But you can cut this to a few days and increase precision at the same time, with an IBM 1620 computer and a set of four IBM lens design programs.

The first program in this package does two things. First, it traces individual meridional and skew rays and fans of sagittal and tangential rays (up to 99 per fan). It also calculates third order aberrations for the system and for individual surfaces.

The second program computes the vignetted aperture of the lens system, constructs a grid across this area and traces selected light rays through the system from this grid. This enables the designer to check the total usable path of light through the system. He may specify up to 999 rays.

The third program evaluates the output of the second program. It computes the radial distribution of light energy and provides focus and origin shifting, if desired.

The fourth program compares third order aberrations in the system with desired values. It automatically computes changes in system parameters and recalculates third order aberrations until the lens system performs within specified tolerance limits.

These lens design programs improve accuracy, help the designer improve lens system performance and make it possible for him to devise more sophisticated designs.

You can get these easy-to-operate lens design programs through your local IBM branch office.

IBM®
DATA PROCESSING

18 October 1963
Vol. 142, No. 3590

SCIENCE

SCIENCE is published weekly by the American Association for the Advancement of Science, 1515 Massachusetts Ave., N.W., Washington 5, D.C. Now combined with **The Scientific Monthly** ®. Second-class postage paid at Washington, D.C. Annual subscriptions $8.50; foreign postage, $1.50; Canadian postage, 75¢; single copies, 35¢. School year subscriptions: 9 months, $7; 10 months, $7.50. Provide 4 weeks' notice for change of address, giving new and old address and zone numbers. Send a recent address label. Opinions expressed by authors are their own and do not necessarily reflect the opinions of the AAAS or the institutions with which the authors are affiliated. Indexed in the **Reader's Guide to Periodical Literature.**

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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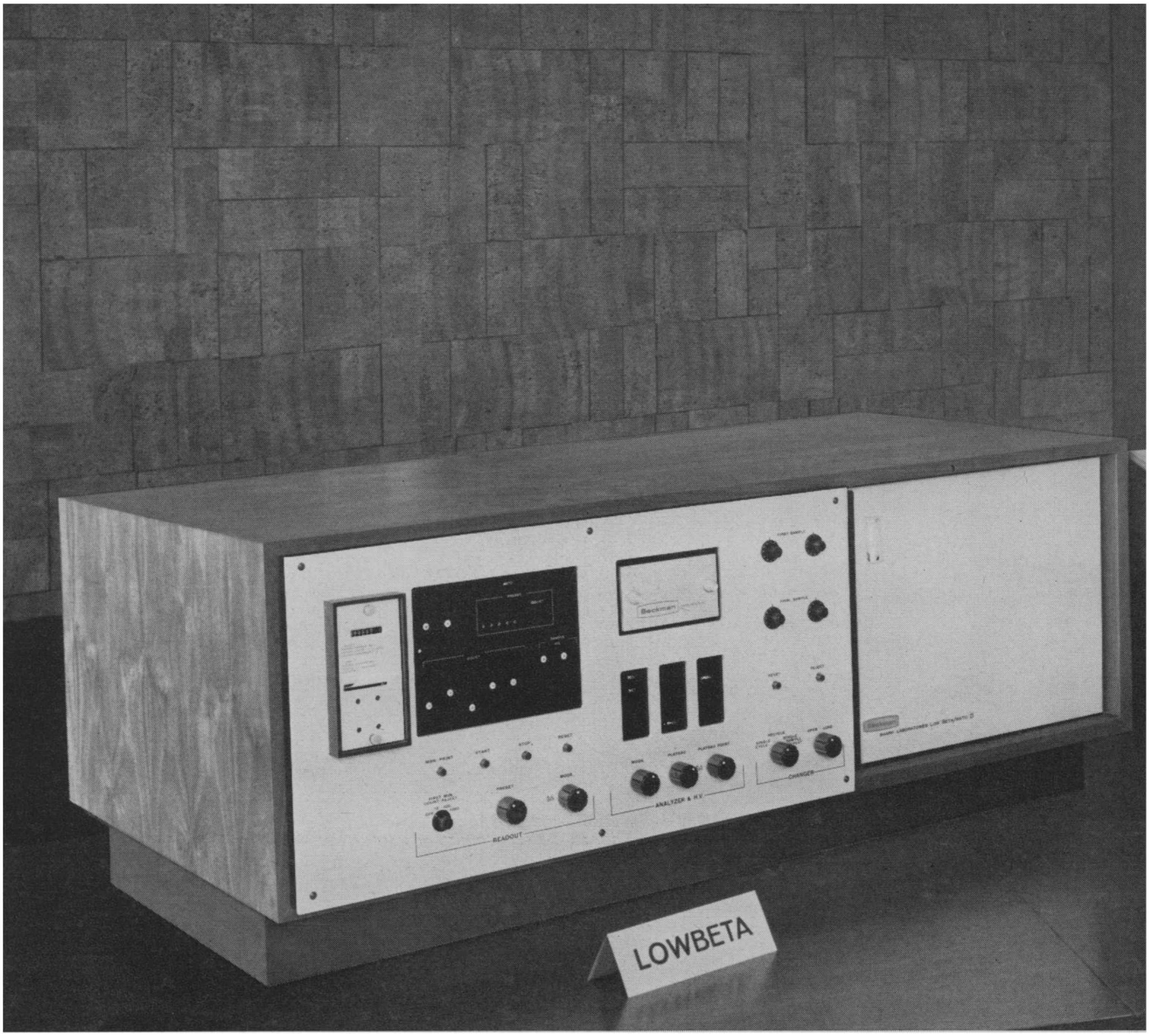
ADVERTISING CORRESPONDENCE: Room 1740, 11 West 42 St., New York 36, N.Y. Phone 212-PE 6-1858.

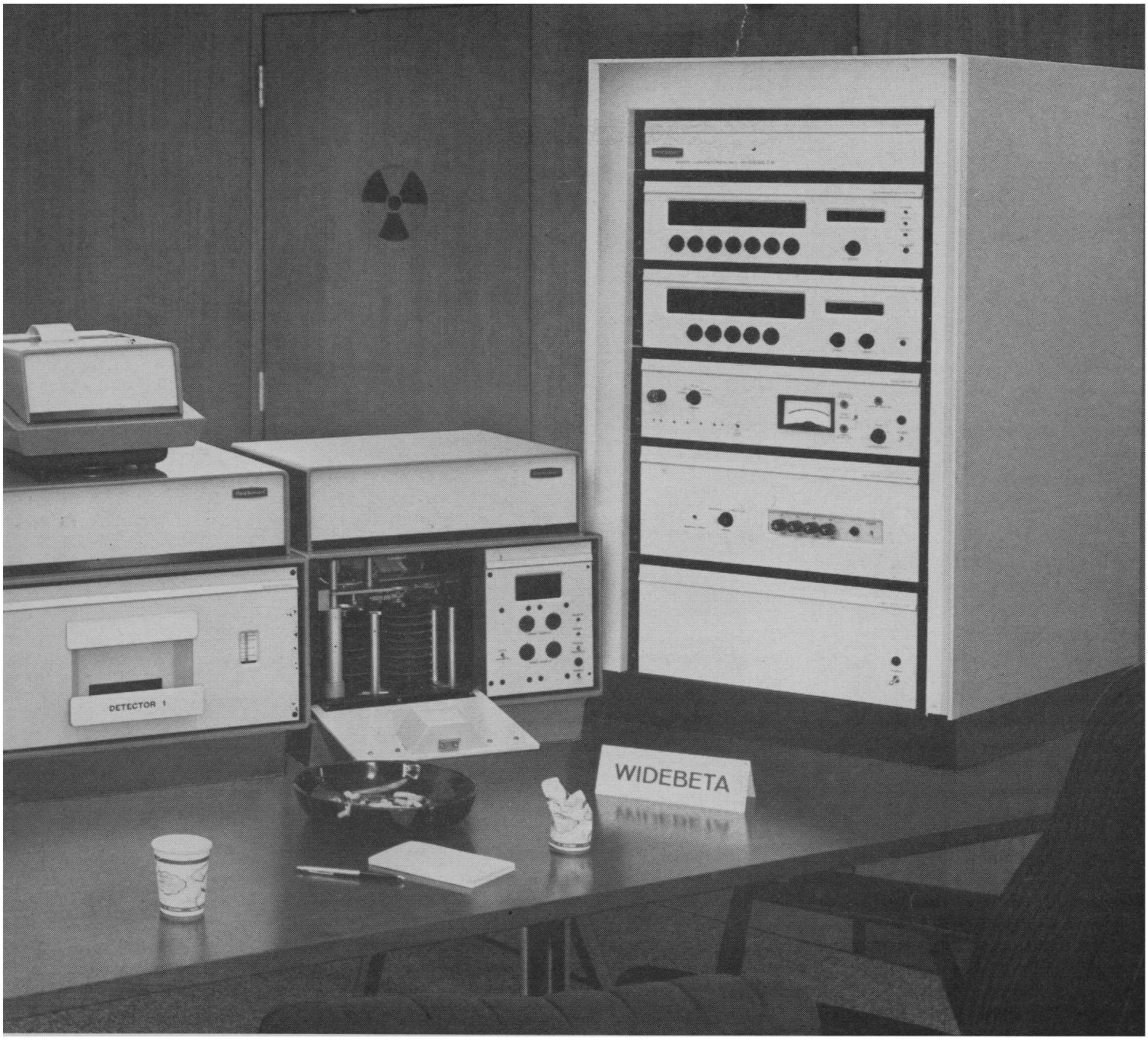
COVER

Photomicrograph of a thin section of shattered, coesite-bearing quartz from Holleford Crater, Ontario, Canada. The severely fractured quartz and the high pressure quartz polymorph, coesite, are the products of hypervelocity shock generated by meteorite impact with the earth (Cross nicols, about × 13). See page 379. [A. M. Reid]



We first asked ourselves, "Do they have the proper background?"

(The question came up just before the Sharp Radioactivity Counting Systems joined the Beckman family. The answer...yes, the lowest background available and fully reproducible too.)



LOWBETA® II is a definite breakthrough in moderately priced planchet counting systems.

Its background is the lowest at any price. And it's the first to guarantee that 95% of all given background measurements in a 24 hour period will be within ±2 standard deviations of the average background counting rate. This assures you precise, error-free sample counting. Sensitivity over the entire planchet area is uniform. New overlapping detectors see to that.

A new 100 sample automatic changer allows you to select individual samples as well as any sample grouping. You may also start the cycle with any sample and end up with any other.

You may select from 12 different LOWBETA II systems depending upon your requirements. Visual and printed readouts. Either geiger or proportional gas operation. Manual or automatic versions. And with three different detector sizes (including the new 5″ size).

WIDEBETA is the most advanced planchet counting system in the world.

It combines the lowest background and full reproducibility with the widest counting range of any system. WIDEBETA performs equally well at a few counts per hour or over one million counts per minute. And with a loss of less than 1% at one million. Live timing is behind this.

WIDEBETA offers full automation. Automatic sample changer handles up to 100 samples. Automatic pulse height sorting and blanking allows simultaneous alpha-beta counting as well as energy separation of mixed beta emitters. Automatic background subtraction provides net count information directly. Digitally presettable timing decades permit automatic normalization of data to percentage of a standard

A wide choice of detectors and optional features makes WIDEBETA the most versatile as well. For more information about these two systems, call your Beckman Sales Engineer or write for Data File LWB-38-164.

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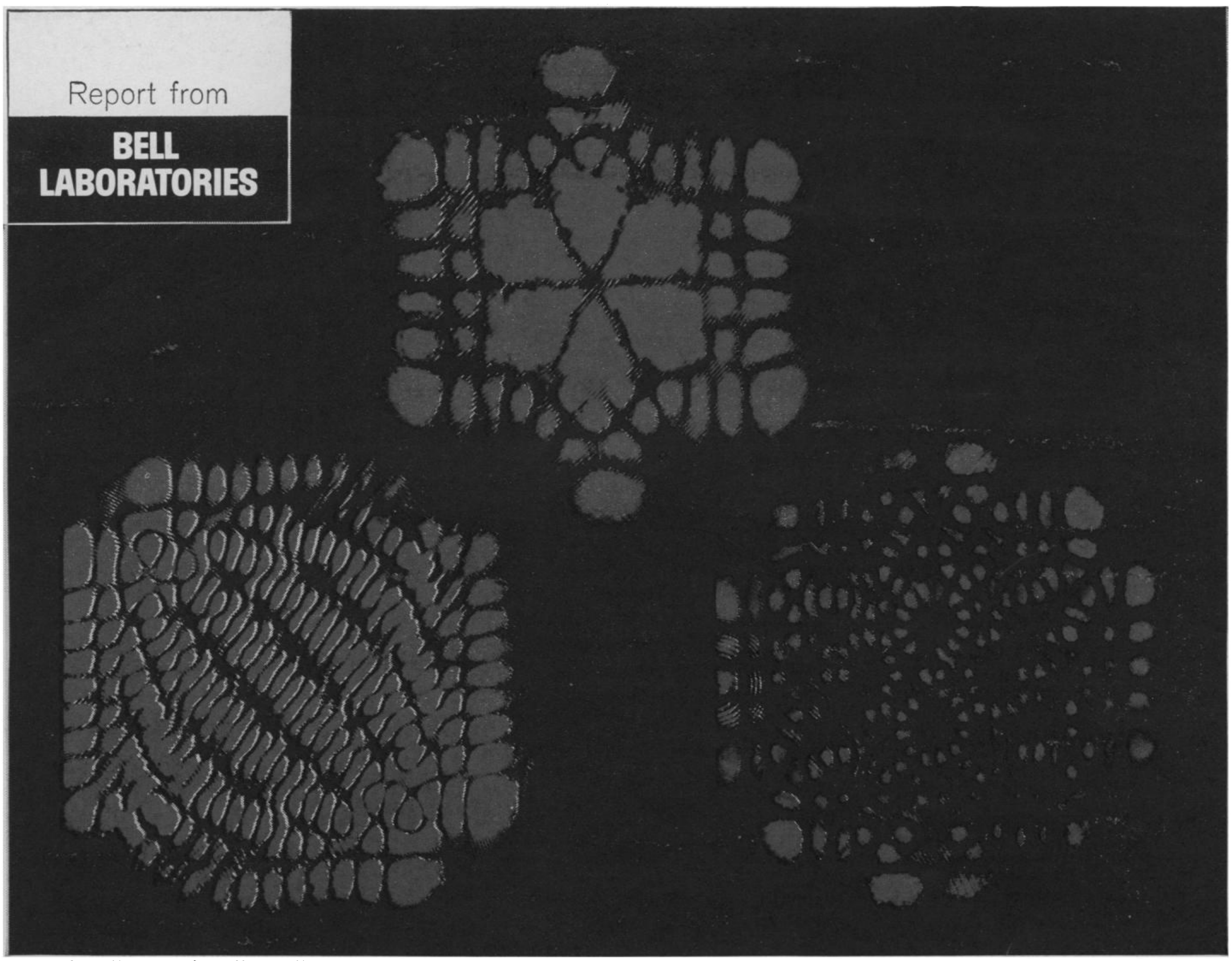

To produce these mode patterns, the normal operation of a helium-neon optical maser is perturbed by placing a pair of wire cross hairs in the cavity. These wires interact with the mode structure of the unperturbed cavity, suppressing some modes and, in certain cases, coupling others together. By changing the angle between the cross hairs, this interaction can be altered and different mode patterns, as shown, can be produced.

A STEADILY GROWING FAMILY OF OPTICAL MASERS

Scientists at Bell Telephone Laboratories are continuing extensive research programs to gain increased knowledge about optical maser (laser) action. The immediate goal of these investigations is more complete understanding of the phenomenon itself. In the long run, however, this knowledge will help us to evaluate better the communications applications.

One aspect of optical maser research is the study of the mode structures in laser cavities. The modes excited in a particular experiment can be identified by mode patterns, shown above, produced by directing the emergent beam onto a photographic plate.

Optical maser research at Bell Laboratories has resulted in a broad new field of radiation science. For instance, discovery of gas lasers also provided the first continuously operating laser. The active medium in this device is a mixture of helium and neon; its operation depends on the excitation of neon atoms by collision with excited helium atoms. Originally, this system emitted infrared light, but recently it has been made to produce visible red and yellow light.

More recently, in another significant advance, our scientists have discovered two other new mechanisms for creating maser action in gases. One depends on the dissociation of oxygen molecules in mixtures of oxygen and neon or argon. The other takes place in pure noble gases—helium, neon, argon, krypton and xenon—and depends on a direct transfer of energy from accelerated free electrons to the gas atoms.

With these mechanisms and various gases or gas mixtures, we have achieved maser action at approximately 150 different wavelengths extending from 0.594 microns in the yellow region of the spectrum to 34.5 microns in the far infrared—and more are in prospect.

BELL TELEPHONE LABORATORIES
World center of communications research and development

Basic Research at Honeywell
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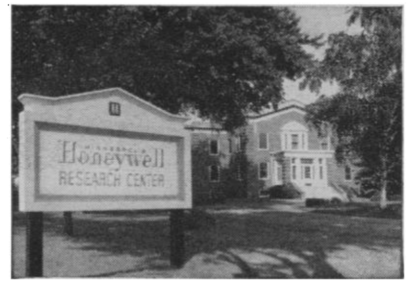
Hopkins, Minnesota



Measuring Heats of Fusion of Salts with a Dynamic Adiabatic Calorimeter

Modification of and additions to known techniques have led to a fast and accurate method of measuring heats of fusion and specific heats of materials.

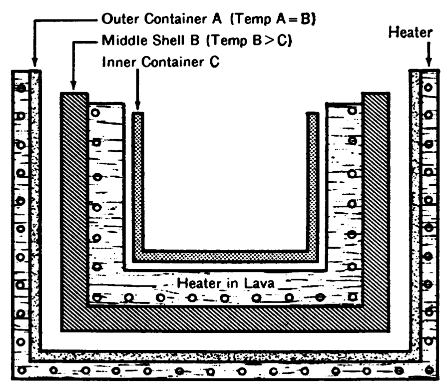
Fused salts are stable at high temperatures, have low vapor pressure, low viscosity and good electrical conductivity. They are also able to dissolve many different materials. Extremely useful in metallurgical processes, they have been used as heat transfer materials, power sources, control devices, and coolants and fuels in atomic reactors.

One area of interest to Honeywell scientists concerns heats of fusion of specific salts. Much older heat of fusion and specific heat data to be found in the calorimetric literature are inaccurate, particularly those on inorganic compounds with high melting points. At the same time present methods of obtaining accurate data are cumbersome, complex and time consuming.

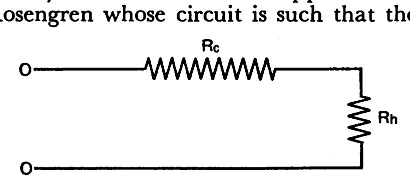
Modifying and adding to known techniques, Honeywell scientists have developed a calorimeter that gives direct reading, highly accurate data in as little as two hours.

A conventional calorimetry equation is $q_h = q_s + q_c + q_1$ or the heat supplied to the system equals the heat absorbed by the sample (q_s) plus the heat absorbed by the calorimeter (q_c) plus any heat loss (q_1).

Honeywell's approach (see illustration) is to eliminate q_1 by maintaining adiabatic conditions between the outer shell (A) and the next or middle shell (B) and to maintain a constant temperature gradient between a higher temperature in the middle shell (B) and a lower temperature in the inner shell (C) containing the sample. The equality of temperatures at (A) and (B) forbids heat from passing from the middle (B) to the outer shell (A) so that after the middle shell temperature reaches its control point all heat must pass to the sample. The outer-middle shell adiabatic condition and the middle-inner constant temperature gradient condition are maintained with two feed-back control systems. If these conditions are met q_1 can be ignored and $q_h = q_s + q_c$. If the sample is removed $q_h = q_c$ and q_c becomes known so that q_s can be determined by a simple subtraction. The problem then becomes how to accurately measure q_h.



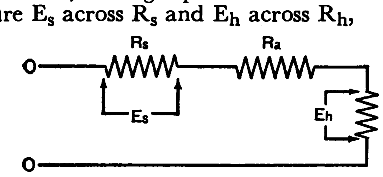
The problem $q_h = \int$ watts x time or $\int$ amps x volts x time is simple to pose, but the integration is difficult without a constant current, voltage or wattage. To obtain a constant power (amps x volts), Honeywell borrowed an approach of Rosengren whose circuit is such that the



difference in power dissipated by R_h will be negligible between any two temperatures if $R_c = \sqrt{R_{h1} \times R_{h2}}$ where R_{h1} is resistance at temperature 1 and R_{h2} is resistance at temperature 2, whereas without R_c the power dissipation decreases inversely as R_h increases.

Desiring, however, to use an adjustable system to cover different temperature ranges, Honeywell separated R_c into R_a, an adjustable resistor, and R_s, a known standard resistance.

Then, adding a potentiometer to measure E_s across R_s and E_h across R_h,



$E_s = R_s i_s$, where i_s is the same as i_h and R_s is known. Thus watts across R_h can be determined: $E_h E_s/R_s$ = watts of constant power.

With a strip chart recorder measuring the temperature of the sample only when power is demanded, a direct readout of the heat of fusion (q_h) is possible. The chart reads time directly between any two points. Therefore, when temperature ceases to climb, fusion is taking place and when temperature rises again fusion is completed.

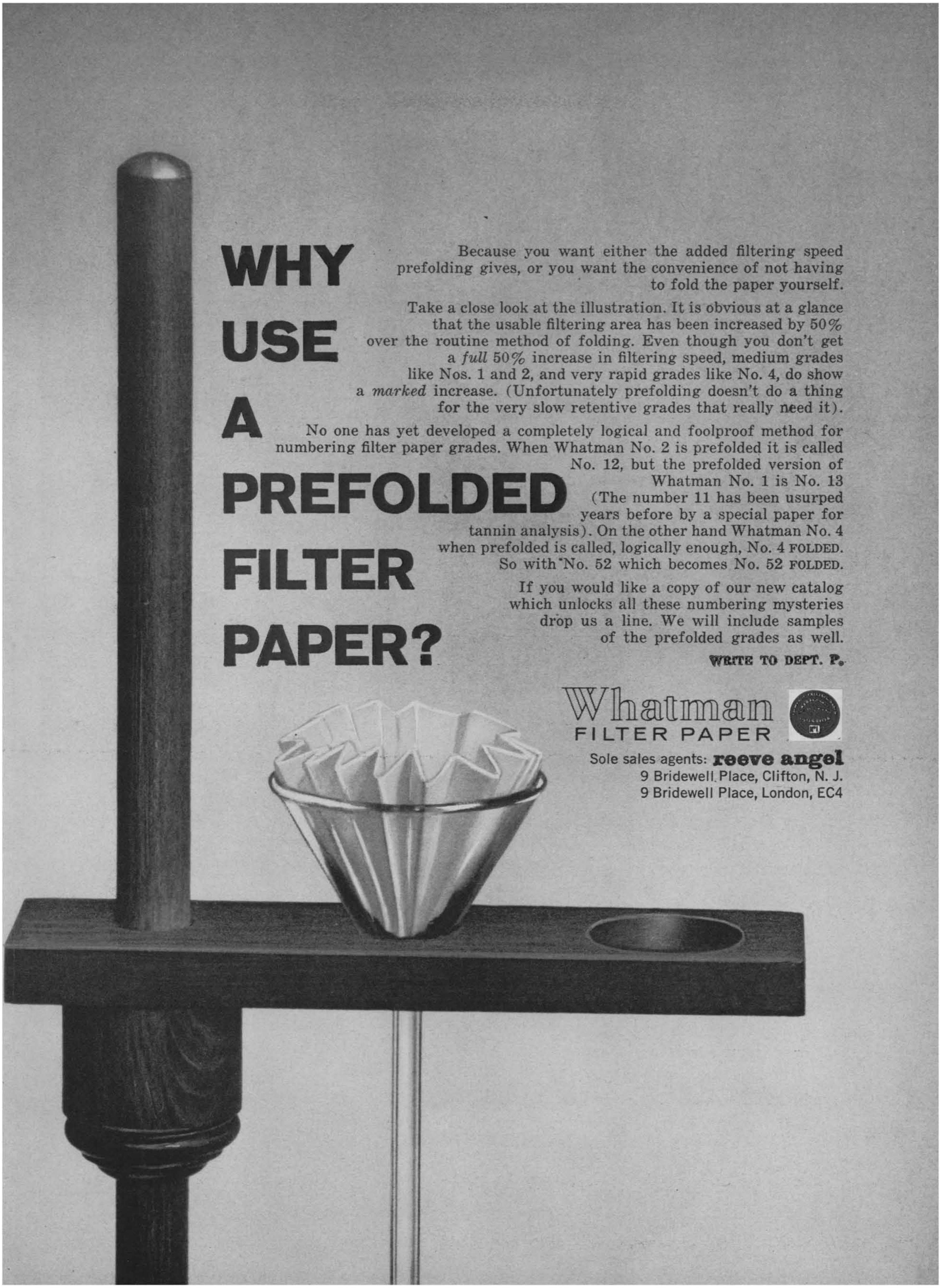
Since q_h = watts x time, and watts ($E_h E_s/R_s$) is maintained constant, q_h becomes a known factor x time, so that by an easy conversion, time for fusion is in effect, q_h, the heat of fusion. By comparing plots with and without the sample, specific heat data are also easily obtained.

This chart, plotted automatically in two to three hours, replaces computations that took several weeks. Results have been impressive. In measuring the heat of fusion of benzoic acid in five runs, one was +1.7% above the Bureau of Standards figure, one +2% and three exactly on standard.

Work is continuing at Honeywell's Research Center. As heats of fusion of various salts are more readily measured and predicted, further uses are expected. If you are engaged in high temperature calorimetry and wish to know more about Honeywell's work in this area you are invited to write Dr. Cyril Solomons, Honeywell Research Center, Hopkins, Minn.

If you are interested in a career at Honeywell's Research Center and hold an advanced degree in any branch of science you are invited to write Dr. John Dempsey, Director of Research, at this same address.

Honeywell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Take a close look at the illustration. It is obvious at a glance that the usable filtering area has been increased by 50% over the routine method of folding. Even though you don't get a full 50% increase in filtering speed, medium grades like Nos. 1 and 2, and very rapid grades like No. 4, do show a marked increase. (Unfortunately prefolding doesn't do a thing for the very slow retentive grades that really need it).
No one has yet developed a completely logical and foolproof method for numbering filter paper grades. When Whatman No. 2 is prefolded it is called No. 12, but the prefolded version of Whatman No. 1 is No. 13 (The number 11 has been usurped years before by a special paper for tannin analysis). On the other hand Whatman No. 4 when prefolded is called, logically enough, No. 4 FOLDED. So with No. 52 which becomes No. 52 FOLDED.
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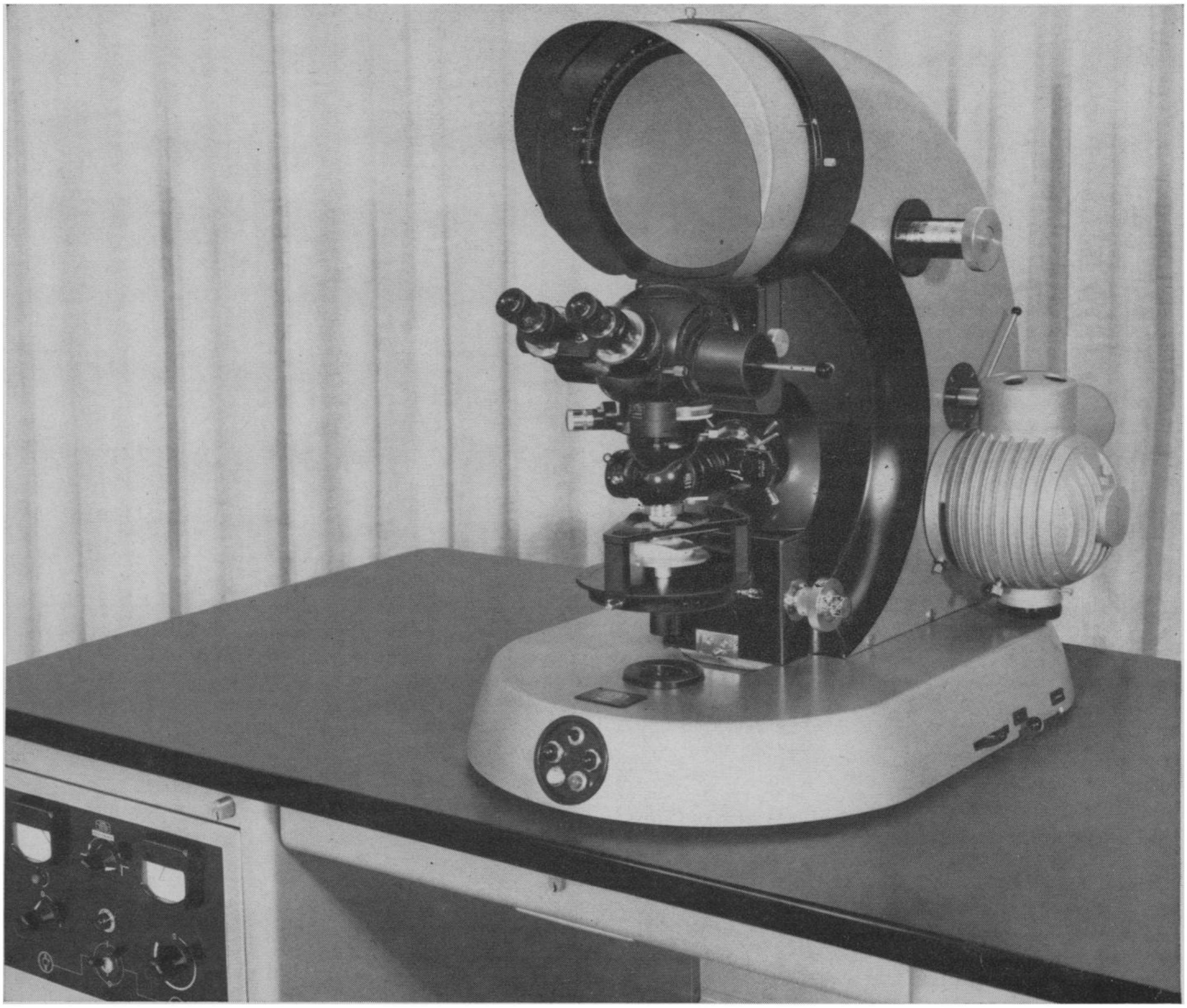

rapidly growing teratoid tumors unlike any he had observed after inoculation of untreated embryos.

It would seem that the ether-soluble substance described by Reinke may be similar to or the same as retine, as described by Szent-Györgi *et al.*

MILTON B. YATVIN
University Hospitals,
1300 University Avenue,
Madison 6, Wisconsin

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1. Reinke, *Deut. Medizenalzeitung* **28**, 579 (1907); *Muench. Med. Wochschr.* **54**, 2381 (1907).
2. W. H. Woglom, *The Study of Experimental Cancer: A Review* (Columbia Univ. Press, New York, 1913).
3. Askanazy, *Wien. Med. Wochschr.* **59**, 2518, 2578 (1909); *Zentr. Allgem. Pathol. Anat.* **20**, 1039 (1909).

Majority Opinion: Right or Wrong?

In a democracy so much emphasis is given to the majority opinion that it is generally assumed that the majority is right. "Fifty million Frenchmen can't be wrong." I would like to raise the question as to whether or not the opinion of the majority is almost always wrong.

History abounds with examples of popular opinion later proved to be incorrect and absurd. The Crusades of the Middle Ages are typical—especially the Children's Crusade in which thousands of young children were sacrificed for no purpose. The search for the Holy Grail and the Fountain of Youth involved large groups of so-called intellectuals. A mania for dancing in the streets was almost universal at one period of European history. The inquisition and witch burning have been popular enterprises. Wars in general have proved totally ineffective and unnecessary. Nothing was sillier than our own destructive Civil War which could have been averted if the opinion of a small minority had been given consideration. In more recent times the German slaughter of the Jews and our own experience with prohibition have furnished plenty of evidence that majority opinion has been found wrong after temporary emotions have subsided.

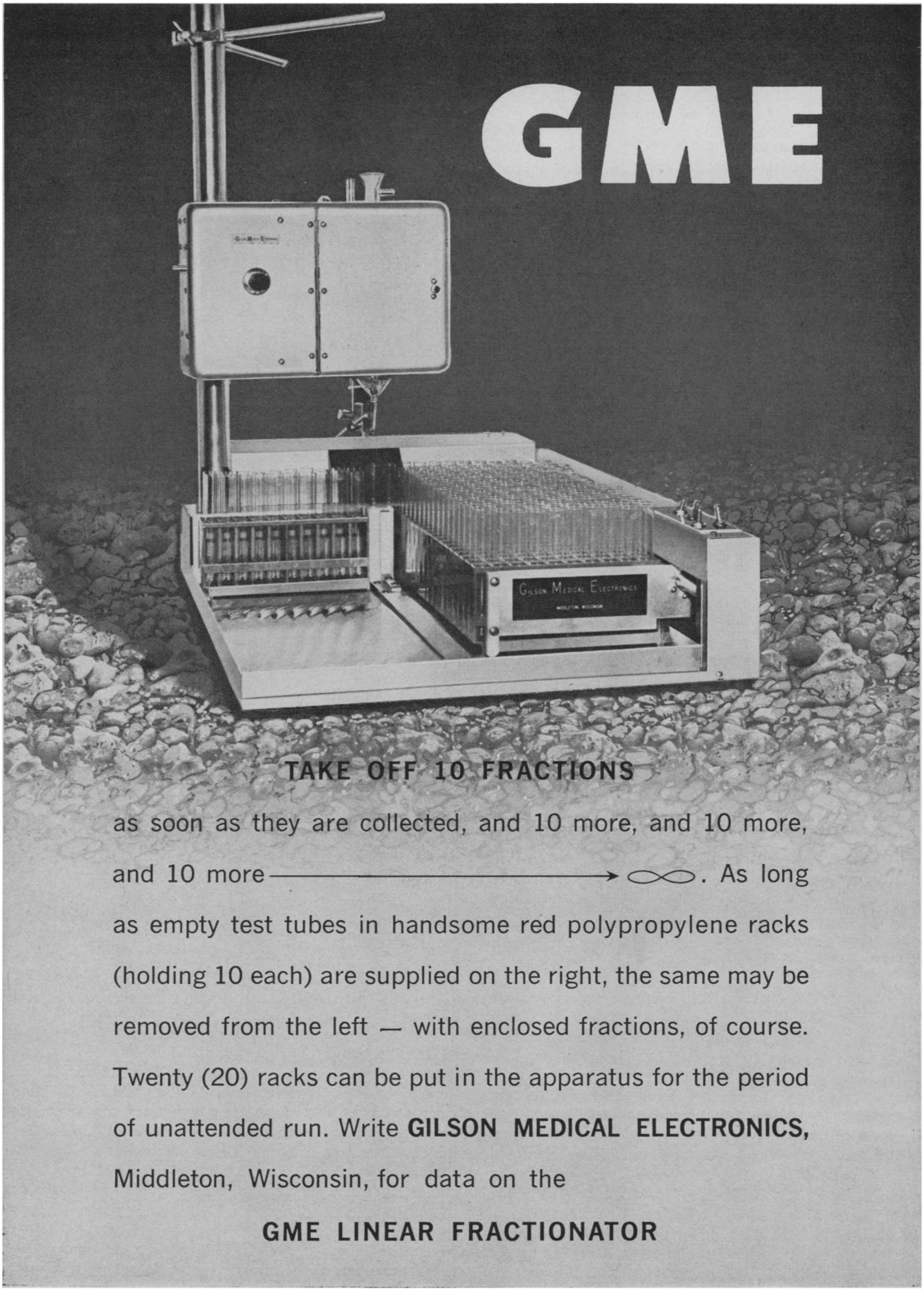
All this leads me to wonder if we are not engaged in another misdirected effort for man-in-space navigation. Unquestionably, the expenditure of hundreds of billions of dollars for these projects has the majority support of the public and Congress. In attempting to push these vast engineering projects by a crash program, we are neglecting fundamental scientific work on properties of material and its environ and the determination of basic constants and knowledge that would lead to a more effective solution of the major enterprises if later they were still considered to be worth our effort. In fact what few real accomplishments have been made along basic research are suppressed if they tend to minimize the development of man-operated rocket ships. For example, there is plenty of spectroscopic evidence published by Kiess and colleagues that the atmosphere of Mars consists primarily of the oxides of nitrogen, yet propaganda is prevalent for a hundred billion dollar space landing in order to study the assumed vegetation and life which present evidence proves cannot exist. I believe these vast sums could be better spent in other ways, with just a few thousand dollars for spectroscopic work on planetary atmospheres by spectroscopists rather than publicity seekers. The future will undoubtedly disclose that the present majority opinion and enthusiasm for plunging into these costly space efforts were ill-advised, both from the scientific and from the political standpoint.

PAUL D. FOOTE
National Academy of Sciences–
National Research Council,
Washington 25, D.C.

Clipping and Conflict

Each week *Science* places in conflict those of its readers who clip out articles and reports of particular interest in order to file them by topic. In the 30 August issue, for example, there were seven articles on behavior and behavioral mechanisms which were massed together on pages 820 to 831. It is impossible to separate all seven of these articles without mutilating many of them, and one is forced to decide which relevant articles to mutilate and which to save, even though he may want to save them all.

Readers would not have to face this conflict if articles and reports on closely related topics were not placed next to each other—that is, if reports on physical and chemical problems were alternated with reports on biological and behavioral problems. The two reports in that issue on the West Ford dipole belt might well have been left together, followed by one of the be-


GME
GILSON MEDICAL ELECTRONICS
TAKE OFF 10 FRACTIONS
as soon as they are collected, and 10 more, and 10 more, and 10 more $\longrightarrow \infty$. As long as empty test tubes in handsome red polypropylene racks (holding 10 each) are supplied on the right, the same may be removed from the left — with enclosed fractions, of course. Twenty (20) racks can be put in the apparatus for the period of unattended run. Write **GILSON MEDICAL ELECTRONICS,** Middleton, Wisconsin, for data on the
GME LINEAR FRACTIONATOR

18 October 1963, Volume 142, Number 3590

SCIENCE

The Pacific Science Center

A year ago, on 21 October, the Seattle World's Fair came to a close, but not its star attraction, not what Murray Morgan, one of the fair's historians, called "The memorable attraction of the Seattle World's Fair—its Sally Rand and Little Egypt, the thing the old-timers will probably be talking about when the next century is a reality rather than a projection . . . the United States Science Pavilion. More than two out of three visitors (6,770,109 out of 9,609,969) sought out the exhibit that the pros had warned was black plague at the box office." From opening day onward, admiring visitors wondered what would happen to the science exhibit when the fair came to an end and commented that it was much too good to be allowed to shut down. Local business and educational leaders agreed, and formed a nonprofit corporation; the U.S. Government agreed, and provided a dollar-a-year lease for the land and buildings and an NSF grant to help with initial expenses. And so the Pacific Science Center was born.

Permanent financing is still a problem, for admission charges cannot meet all of the costs. But financial help is beginning to come from industry, local government, and private individuals, and there is optimism that the financial problem can be met if the other major problem is solved, that of converting the exhibit from one designed for a stream of one-time visitors to a permanent community science center. Taking tips from and hoping to improve upon other science museums here and abroad, staff, trustees, and a national advisory committee are planning a multiple-purpose institution to serve a variety of users. They want a science museum with gradually changing exhibits that will be of interest and educational value to students. They intend it to be of equal value to the large number of adults who want to learn some elementary things about science, things they did not learn in school. School teachers from the region are coming to the Center for discussions of science teaching, for help in locating or building teaching materials, and for ideas they can use in their own classes. Whole classes come for lectures, science films, guided tours, and the opportunity to use the specially designed and ingenious demonstration equipment. Possibilities are being explored of using the Center as a home and sponsor for amateur science groups. The serene and lovely buildings which Minoru Yamasaki designed for the U.S. Science Exhibit provide a setting of great beauty for exhibits relating science and the arts. And the acoustic perfection of one of the five great halls suggests exhibits and demonstrations linking science and music. Along these varied lines the staff and trustees are developing their ideas, planning a Center that will appeal to a variety of audiences and that will have a continually evolving program.

The public reception of the U.S. Science Exhibit taught a lesson to those who have claimed that science can be made palatable for a general audience only if it is candy-coated with gadgetry, breakthroughs, and artificially exciting treatment. Imaginative exhibits on basic science hold the interest of a large public audience if technical jargon is avoided and if clear explanations are given. The Pacific Science Center inherited an excellent set of exhibits and has the record of their effectiveness as a guide for future development. If the Center succeeds as well as did the U.S. Science Exhibit from which it grew, it can become a model that other communities will want to copy. —D.W.


A new
pH measurement
instrument
by which
all future instruments
must be judged
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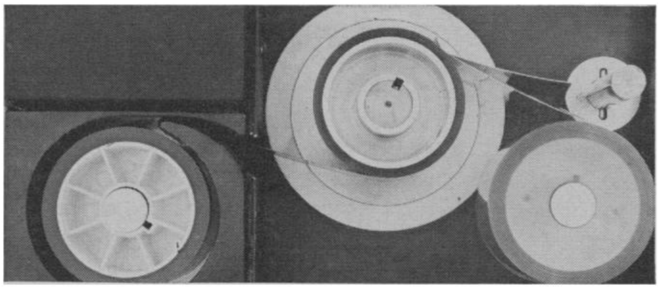
Kodak reports on:

processing and printing long film by dampness . . . whole needles evenly distributed in a lasting binder on a sensible base . . . "G" for gas chromatography and green labels

Just roll them up together



This represents the principle of either intermittent or non-intermittent processing and printing of long rolls of film by dampness—mere dampness. The principle is quite simple and not quite revolutionary any more. In its new manifestation it delivers not only an immediate positive but a first-class negative for future positives. Perhaps the message will strike right between the eyebrows of some reader who has been struggling hard with the pesky details of apparatus for photographing our too rapidly shrinking planet for the ultimate purpose of making it more livable for our burgeoning species and/or of peace-keeping. (Probably the peskiness of the details has diverted his attention from ultimate purposes.)

We are wide open. We can play guiding angel to this new but well proved technique for broadening the scope and feasibility of photographic surveys, supplying nothing more billable than hospitality and encouragement, hoping that the eventual consumption of our negative materials will reward us for improving the quickness and quality of aerial photography. We can, on a special order basis, supply just the KODAK BIMAT Film, which imbibes solution, applies it to the negative film, and comes away bearing the positive image. We can similarly supply just the KODAK BIMAT Imbibant. We can likewise supply suitable negative films. We can supply the whole works. We can design the hardware, build the hardware, or shake the hand of him who intends to prosper by proving in fair competition that he can outdesign or outbuild us.

Book an appointment for a preliminary discussion by a letter to Eastman Kodak Company, Special Sensitized Products Division, Rochester 4, N. Y.

Thoughts to buy tape by

There is a new magnetic tape. Intended for those who record sound for a living instead of just for fun, it is now coming into stock at electronics supply houses. These dealers, however, consider it none of their business whether the tape is needed for fun, profit, or the general betterment of the human race.

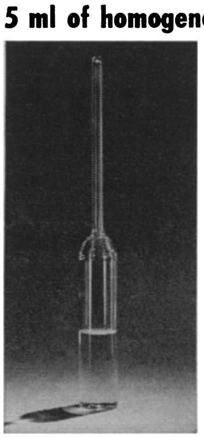
There are two main points of novelty:

1. We suspend our iron oxide needles in a new binder, which is adaptable only to our highly proprietary and unbeatably clean and uniform method of manufacturing sound tape. Excellent as the generally used poly(vinyl chloride) may be for the purpose, our binder seems not only to age with demonstrably more grace but it forms a smoother top surface (which is widely known to reduce intermodulation distortion, for reasons never wholly understood). The needles do not aggregate in it in the usual wood-grain-like pattern, nor do they get battered and fractured in the attempt at homogeneity of distribution. Therefore print-through measures a whole 55 db down from the recorded signal in the standard test, and this in turn greatly extends the time between periodic rewindings that tape-recordings should get.

2. The support is not the super-strength kind but cellulose triacetate, treated to make it stronger than triacetate has any business being. Amateur recordists generally don't realize when they buy super-strength that the low-tension equipment used in the home never requires it, though it costs something in audio uniformity and money. Professionals with their high-tension equipment, on the other hand, have long known that in case of trouble, a clean break is instantly apparent, remediable, and preferable to the treacherous stretch—over 70% before breaking—of the super-strength stuff. (Our treated triacetate stretches no more than 0.5%. We trademark it DUROL Base.)

Didn't you know we made magnetic tape? Ask for EASTMAN *Type A303. (Type A304 has a thicker coating for higher output with less amplifier gain and its attendant noise. It is recommended only for commercial recording of originals on adjustable-bias equipment.)*

5 ml of homogeneity



For around $30 per vial, we take pride in offering 5 ml under N_2 of

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EASTMAN G943 sec.-Butyl Alcohol
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EASTMAN G972 Cyclohexanone
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EASTMAN G1697 2-Ethoxyethanol
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Oceanography

Major aspects of the oceanographic program of the IGY were summarized at a National Academy of Sciences symposium on the results of the IGY-IGC. Los Angeles. Five papers were presented. Hence a comprehensive summary of the exploratory geology and geophysical expeditions, was obviously impossible. A typical expedition included two ships working together, traversing an area of several million square kilometers and using a variety of oceanographic instruments and techniques such as echo soundings, bottom cores, rock dredges, bottom photography, gravity meters, magnetometers, heat probes, seismic refraction, and others. A comprehensive review of such a wide-ranging program would either be very long or little more than a listing of names and places. R. W. Raitt (Scripps Institution of Oceanography) limited his discussion to exploratory work in the South Pacific by Scripps expeditions. Of particular interest have been the observations relevant to the problem of convective currents in the earth's mantle. Work was concentrated in the trenches that ring the Pacific basin, and on the East Pacific Rise which, in the South Pacific, runs in a general north-south direction along longitude 115°W. Spectacularly high heat flow has been recorded on the Rise, while lower than normal heat flow is the rule under the trenches. Lower than normal mantle velocities of 7.6 kilometers per second are recorded under the East Pacific Rise.

A second major program was the study of the deviation of sea level from the mean. In numbers of persons and countries participating it was probably the largest. Some old tide stations were reactivated, and many new ones were established. An effort was made to improve the geographical distribution of tide stations, and some were put on remote Pacific islands.

The analysis of the data has been done by relatively few researchers (E. Lisitzin, Finland; J. G. Pattullo, Oregon State University; and W. L. Donn, Lamont Geological Observatory). After subtraction of the astronomical tides, sea level at any given time may be the result of a combination of factors, including local wind and storm surges. On the average, however, sea level is apparently determined by two factors. One is the barometer effect: for every decrease of 1 millibar in pressure, sea level rises 1 centimeter. The second is the volume effect: heated water expands and sea level rises. The barometer effect is predominant at high latitudes, the volume effect south of 40°N. The combination of the two accounts for most of the observed change. It has not yet been possible to identify clearly any seasonal change in mass, such as might be caused by redistribution of the water within the oceans, or between the oceans and the land.

The three remaining papers focused on different aspects (at least different geographic aspects) of ocean circulation. G. Dietrich (University of Kiel) spoke about the 25 ships from many countries which were engaged in the Polar Front Survey of the North Atlantic. It is at Dietrich's laboratory at Kiel that the summary atlas of this work is being prepared. Even though the region north of the Gulf Stream is near many of the countries which support major work in oceanography, few data have been obtained from the region in the winter, perhaps because, as Dietrich noted, the wind is force 8 or greater 50 percent of the time at that time of year.

Dietrich was not the first speaker, or the last, to note that the IGY raised more problems than it solved. There have been three expeditions in the area subsequent to the IGY for studying the convection and renewal of the deep water off Greenland and the flow of the cold, heavy water from the Norwegian Sea over the Faroe-Shetland ridge and into the deep North Atlantic.

The Polar Front Survey and subsequent work in the area was planned systematically. The work in Antarctica reported on by V. G. Kort (Institute of Oceanology, Moscow) was generally done in conjunction with Antarctic resupply expeditions. However, these expeditions did provide many more hydrographic data. Although Kort's summary of transport and heat budget estimates for the zonal and particularly the meridional currents is controversial, there was certainly general agreement with his belief that further progress in this region requires expeditions whose primary purpose is the study of specific features of Antarctic circulation.

Until recently most of our knowledge of subsurface currents came from indirect measurements. During the IGY and since, more and more direct observations have been made, and the

results of several of these programs were discussed by J. A. Knauss (University of Rhode Island). One finding was the verification of a prediction by H. Stommel (Woods Hole) that there should be a southward-flowing western boundary current in the deep water of the North Atlantic. Such a current, flowing at speeds between 9 and 18 centimeters per second below 2000 meters, was observed off the Blake Plateau.

Of even greater interest, however, have been the more recent measurements of J. W. Swallow (England) which suggest that the deep water of the entire western North Atlantic is in a state of turbulent unrest. The role of these large-scale eddies is still unclear, but it appears possible that many of our ideas about the general circulation will have to be reexamined. Turbulent motion, on a scale greater than was expected, but still considerably less than that in the western North Atlantic, has been observed also in the eastern North Atlantic.

During the IGY and since, information on equatorial undercurrents has increased. These eastward-flowing currents with speeds of 1 to 1½ meters per second are found just below the surface along the equator and are among the largest currents in the ocean. They are also the most perplexing. The Cromwell Current has been traced for at least 10,000 kilometers across the Pacific. The Atlantic Equatorial Undercurrent appears to be analogous to the Cromwell Current. Recent attempts to find a similar current in the Indian Ocean have shown that there is a profound difference in the current structure at the equator between the two monsoon seasons. Such observations give additional credence to the idea that these undercurrents are wind-driven. During the northeast monsoon a weak undercurrent appears to develop, but during the southwest monsoon the current structure appears to be very unsteady.

John A. Knauss
Graduate School of Oceanography, University of Rhode Island, Kingston

Forthcoming Events

October

23–24. **Industrial Hygiene** Foundation, 28th annual, Pittsburgh, Pa. (R. T. P. de-Treville, 4400 Fifth Ave., Pittsburgh 13)

23–25. **Design of Experiments** (invitation only), Huntsville, Ala. (F. G. Dressel, Army Research Office, Durham, Box CM, Duke Station, Durham, N.C.)

23–25. **Human Factors** Soc., Palo Alto, Calif. (J. A. Kraft, Bioastronautics Organization, 50-03, Lockheed Missiles and Space Co., Sunnyvale, Calif.)

23–25. **Optical** Soc. of America, 48th annual, Chicago, Ill. (OSA, 1155 16th St., NW, Washington 6)

23–1. Association of **American Medical Colleges**, Chicago, Ill. (R. H. Young, 303 E. Chicago, Chicago 11)

25. **Transport Mechanisms**, symp., St. Louis, Mo. (R. Rubright, Jewish Hospital of St. Louis, 216 S. Kings Highway, St. Louis 10)

25–27. **American Heart Assoc.**, 36th annual, Los Angeles, Calif. (American Heart Assoc., 44 E. 23 St., New York 10)

27–1. American College of **Surgeons**, 49th annual, San Francisco, Calif. (ACS, 40 E. Erie St., Chicago 11, Ill.)

28. American Soc. of **Safety Engineers**, Chicago, Ill. (A. C. Blackman, ASSE, 5 N. Wabash Ave., Chicago 2)

28–29. **Combustion** Inst., western states section, Los Angeles, Calif. (A. S. Gordon, Code 5059, U.S. Naval Ordnance Test Station, China Lake, Calif.)

28–29. **Pediatric Surgery**, intern., Paris, France. (D. Pellerin, Hôpital des Enfants-Malades, 149, rue de Sèvres, Paris 15e)

28–30. **Antimicrobial Agents and Chemotherapy**, 3rd interscience conf., Washington, D.C. (E. E. Tretbar, American Soc. for Microbiology, 230 N. Michigan Ave., Chicago 1, Ill.)

28–30. **Electronics**, 19th natl. conf. and exhibition, Chicago, Ill. (NEC, 228 N. LaSalle St., Chicago 1)

28–30. National Council for **Geographic Education**, Columbus, Ohio. (L. Kennamer, Univ. of Texas, Austin)

28–31. Technical Association of the **Pulp and Paper Industry**, 18th engineering conf., New Orleans, La. (C. E. Green, B. L. Montague Co., Drawer 5428, Station B, Greenville, S.C.)

28–1. American Inst. of **Aeronautics and Astronautics**, 1st, Atlantic City, N.J. (Meetings Dept., AIAA, 500 Fifth Ave., New York 36)

28–2. **Stable Isotopes**, working conf., Leipzig, Germany. (Institut für Physikalische Stofftrennung, Deutsche Akademie der Wissenschaften, Permoserstr. 15, Leipzig 05)

29–31. **Aerospace** Nuclear Propulsion and Power, 2nd intern. symp., San Diego, Calif. (IEEE, Box A, Lenox Hill Station, New York 21)

29–1. **Plasma** Phenomena and Measurement, intern. symp., San Diego, Calif. (D. J. Niehaus, Bendix Corp., Research Laboratories Division, Southfield, Mich.)

30–1. Gulf Coast Assoc. of **Geological** Soc., 13th, Shreveport, La. (T. E. Godfrey, 201 Oil and Gas Bldg., Shreveport)

30–1. **Parenteral Drug** Assoc., annual conv., New York, N.Y. (PDA, Broad and Chestnut St., Philadelphia 7, Pa.)

31. American Federation for **Clinical Research**, midwestern section, Chicago, Ill. (D. R. Korst, St. Joseph Mercy Hospital, Ann Arbor, Mich.)

31–1. **Materials**, intern. conf., Pittsburgh, Pa. (E. R. Schatz, Dean of Research, Carnegie Inst. of Technology, Pittsburgh 13)