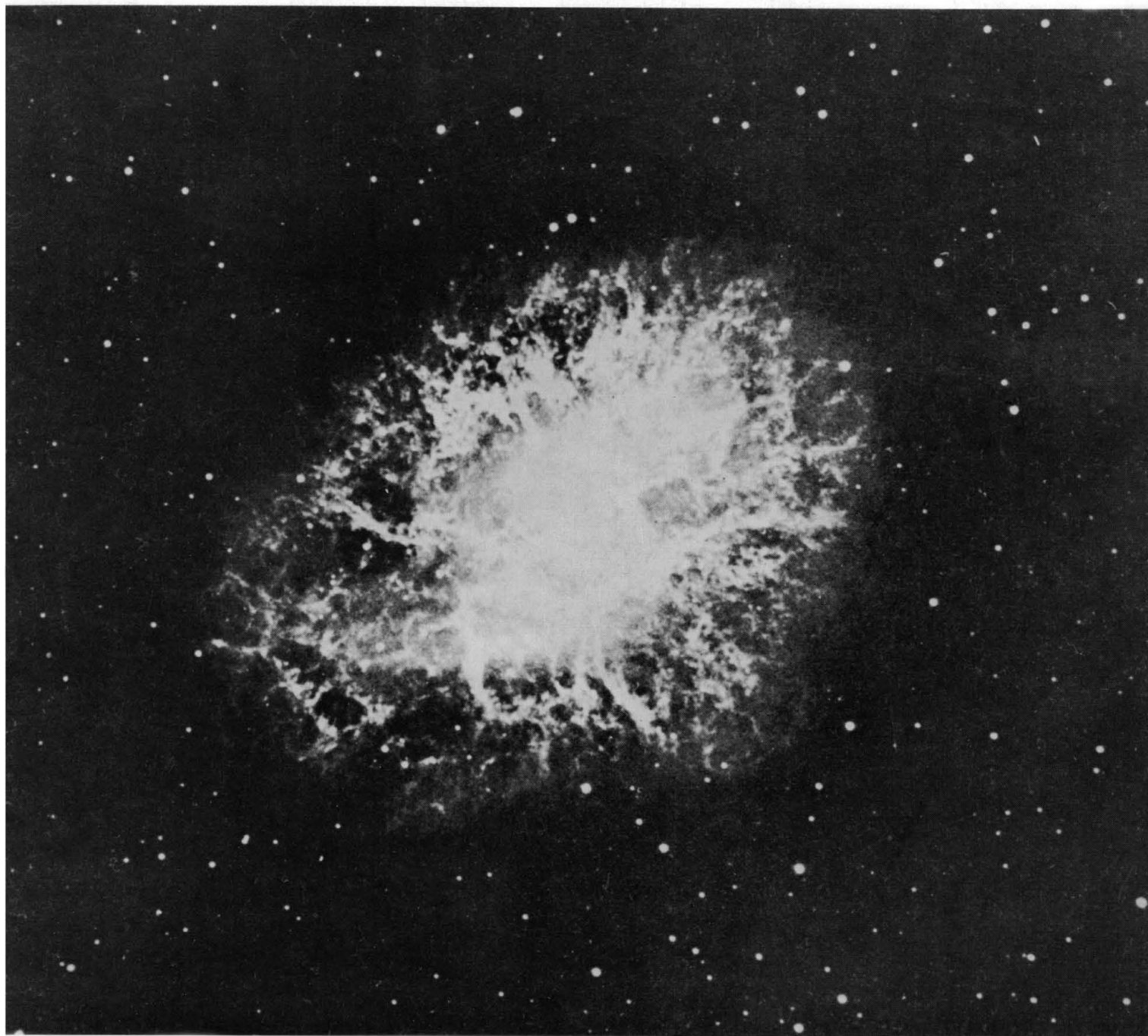


# SCIENCE

19 January 1962

Vol. 135, No. 3499

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





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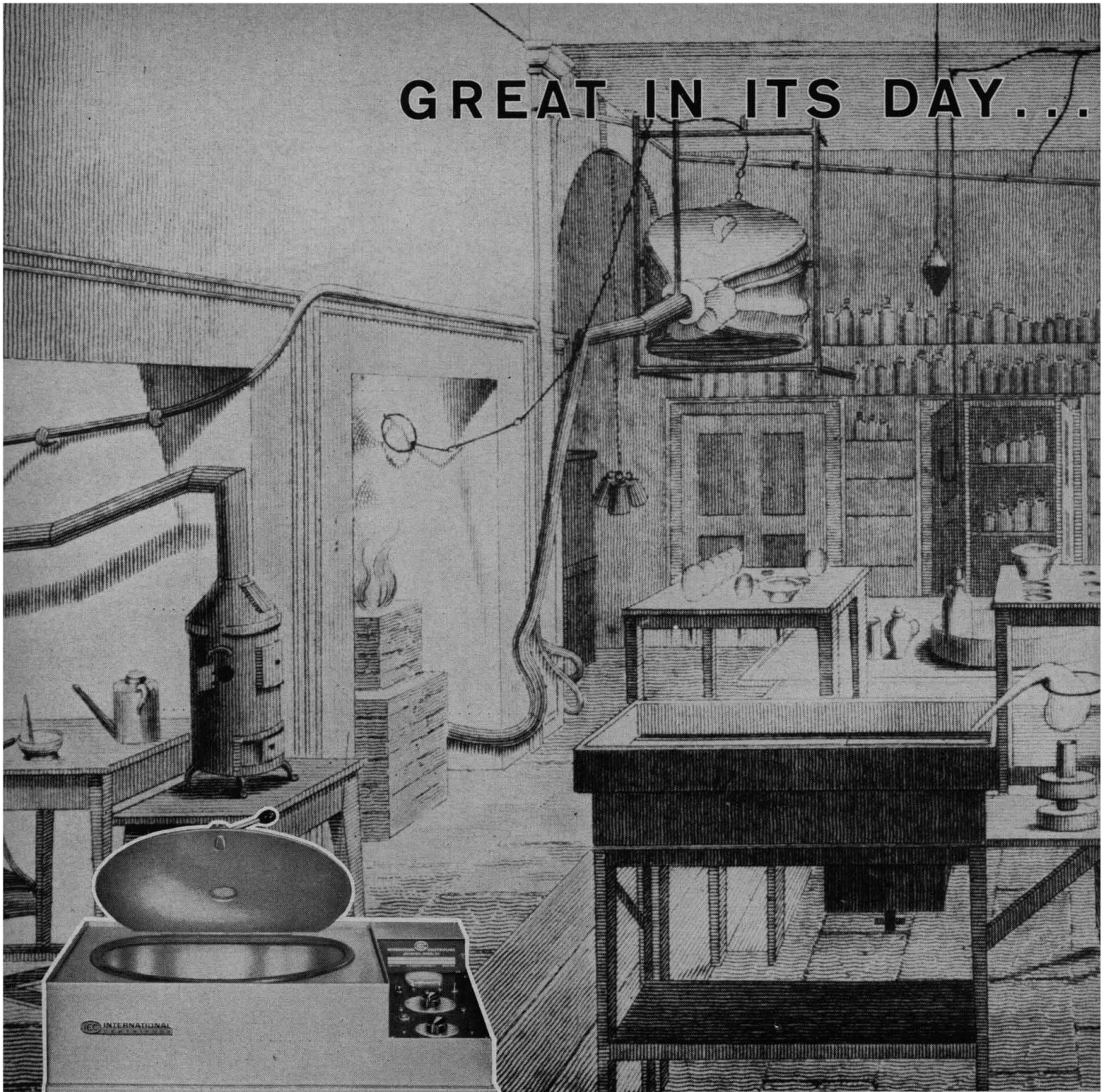




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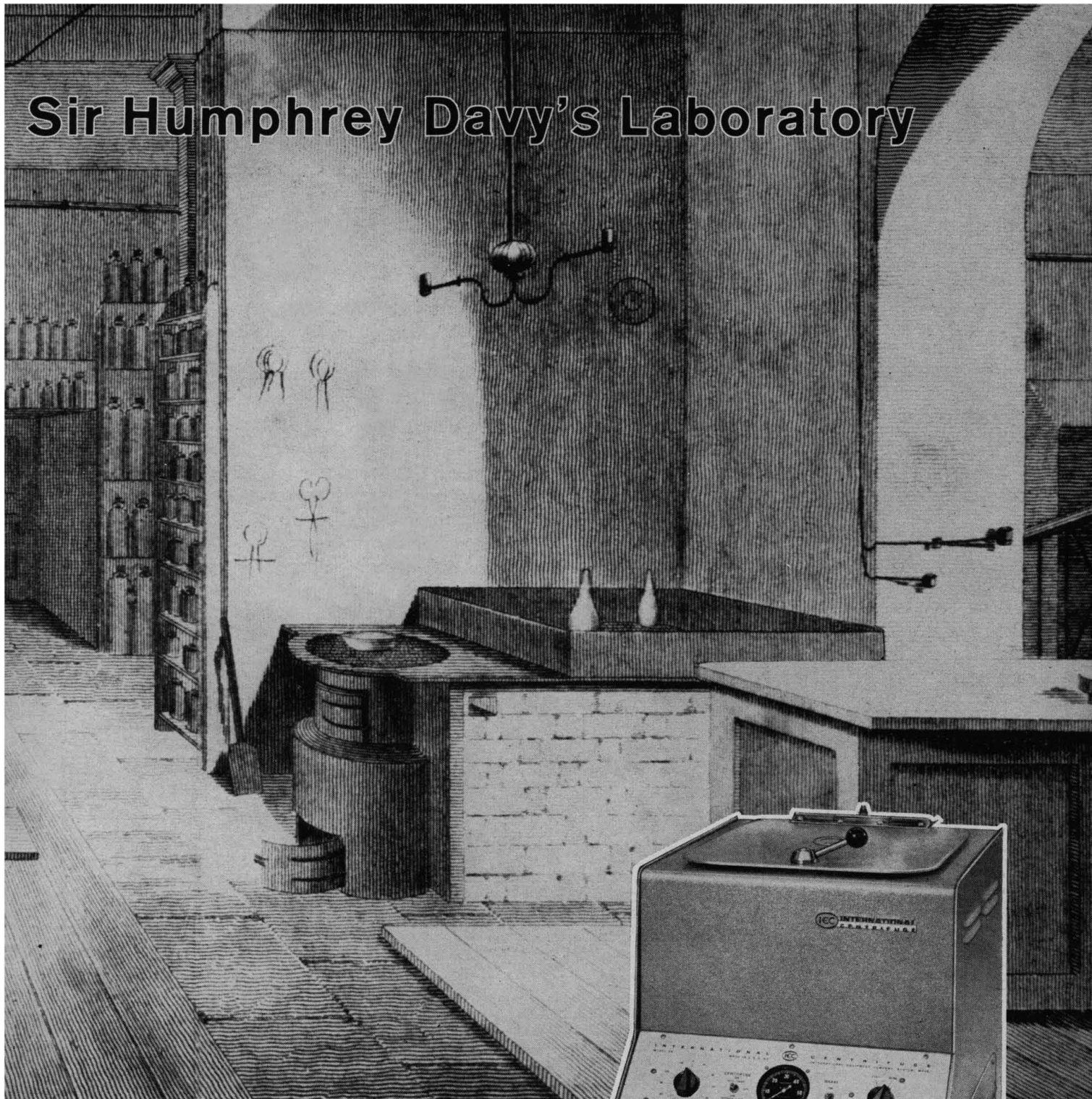
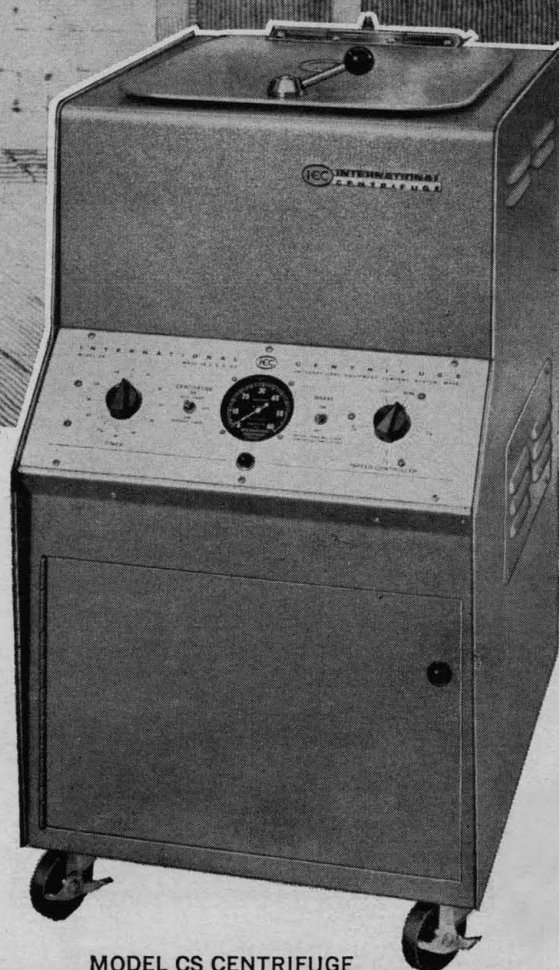


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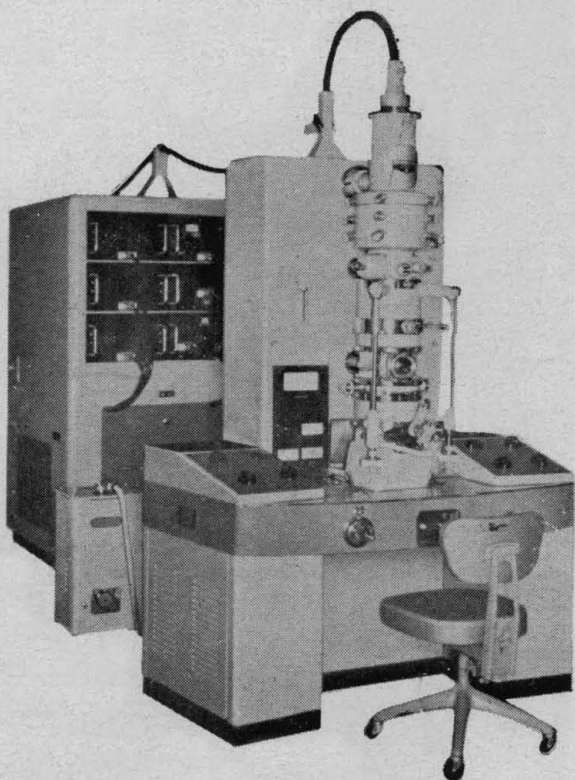


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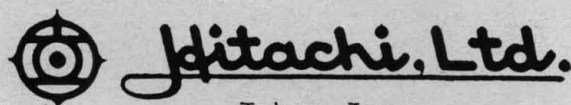
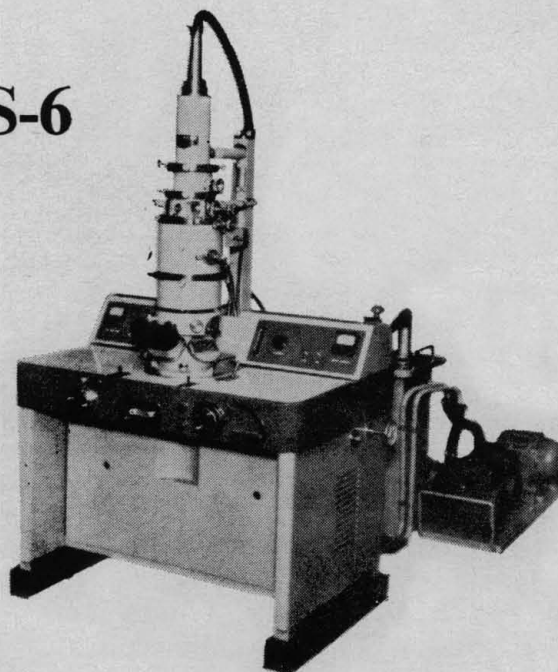
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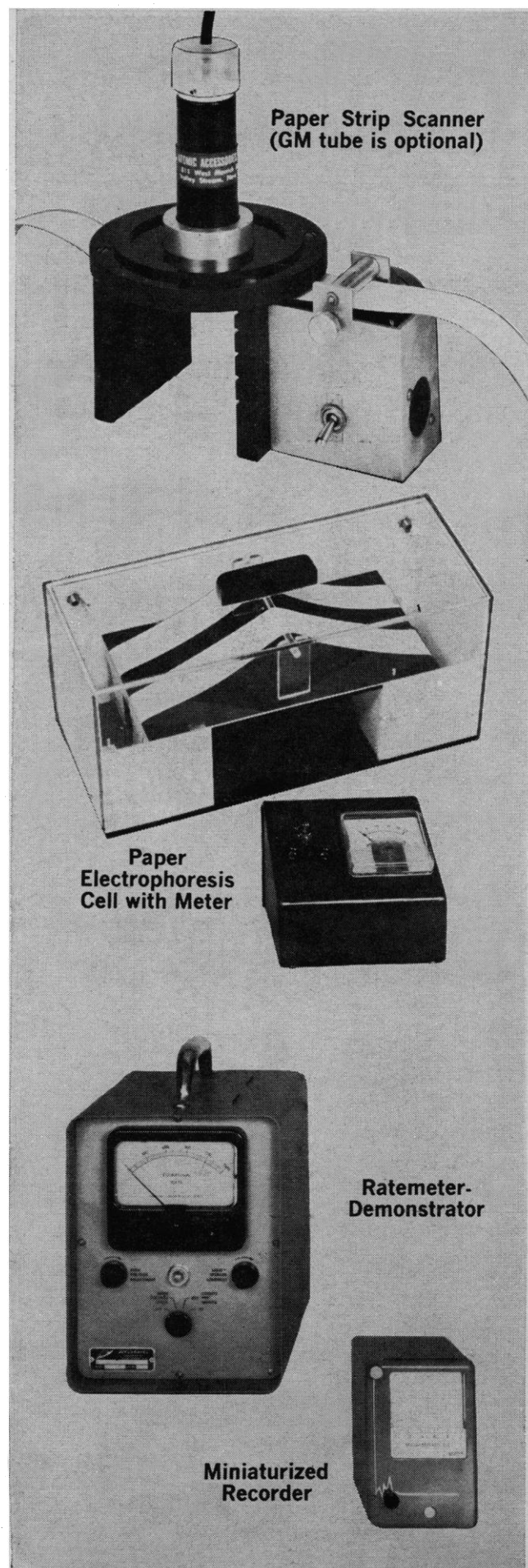
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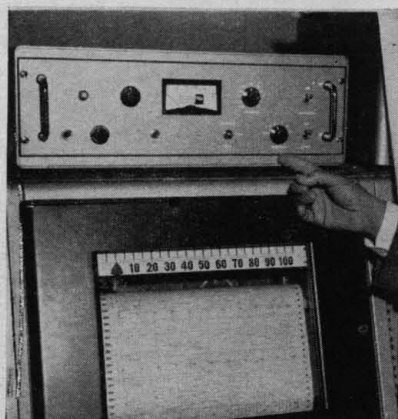
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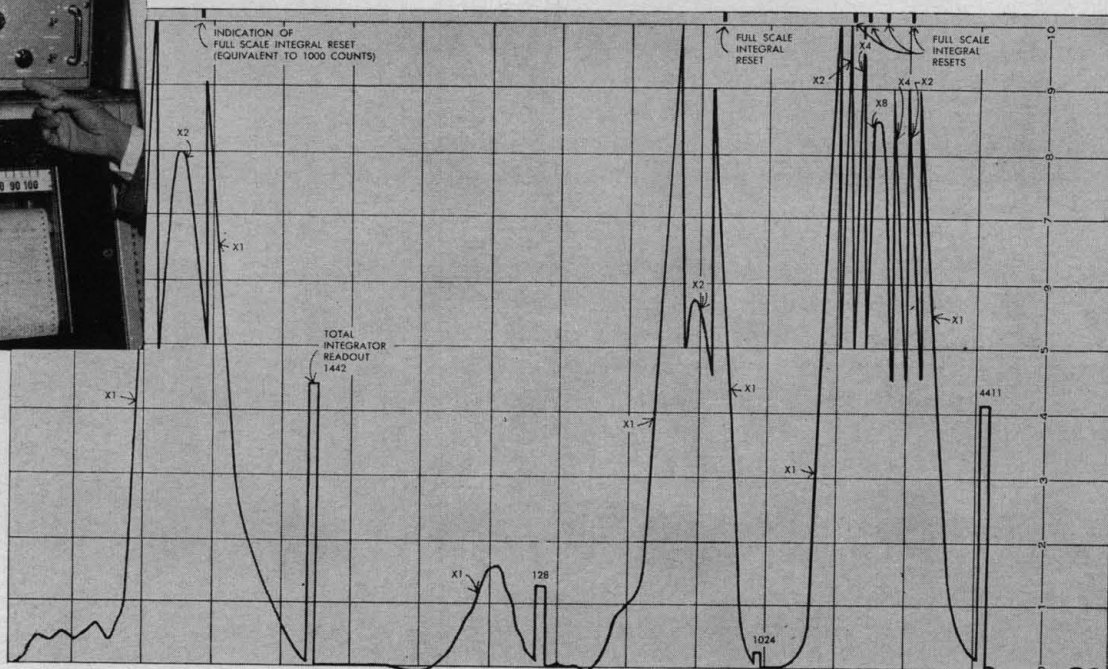
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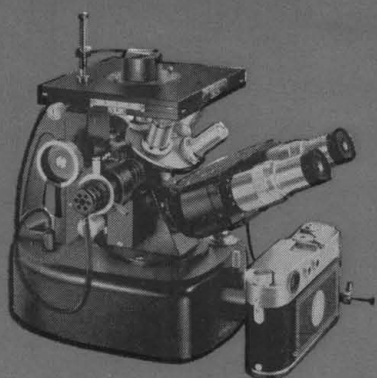
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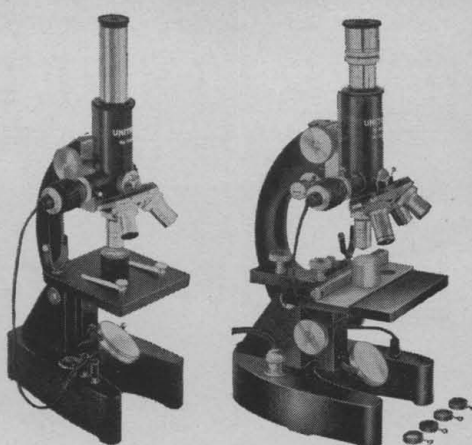
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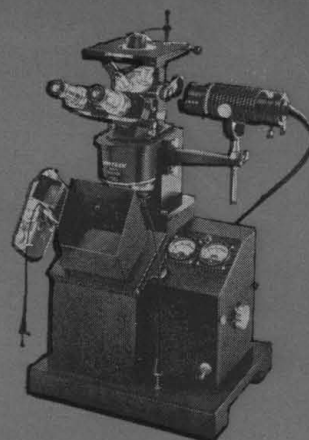
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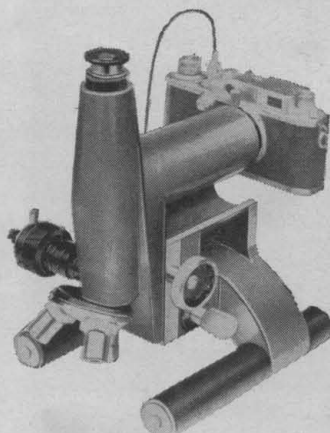
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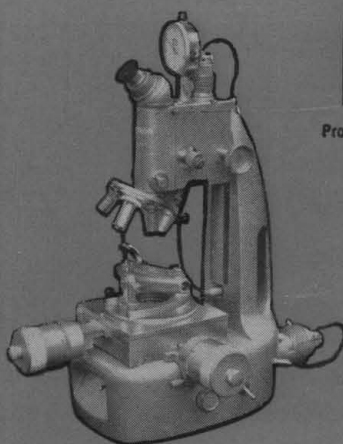
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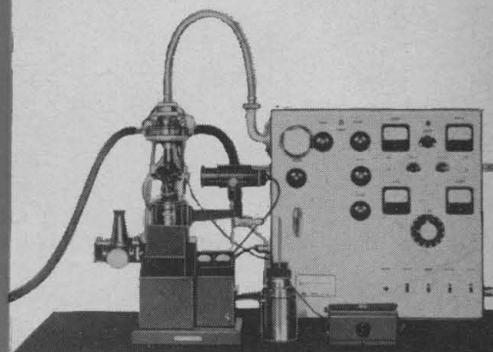
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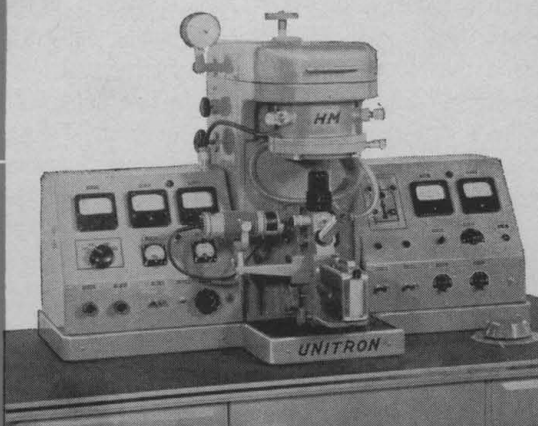


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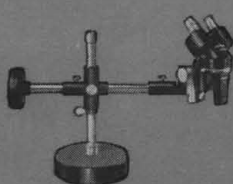
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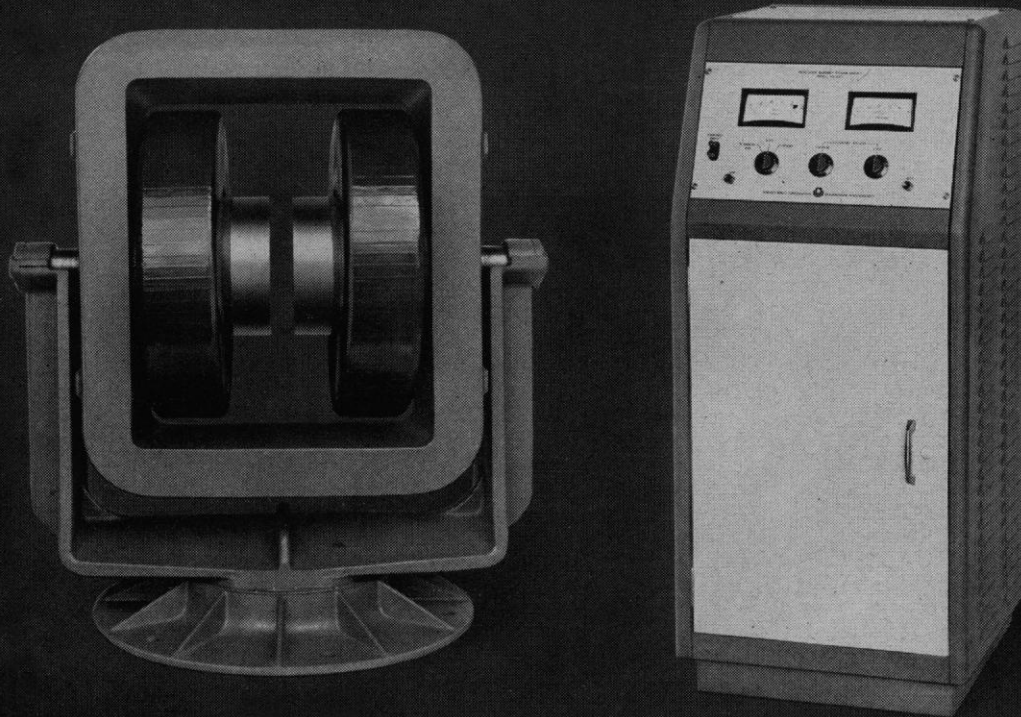
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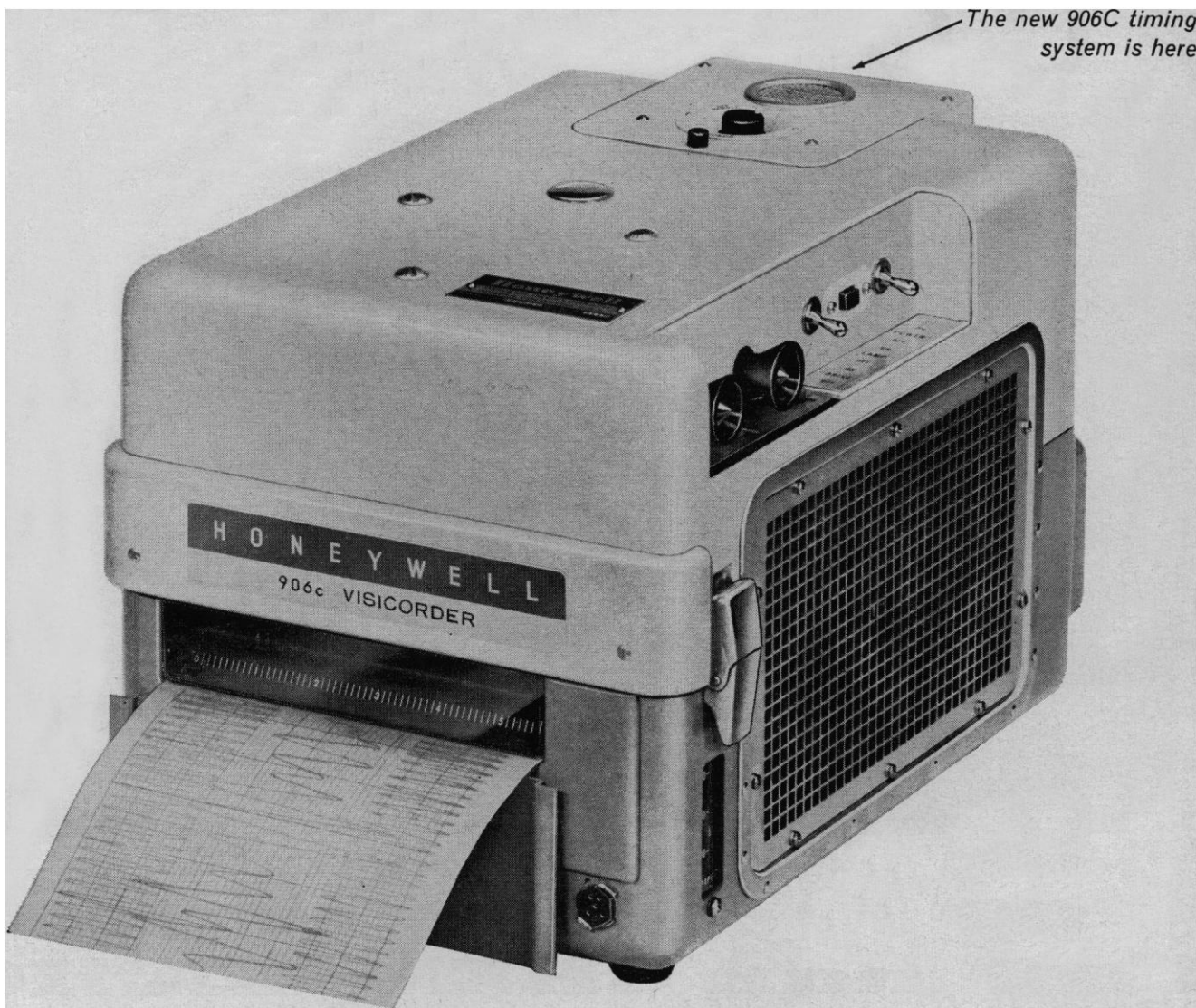
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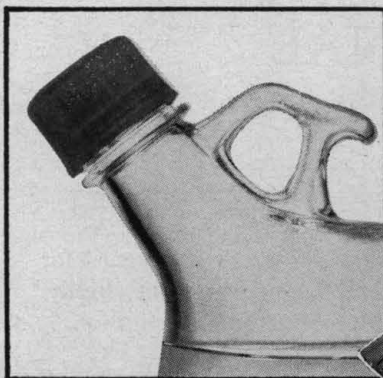
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Edited by WILLIAM C. YOUNG, Ph.D., Professor of Anatomy, University of Kansas, Lawrence. Foreword by GEORGE W. CORNER, M.D., D.Sc.

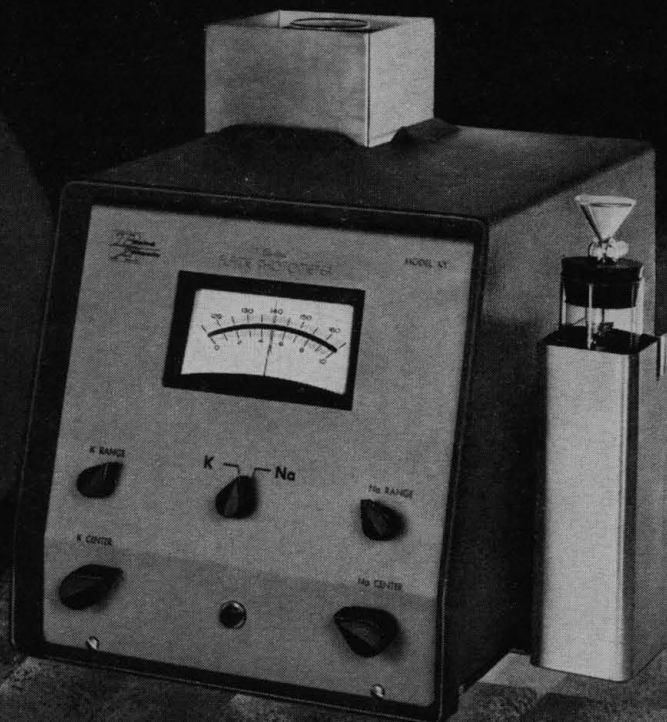
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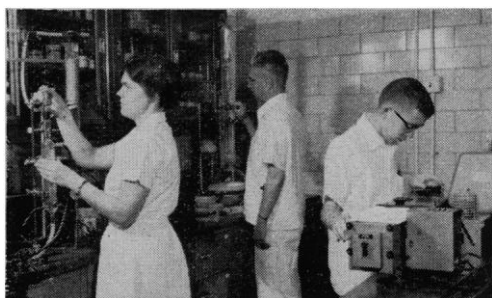
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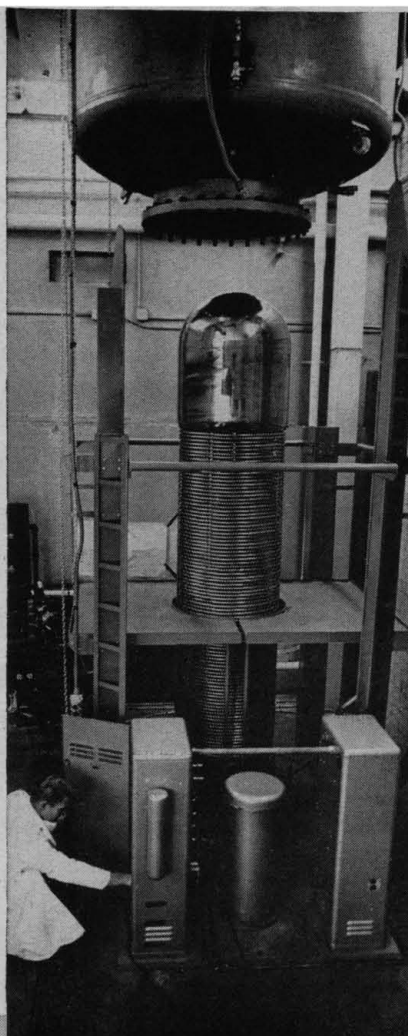
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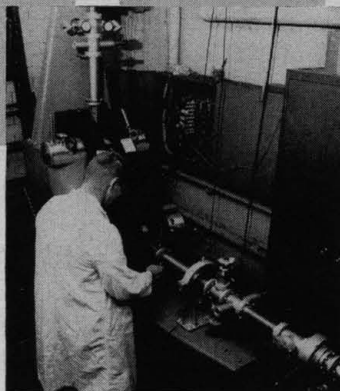
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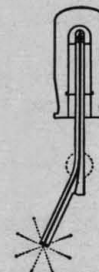
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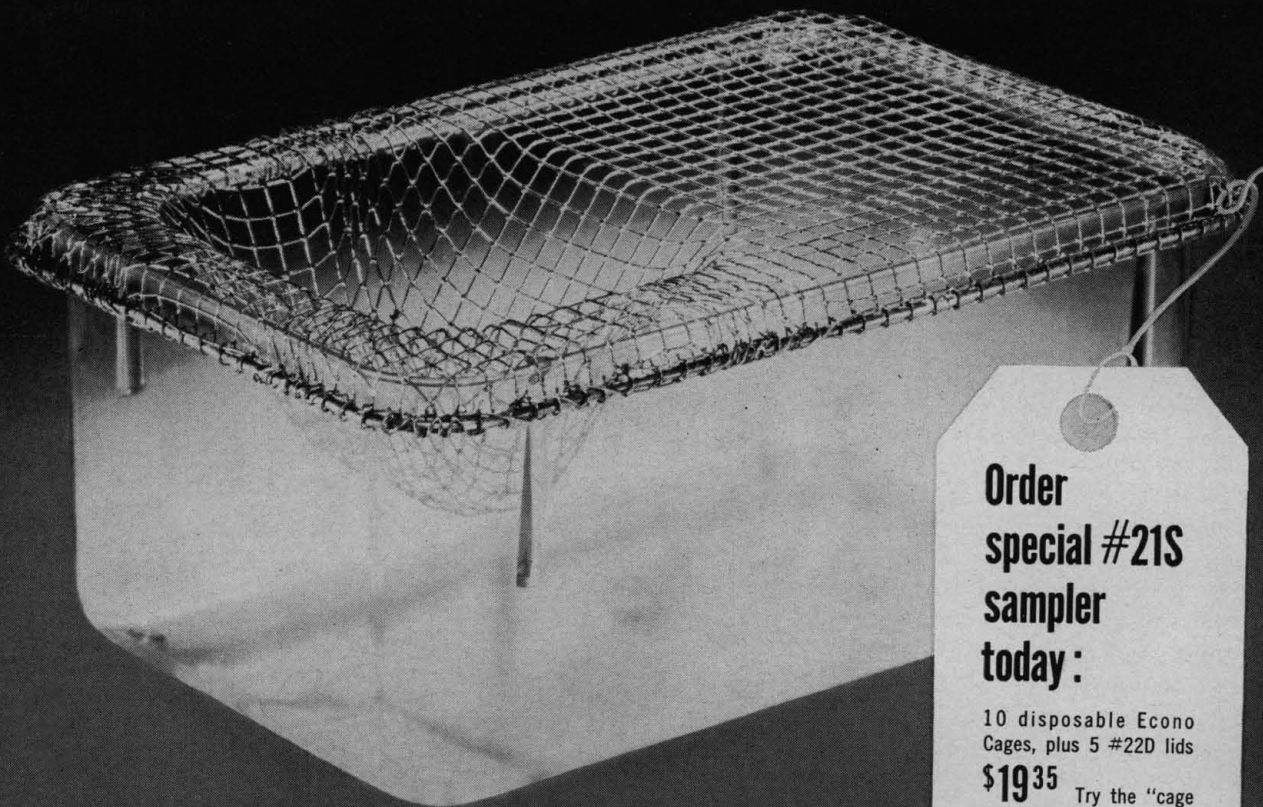
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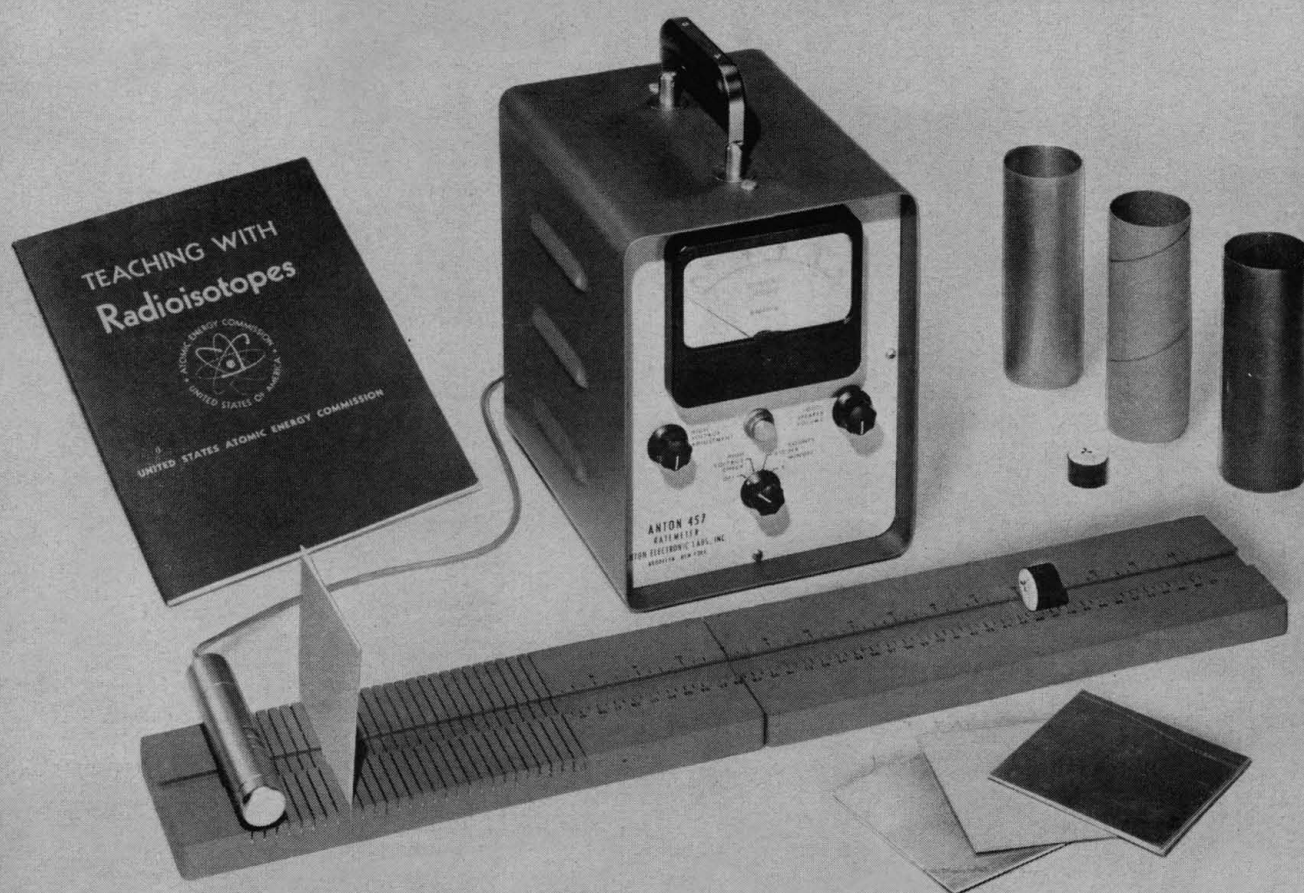
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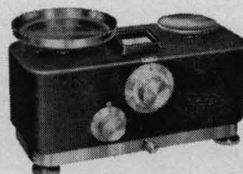
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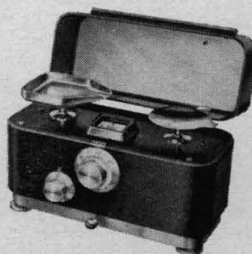
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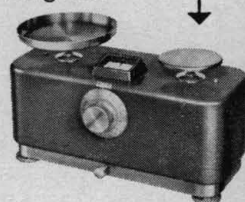


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Fine Weighing Dial:  
1 gram by  
.01 gram graduations  
(Readability: .002 g)

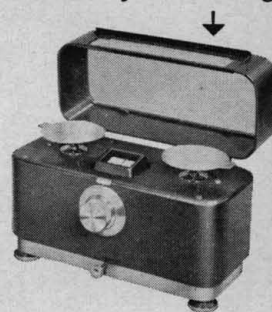


**TORSION DWL2-1**  
Specifications are same  
as the DWL-2 except that  
this model has scoop for  
seeds or other bulky  
material

**TORSION DLT5**  
Capacity: 500 grams  
Dial graduated 10 grams  
by .1 gram graduations  
Readability of Dial:  
.02 grams



**TORSION DLT2**  
Capacity: 120 grams  
Dial graduated 1 gram  
by .01 gram  
graduations  
Readability of Dial: 2 mg



**TORSION DLT2-1**  
Same specifications as  
DLT2 but has scoop for  
seeds or other bulky  
material

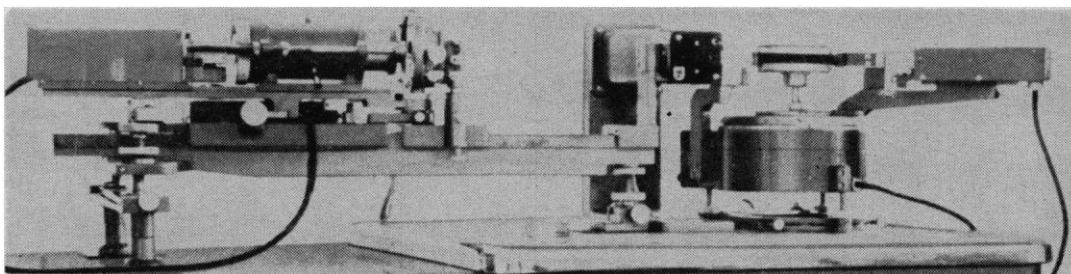


**TORSION DRx**  
Capacity: 120 grams  
Dial graduated 15 grains  
by 1/8 grain graduations  
and 1 gram by .01 gram  
graduations  
Readability of Dial:  
1/4 dial division

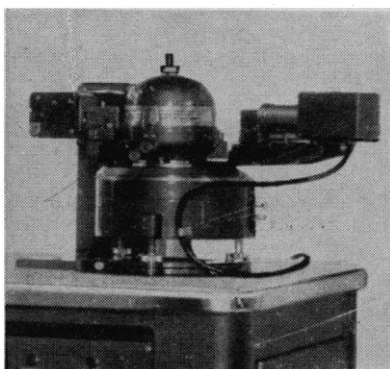




# X-Ray Diffraction Equipment by RIGAKU

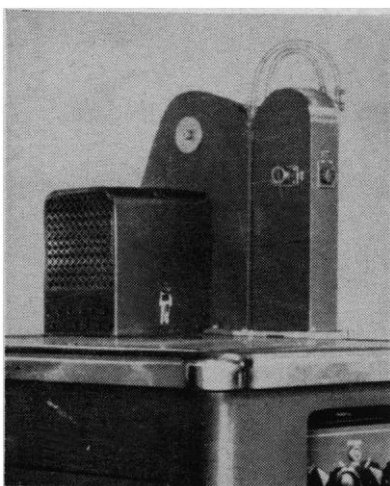
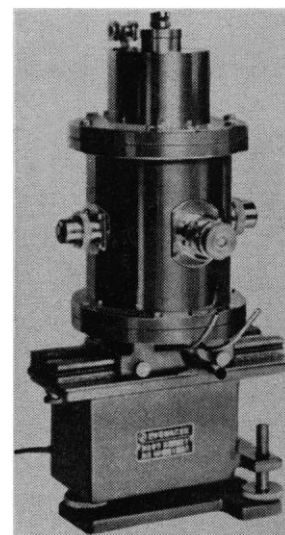


Shown above is the Rigaku Low Angle Scattering Goniometer, one of many fine instruments designed and built by Rigaku Ltd., pioneers in the x-ray diffraction equipment field since 1923. The Low Angle Scattering Goniometer has been designed for use with all standard x-ray diffraction units, to study the size, form, orientation and aggregate condition of fine individual particles of a substance. It is also used in studying the crystal periods of extra-long periodic substances, by either automatic recording or photographic techniques. It is useful in the study of organic and inorganic colloids, protein molecules, fiber micelles, resins, catalysts, clays, metals, etc.



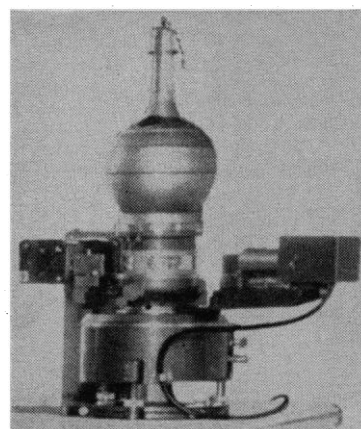
**LEFT** The Rigaku High Temperature Specimen Holder is used for investigations, at high temperatures, of solubility changes as well as structural changes in the test sample. This precision instrument maintains a temperature gradient of plus or minus 5% at temperatures up to 1500°C, in vacuum or with atmospheres such as air or inert gas.

**RIGHT** The Rigaku Continuous High Temperature Camera has been designed to make a continuous record of x-ray diffraction patterns of crystal specimens, in series, on film. The camera has a unique ability to capture ever-changing x-ray diffraction patterns, and features a high vacuum system, high maximum temperature and simplified operation.



**LEFT** The Rigaku Rota Unit provides the high power required for rapid analyses. Current of 100 mA at 50 KV are available from various target materials. The water cooled rotating anode is positively sealed to preclude water leaking into the vacuum. This highly reliable research tool can be used with solids, liquids or gases.

**RIGHT** The Rigaku Low Temperature Specimen Holder is used to investigate, at low temperatures, solubility and crystal structure changes in the specimen under survey. The temperature of the specimen is lowered to -190°C, using liquid nitrogen as the refrigerant. The investigation can be made with the specimen in an atmosphere of air, inert gas, or a vacuum.



**BELOW** The Rigaku Microflex is a Microfocus X-ray Diffraction Unit, designed to provide a research tool for the analysis of minute areas of a crystal, as well as the crystal structure of micro substances in the specimen, etc. The versatile Microflex can be used as either a projection or reflection type instrument, depending on the specimen being analyzed.

*Call or write for more information at the most convenient of the three addresses shown below.*

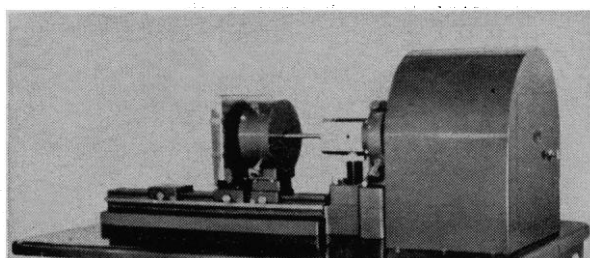
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Volume 1, September 1961, 506 pp., \$16.00

**Automatic Process Control**  
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**Reactor Control**

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*By* SIDNEY UDENFRIEND, *National Institutes of Health, Bethesda, Maryland*

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Besides providing a working knowledge of fluorescence theory and practice, this work is intended to convey the wide range of potential applications of this method to structural studies on proteins and other macromolecules, to research into enzyme-coenzyme-substrate interaction, to immunochemistry, to studies on endocrine secretions, and to many other areas of research and testing. 'Biology' is used in a broad sense and includes applications in public health and sanitation, food inspection (including quality control), toxicology, detection of insecticide residues, and other specialized fields.

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The material included in the first edition has been modified extensively in order to incorporate recent improvements and advances in techniques. In addition, considerable material has been added, including discussions of test samples, blank tests, description of a second type of efficient vibration-absorbing balance table, enlargement of the section on microchemical balances, new Kjeldahl procedures to determine nitrogen in compounds in which nitrogen is connected to nitrogen or to oxygen, oxygen flask combustions, determination of fluorine, and microhydrogenation. All of the methods included have been stringently evaluated for reliability in the hands of many different chemists.

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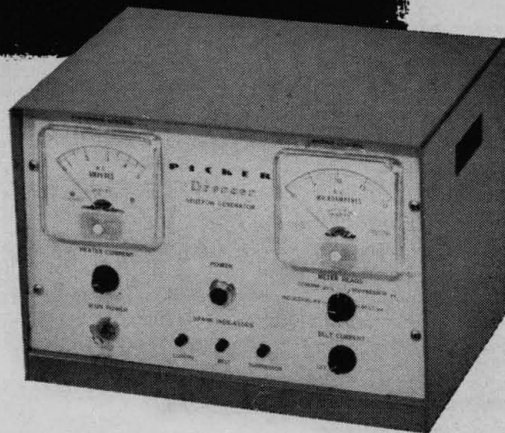
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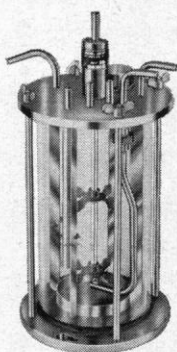
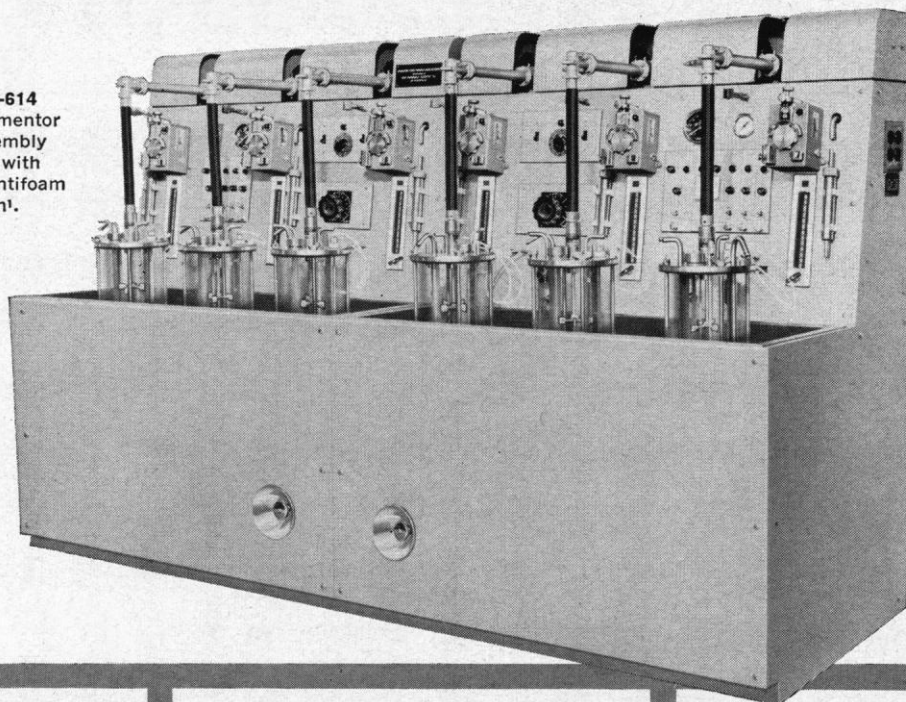


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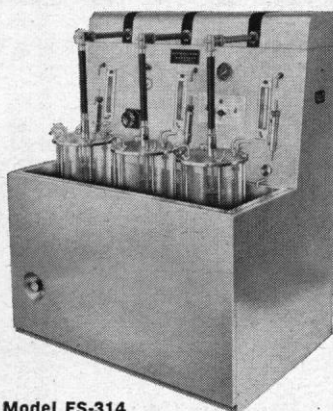




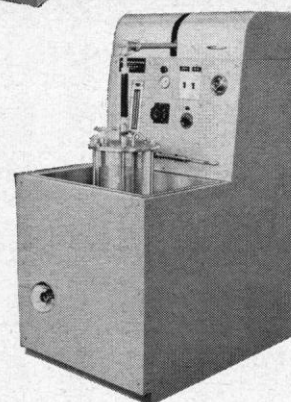
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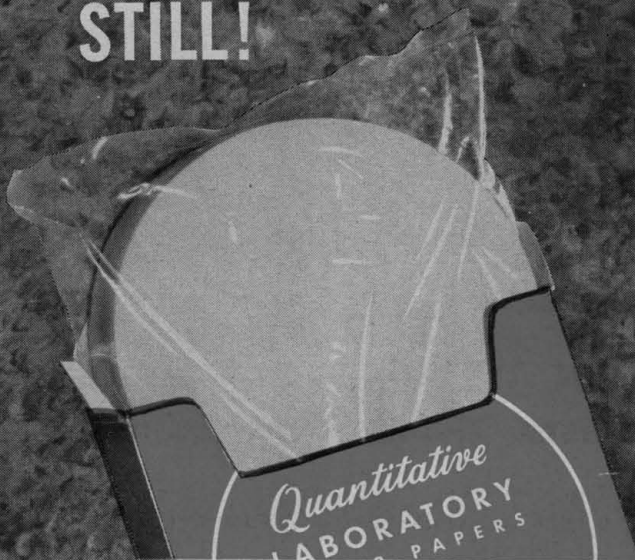


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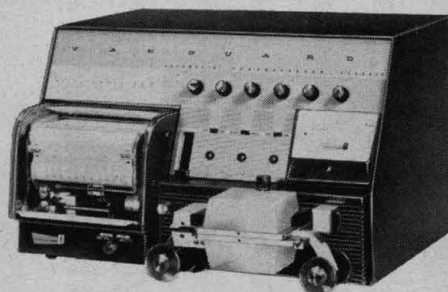
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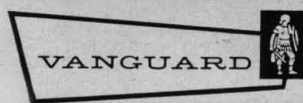
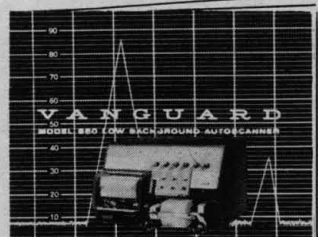
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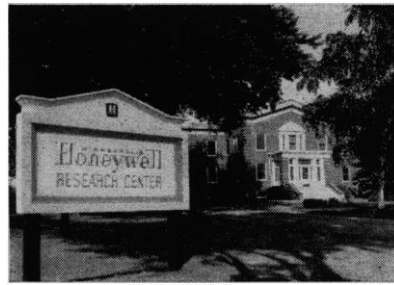
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# Microplasticity: The Behavior of Materials Under Microstresses

**Minute deformations, caused by only small stresses and involving the movement of only a few dislocations, are not accounted for in existing stress—strain tables. Recently such deformations have assumed vital importance and new data are sorely needed.**

The bridge-building engineer refers to his well-thumbed tables of yield points based on 45 years of compilation by the Bureau of Standards and other agencies, allows a safety factor, and rests assured his bridge will stand and perform well for many years. These yield stresses correspond to a deformation of about .002 inch per inch.

But the space age engineer, concerned with micro-inches of tolerance, finds these tables almost useless. A deformation of one micro-inch (.000001 in.) per inch can be significant. Data are needed for deformations of this small order of magnitude. For example, the yield point of beryllium is listed as 35,000 psi, a yield involving millions of dislocations. Actually micro-stress yields occur at 2200 psi.

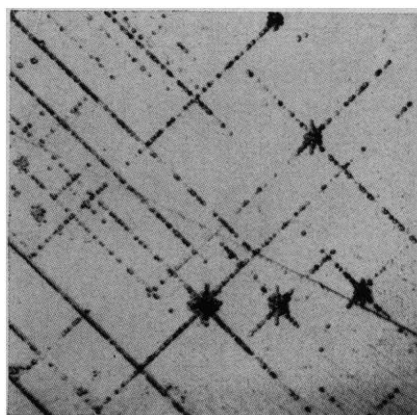
Reversible elastic deformation involves only a stretching of inter-atomic bonds. Permanent plastic deformation results when these bonds are broken, due to the movement of dislocations, and new bonds form. A one micro-inch "step" results from the emergence of only 100 atomic dislocations. Today's design engineers are concerned with just such a minute deformation.

The regular arrangement of atoms in a crystal is disturbed by defects. Dislocations are one type of defect. These exist naturally in crystals and normally migrate when stress is applied. They glide along crystallographic planes causing the crystal to shear.

Stress levels which may be tolerated determine the material chosen for a par-

ticular application. Normally, in working with metals the movement of minute dislocations is restricted by conventional alloying and heat treating techniques. This, however, raises a serious problem for the design engineer working to close tolerances in that metals so treated are no longer thermodynamically stable. This introduces potential dimensional instability.

With this as a background, Honeywell scientists are exploring the use of unconventional materials in which dislocation movement is fundamentally difficult due to the character of their atomic bonding. For example, pure alumina has proven excellent in its ability to resist dislocation and to retain dimensional stability. Honeywell engineers working with this material successfully in advanced gyros



*150X Photomicrograph of surface of etched magnesium oxide showing the movements of dislocations on crystal planes.*

have found that dislocation movement cannot be measured prior to fracture. At the same time it remained dimensionally stable up to 500°C.

Honeywell research scientists are engaged in a broad program in this field and are using a number of investigative techniques. Photomicrography of etched materials is proving to be an ideal approach. Etched pits of dislocation can be clearly seen and have been measured. Samples have been subjected to further stress and the motion of dislocations noted or measured by this technique.

For some polycrystalline materials such as aluminum and beryllium, no satisfactory, delicate etch is known. Therefore strain gages are used to measure deformation in these materials.

Obviously a better understanding of the micromechanical behavior of materials is needed. Where choice of materials is critical, it is essential to be able to predict performance and to have some criteria which ultimately result in improving materials.

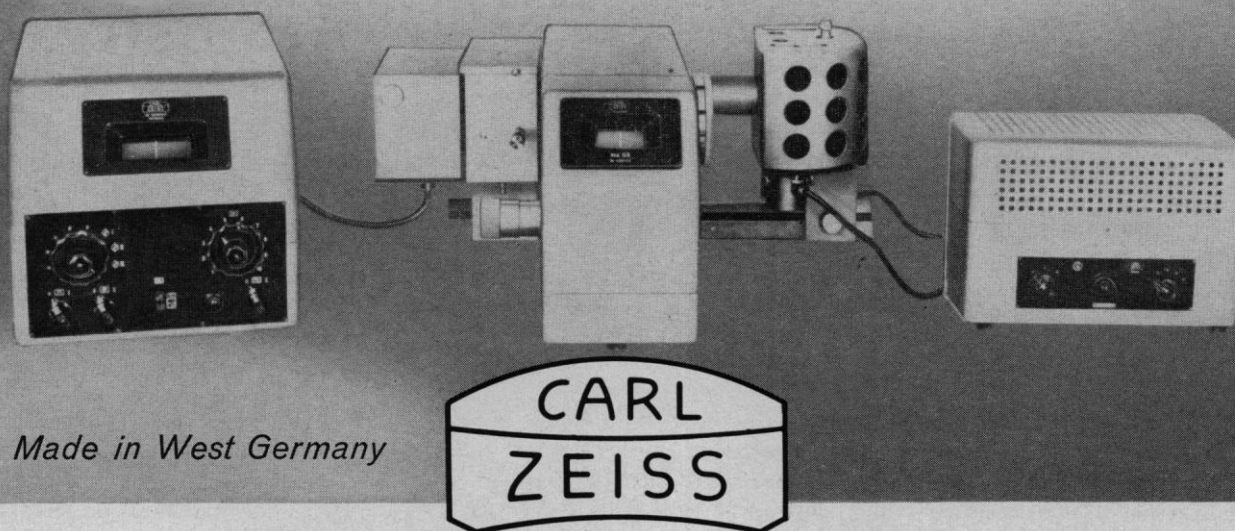
It is hoped that present work in this area of microplasticity will open new possibilities for the functional use of materials presently considered unconventional and, at the same time enable us to meet new, more precise design requirements.

If you are engaged in scientific work involving microplasticity or are interested in techniques involved in improving the physical properties of materials and would like to know more about Honeywell's research in this area, you are invited to correspond with: Dr. C. H. Li, Honeywell Research Center, Hopkins, Minnesota.

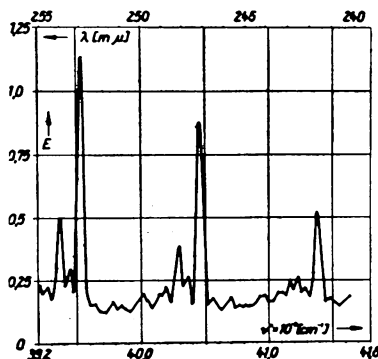
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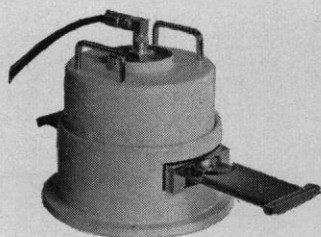
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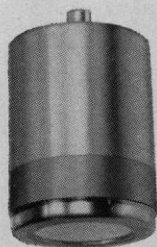
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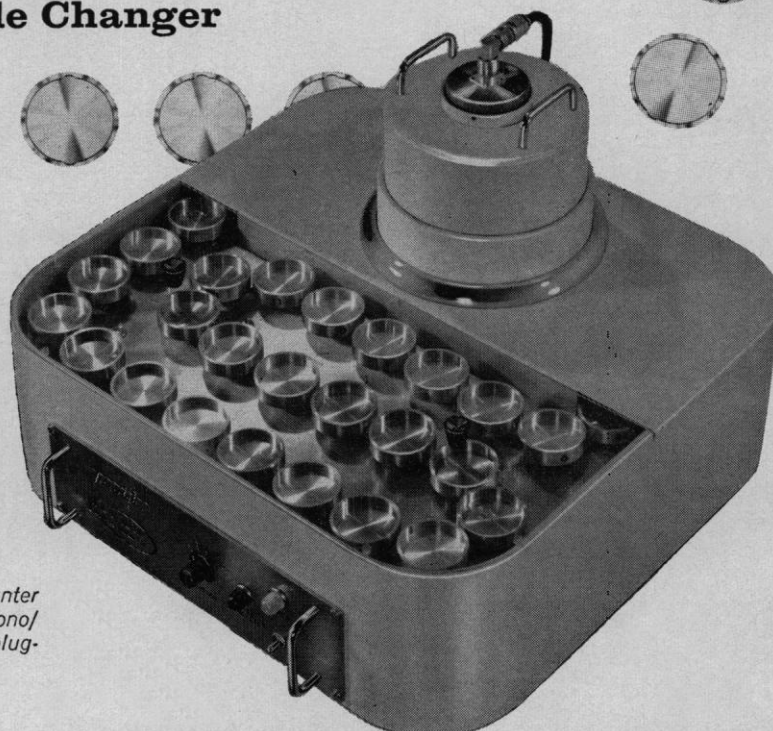
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**The Tracerlab MULTI/MATIC Sample Counting System** when combined with other Tracer/matic components . . . scalars, time and count printers, or time, count and CPM printers . . . provides more specific sample information than any other system.

For complete specifications on the new low cost, economical-to-operate Tracerlab MULTI/MATIC Sample Changer write for Bulletin M.

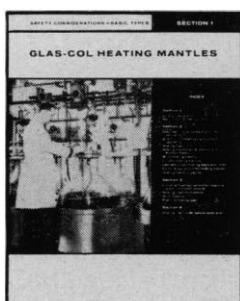
*Tracerlab* 

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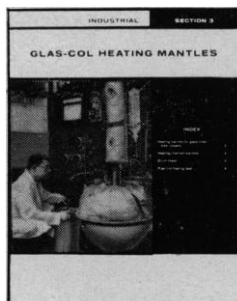
Just published by Glas-Col

# Complete new guide to electric heating mantles

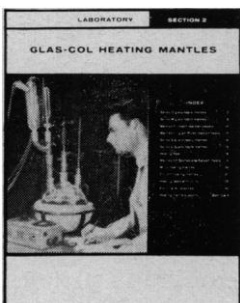
Written for laboratory directors, plant managers,  
design engineers, safety directors...*in 4 separate sections*



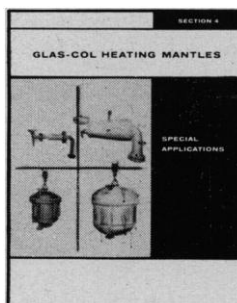
**Section 1** Basic types of heating mantles . . . safety considerations . . . how *not* to use heating mantles.



**Section 3** Industrial-scale mantles for glass-lined steel vessels . . . heating chamber blankets . . . drum heaters . . . pipe line heating tapes.



**Section 2** Laboratory mantles made of glass fabrics for safe operation to 450°C and quartz fabrics (650°C) for flasks, beakers, funnels, vacuum vessels, evaporating dishes, bottles and jars . . . heating tops . . . mantles for columns and for Soxhlet, Kjeldahl and micro flasks . . . heating tapes and cords . . . electrical controls . . . mantle supports.



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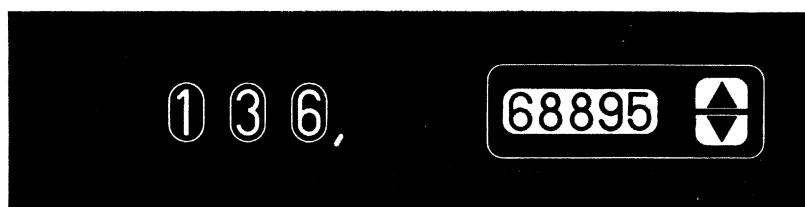
Trademark Reg. U.S. Pat. Office. U.S. Patents 2,231,506; 2,282,078; 2,739,220; 2,739,221





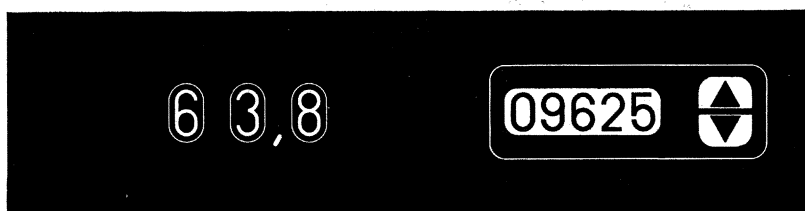
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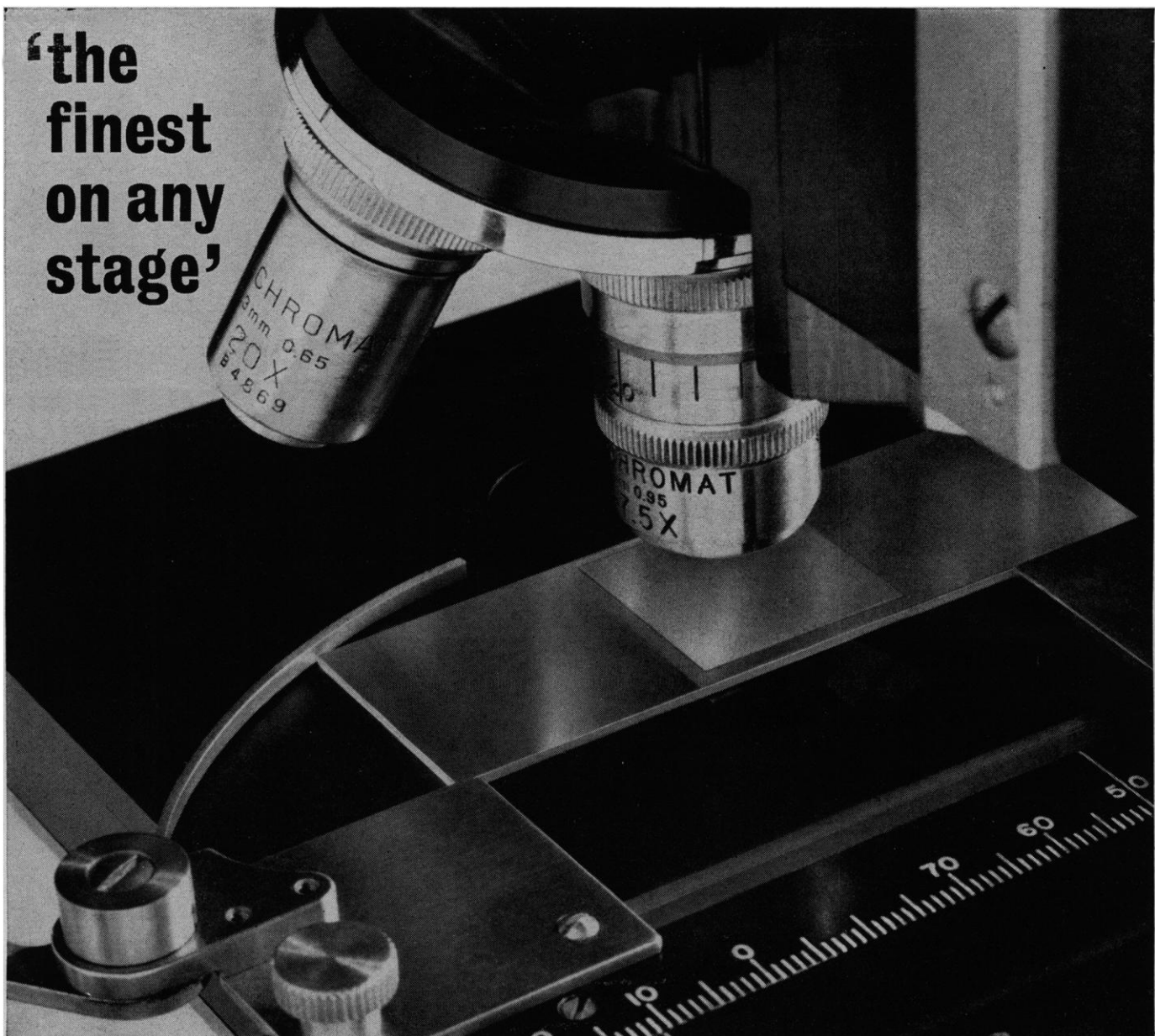
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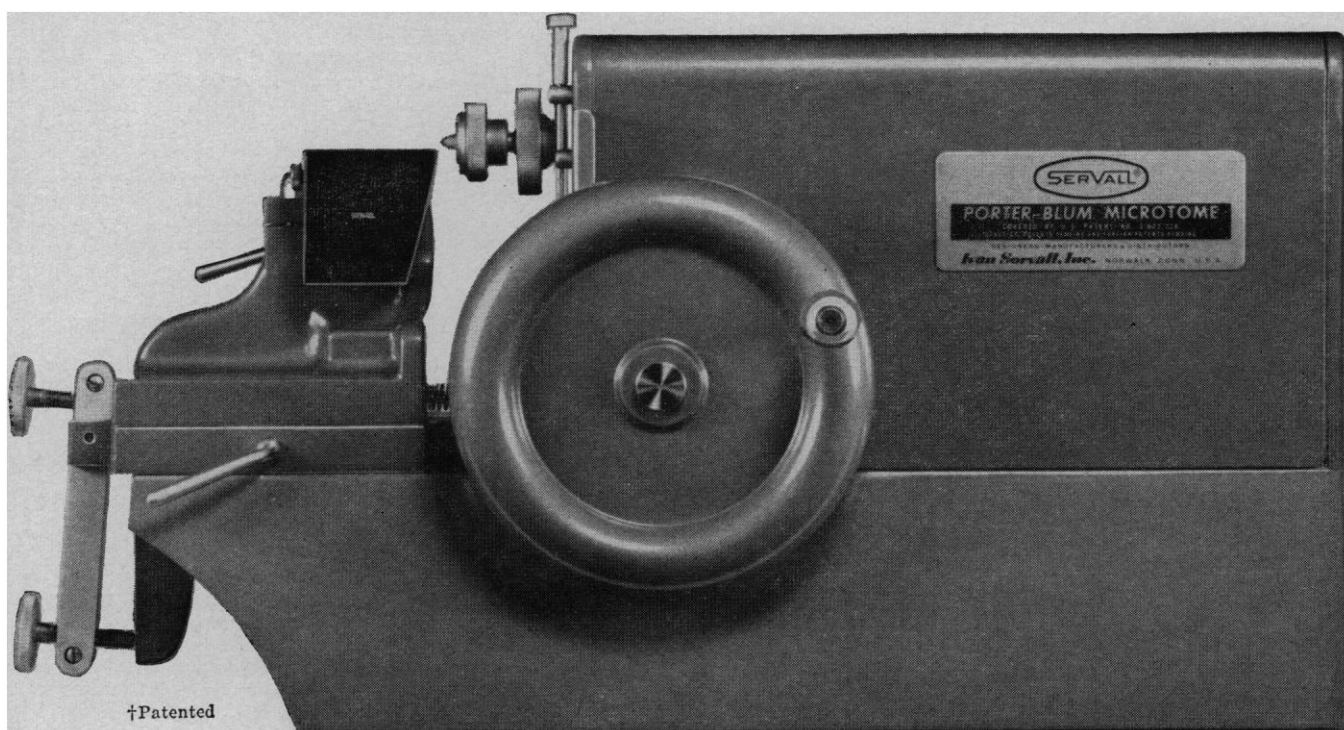
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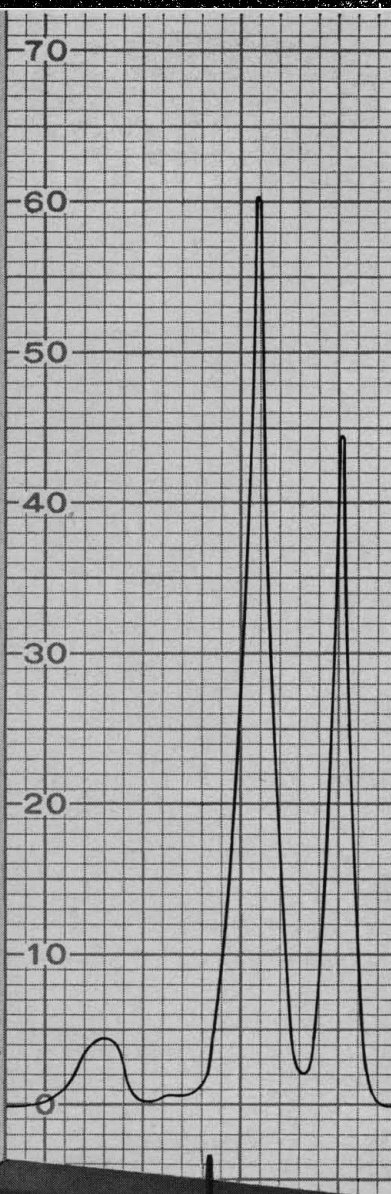
*Please ask for Bulletin SC-1-MT*

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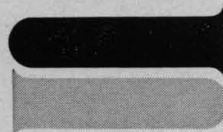
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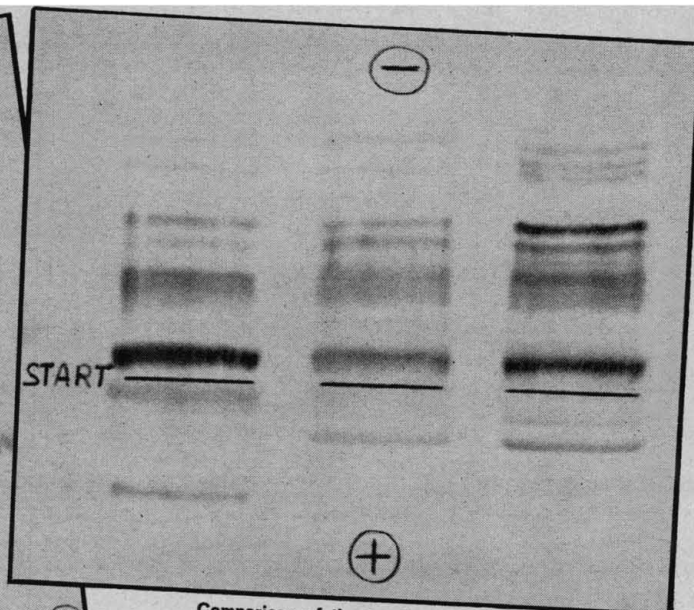
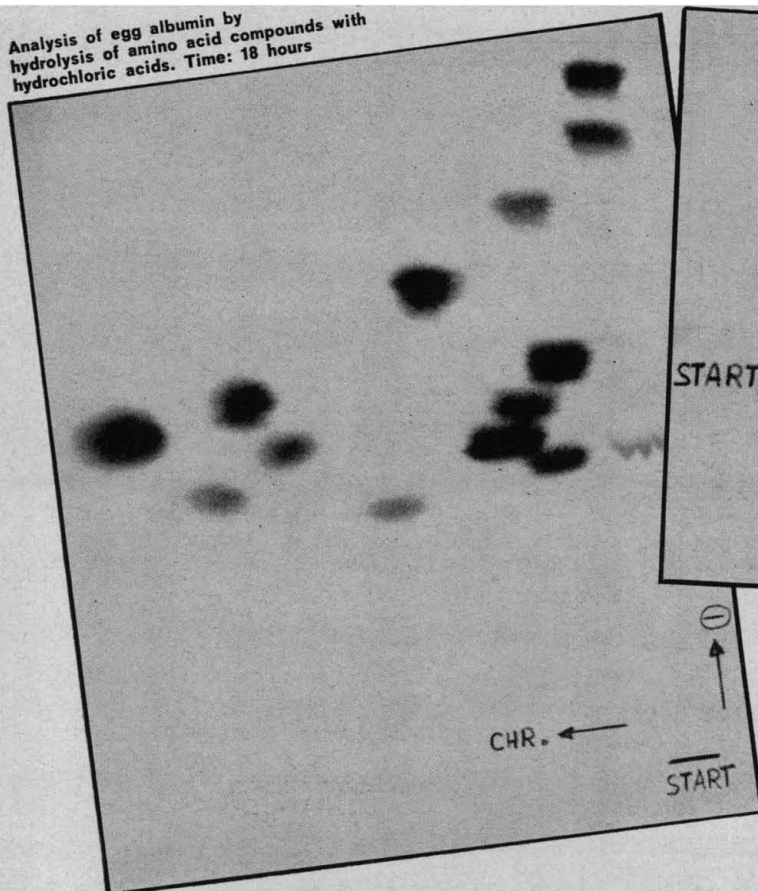
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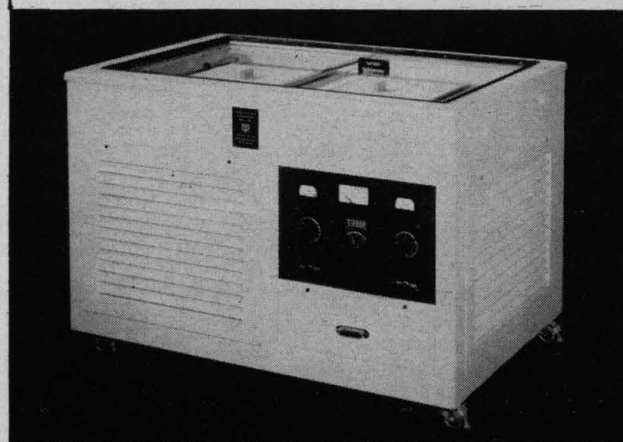
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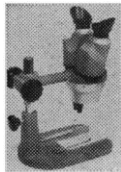
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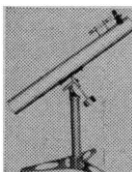
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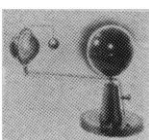


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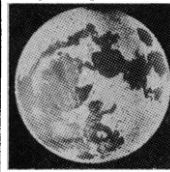
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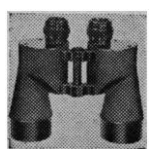


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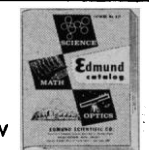
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## Tough Argument on a Tender Question

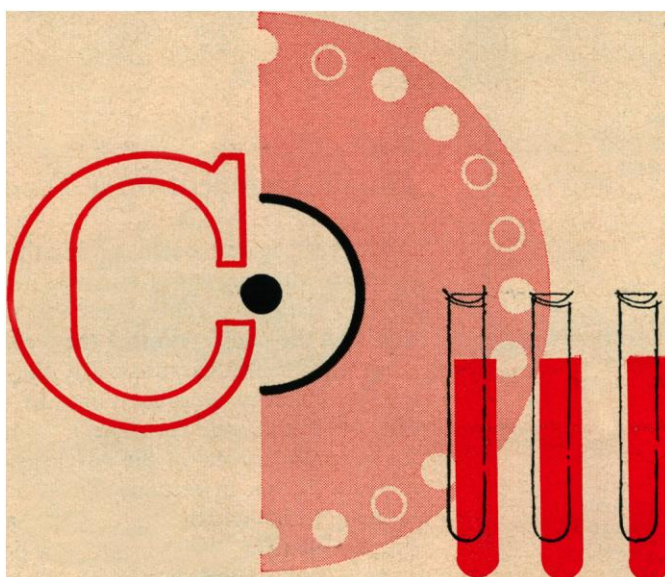
The case against our matching the Soviet atmospheric tests of nuclear weapons with a series of our own includes a respect for the good opinion of other nations, a concern for the hazards created by the resulting radiation, and the conviction that the way to stop the arms race is to stop. To these arguments, paradoxically, may be added an argument from immediate military considerations. In a recent talk at Cornell University, Hans A. Bethe, who for some years has been advising the government on the scientific aspects of the development and control of nuclear weapons, reminds us that in certain cases a Soviet advance in weaponry, although working to Soviet advantage, might also work to our advantage. He then suggests that the Soviet tests might be just such a case.

As is well known, American strategy aims, by developing a comparatively invulnerable retaliatory force, to reduce the premium that the Soviets might place on a surprise attack. Minuteman missiles launched from hardened bases and Polaris missiles launched from submarines are part of this effort. There is a premium on surprise attack when the attacker can hope to destroy the nuclear forces of his opponent before those forces can be used. Our possession of an invulnerable retaliatory force reduces this premium. Such possession also reduces the likelihood of war in another, less obvious way. It makes us, the possessors, less nervous. We need not launch an attack in response, as Bethe says, "to mere indications on a radar screen," for fear that our retaliatory forces will be destroyed if the attack proves real.

The contention, as explained by Bethe, that at least part of the Soviet tests might also operate to American advantage is based on an analysis of the atmospheric debris and other effects of the tests. The analysis shows that some of the series was devoted to testing weapons that, among other possible uses, could be used in building an invulnerable retaliatory force. Soviet possession of such a force could reduce further the likelihood of war by subjecting Soviet actions to the same stabilizing influence that such possession subjects our actions.

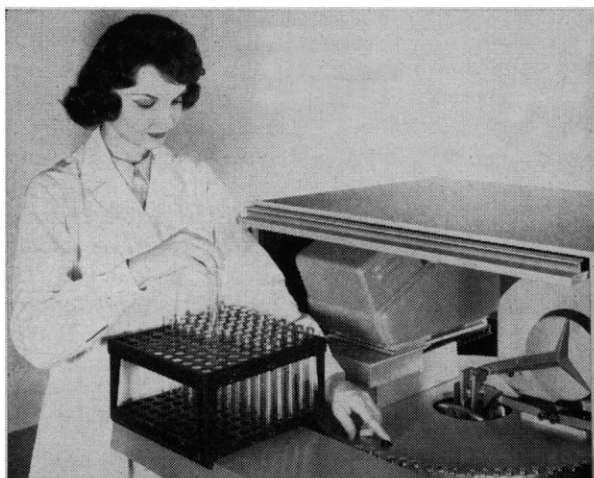
There is a caveat in Bethe's account of this argument in that he notes that it applies only to some of the Soviet gains. Other gains, he implies, might have to be matched by a restricted series of tests on our part. But if the main argument does play a role in a decision by President Kennedy not to resume atmospheric testing, it will be an important application of that new thinking about armaments which finds that security does not always require us to stay ahead of a potential enemy. As explained by Thomas C. Schelling in his article in *Arms Control, Disarmament, and National Security* (Braziller), an important aspect of security is stability; stability, in turn, may be promoted at times by an increase rather than a decrease in arms; and there may be a tacit agreement on both sides to work for such stability.

Both Bethe in his discussion of the immediate problem and Schelling in his general discussion are quick to point out that we do not know whether the Soviets are interested in promoting stability in this area. In world affairs in general, to add the obvious, it is instability that works to Soviet advantage, and the Soviets may not be so impressed by the dangers of nuclear war that they will purposely give up even a portion of that advantage. Nevertheless, if they develop an invulnerable retaliatory force, stability may be promoted, whatever the motivation behind the development.—J.T.



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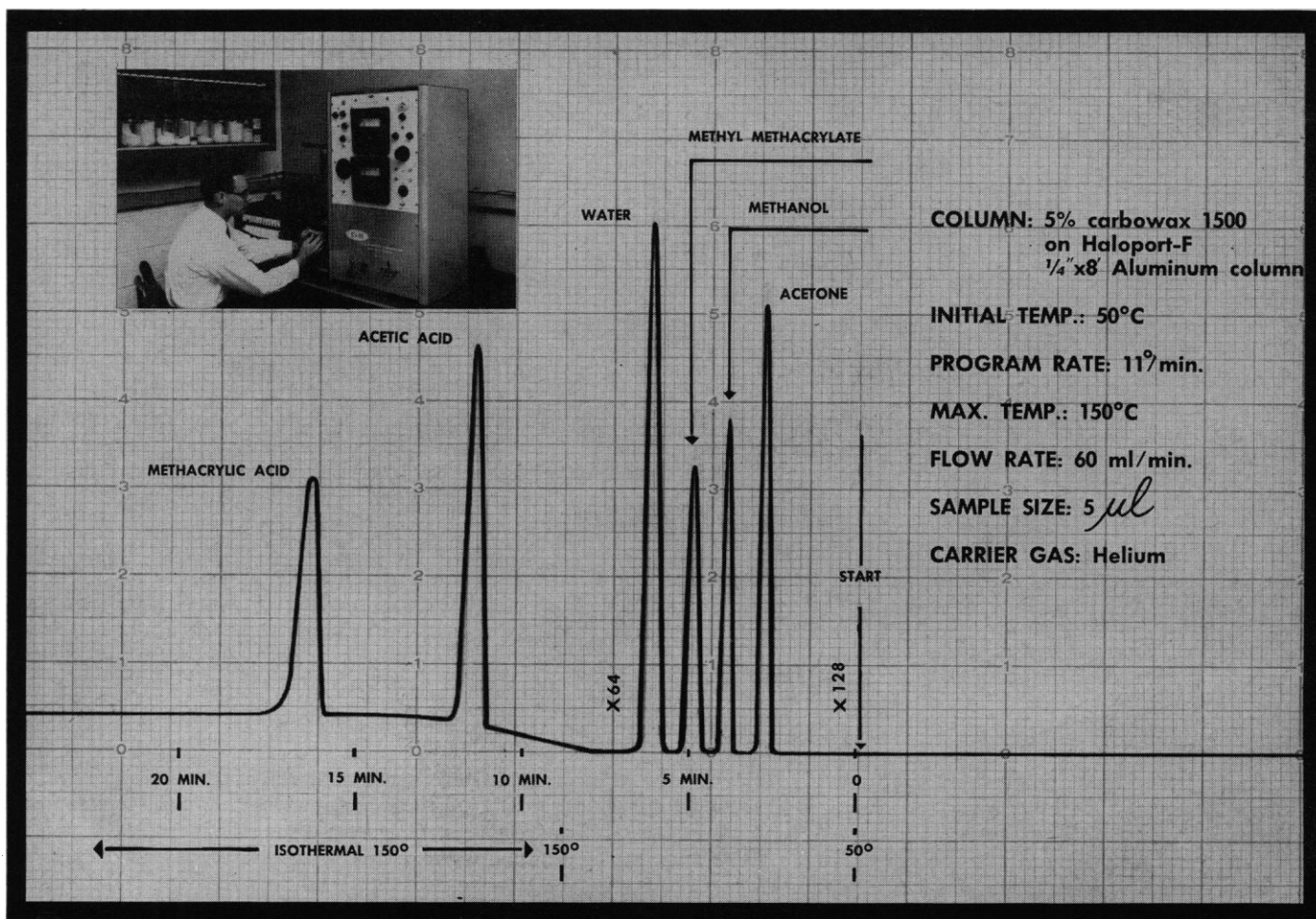
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- (1) Schoenbrunn, E. F., Gardner, J. H., *J. Am. Chem. Soc.* 82 4905 (1960).
- (2) *Facts & Methods*, an F & M Scientific Corp. publication, p. 7, Fall 1961.

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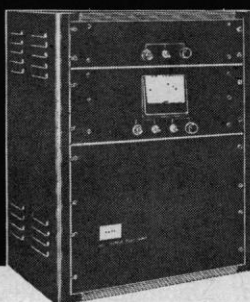
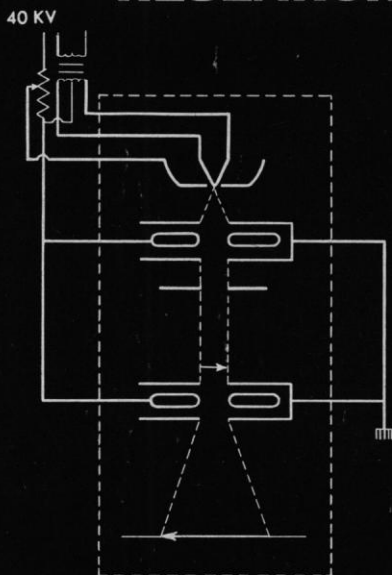
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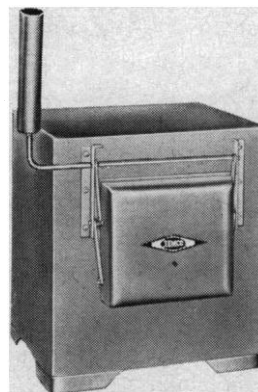
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rupted by flooding of reservoirs impounded behind a number of dams; (iii) the need to expand the scale of research on the Austronesian and Papuan languages (these constitute from ¼ to ½ of the languages of the world); and (iv) the need for linguistic surveys in Southeast Asia and long-range anthropological research in New Guinea and Melanesia.

The Section of Biological Sciences held interdisciplinary symposia on plants and the migrations of Pacific peoples, on Pacific Basin biogeography, and on the biotic balance of island faunas and floras. There were other significant symposia on pollen clues to ancient Pacific floras, algal productivity in the Pacific, ecology and protection of rare plants, wood anatomy and taxonomy, the culture of pond fishes, immunogenetic concepts in marine population research, the behavior of predaceous marine fishes, endocrinology of fishes, biological and physical aspects of light in the sea, and crop pests and biological control. The section recommended that all governments support the program of the Charles Darwin Foundation for preserving and studying the unique animals and plants of the Galapagos Islands; that adequate staffs of well-trained plant-quarantine personnel be employed in the Pacific Islands; that increased impetus be given to international research on the coconut rhinoceros beetle and on rat control; that the United Nations be requested to establish an isolated island biological laboratory for facilitating study of pathogens and pests; that an adequately staffed and equipped research group study the biology and growth of *Chanos* (milkfish) in its marine environment and locate the exact migration routes and spawning grounds; that the preparation of regional monographic floras (similar to *Flora malesiana*) should be encouraged; that a U.S. National Tropical Botanic Garden be established in the State of Hawaii; that all governments review the adequacy of staffing and financing of taxonomic research for scientific collections in their countries; that rare plant species be preserved by the establishment of protected reserves in natural habitats or by cultivation in botanical gardens; and that UNESCO promote closer collaboration among linguists, anthropologists, and botanists in the study of Pacific ethnobotany.

The Section of Conservation had the briefest program, yet presented the longest list of resolutions—a reflection of the many urgent problems involved

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in the maintenance of plant and animal communities in the Pacific region. The multidisciplinary aspects of conservation were emphasized by the considerable number of symposia that were jointly sponsored with other sections. Particularly significant were those on ecological consequences of the use of toxic chemicals in pest control, preservation of faunas and habitats, and the role of cultural values in land use. Discussion in the latter symposium centered on a vital theme—that man now possesses the proper techniques for implementing conservation, and that the real problem lies in conflicting attitudes toward land use. The urgency of land-use planning and the setting aside of natural areas as wilderness preserves was emphasized. Specific resolutions toward this end were those urging designation of the summit area of Mount Kosciuszko, Australia's highest mountain, as a wilderness area; the creation of a National Park on Kauai Island, to include Waimae Canyon and Alakai swamp; and the enlargement of Haleakala National Park. Protected wilderness areas (natural communities) should be kept distinct from scenic reserves and public recreation areas. A list was compiled of species of animals and birds threatened with extinction (from marine turtles, to Javan rhinoceroses, to the Hawaiian nene) to draw attention to the necessity for effective protection. For example, it was urged that the governments of Sarawak, Brunei, North Borneo, and Indonesia eliminate completely all killing, trapping, or export, under any circumstances whatever, of the orangutan, gibbon, or other tailless apes. Further, the UNESCO Science Cooperation Office for Southeast Asia was asked to convene a regional meeting to deal with problems of conservation of natural resources.

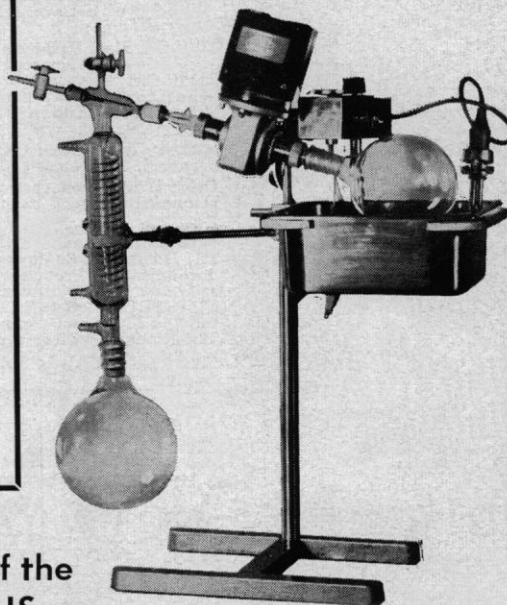
The major symposia of the Section of Forestry dealt with the organization and development of research, research methods in forest regeneration, animal-forest relationships, tree improvement for the Pacific region, forest inventories, forest growth, forest fire research, lignocellulose chemistry, wood anatomy and taxonomy, structural utilization of wood, and research in forest product development. It was concluded that the Food and Agriculture Organization of the United Nations should be asked to sponsor the collation of results of forest-product research and to foster the interchange of data.

The Section of Geography returned to the Pacific Science Congress after a

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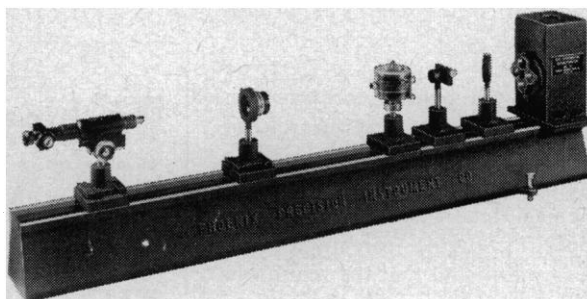
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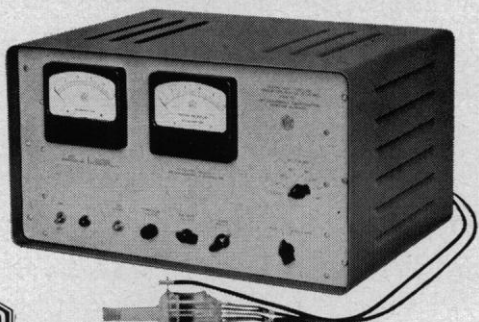
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lapse of 28 years. Over 115 geographers from 16 countries participated. The most significant symposia were multidisciplinary, cosponsored by other sections. They dealt with the history of scientific geographical exploration in relation to development of the Pacific map, social and economic implications of mechanization of rice agriculture, Pacific Island terraces, Pleistocene and post-Pleistocene climatic variations in the Pacific area, and peasant and plantation agriculture. Two commissions of the International Geographical Union (on World Land Use Survey and on the Humid Tropics) held open meetings. It was urged (i) that existing international agreements be studied with a view to facilitating the exchange of maps and aerial photographs for scientific purposes and establishing or strengthening facilities for reproducing aerial photographs; (ii) that governments of the countries concerned initiate preparation of a comprehensive atlas of the Pacific Basin; and (iii) that all sources of material on the historical cartography of the Pacific be carefully studied and cataloged.

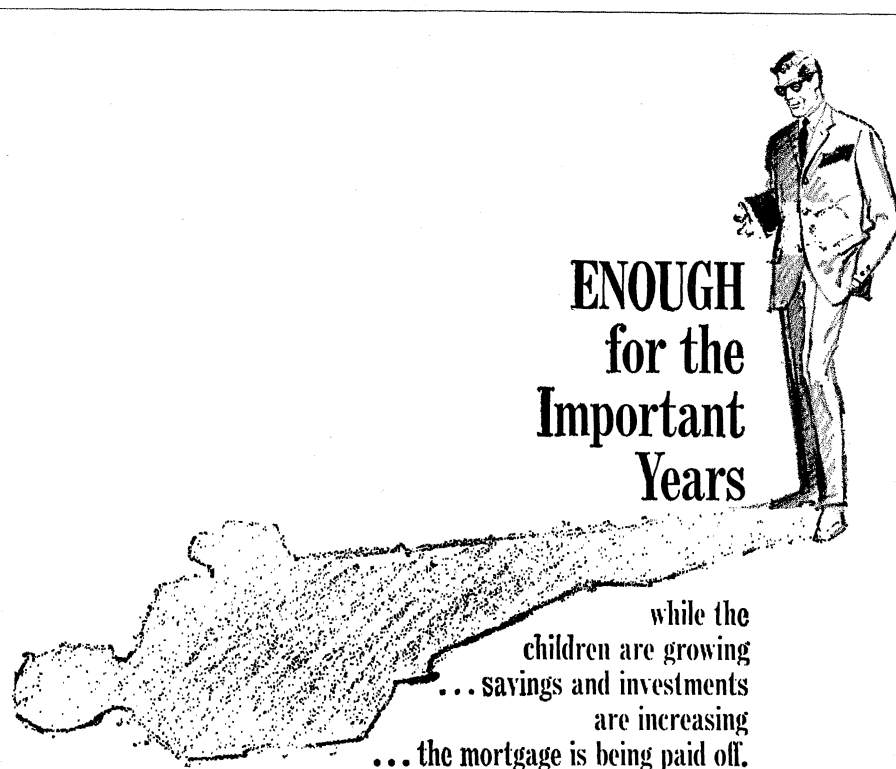
The major symposium of the Section of Geophysical Sciences was the 2-day "Matthew Fontaine Maury Memorial Symposium for Antarctic Research." Other important symposia dealt with the following subjects: large changes in the general circulation of the atmosphere and the Pacific Ocean, agricultural meteorology, meteorological results from satellite measurements, tropical cyclones, monsoon meteorology, oceanographic instrumentation, radioactive tracers in oceanography, tsunamis, equatorial circulation in the Pacific, North Pacific circulation, deep circulation in the Pacific, volcanism and plutonism in relation to types of crustal deformation, topography and sediments of the Pacific, and earth's crust in the Pacific Basin. Resolutions urged the ultimate establishment of an international tsunami warning system for the Pacific, and greater efforts to obtain gravity data over a broader area, with special emphasis on the southern Pacific Ocean.

The principal symposia of the Section of Public Health and Medical Sciences dealt with nutrition survey techniques and formulation of food composition tables, nutrition and cardiovascular disease, nutrition and population control, venomous and poisonous animals and noxious plants, mammal ecology in relation to public health, filariasis and onchocerciasis, premedical education, arthropod transmission of virus

diseases from animals to man, avian biology and human disease, sociocultural aspects of preventive medicine, zoonoses in the Pacific area, eradication and control programs, and medical ecology. Strong approval of fluoridation of community water supplies, where engineering was feasible, was expressed. It was also the consensus that some form of population control is imperative, for a host of sociological reasons. Because there is insufficient information on the dietary intakes of "apparently healthy" people living on the foods indigenous

to many of the Pacific areas and because such information is essential to an understanding of dietary standards and the balance between food supply and the expanding populations of the Pacific, it was resolved that all Pacific countries be urged to collect data relating to food and nutrient consumption of specified groups of "healthy" people living on foods usually available.

New to the congress was the Section on Scientific Information, which held five sessions at which 44 papers were presented and discussed by representa-




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tives from 15 different countries and eight international organizations. The council of the Pacific Science Association was asked to establish a standing committee on communication of scientific information as a means of securing the participation of Pacific-area countries in the joint planning and execution of measures to improve communication in the sciences. Improved means of disseminating information are needed for educating and training scientific information specialists and for

maintaining cooperative regional union lists of scientific and technical serials, and union catalogs. Also needed are interlibrary loan services among information centers, loan services for individual scientists, facilities for reproducing documents, and photocopying services. It was announced that the Japanese are considering publication in English of their seven bulletins of abstracts in the physical and mathematical sciences, and that the All-Union Institute of Scientific and Technical Information

of the Academy of Sciences of the U.S.S.R. plans to publish abstracts of Russian papers in English.

There were varied and exceptionally well organized intra- and postsession field trips, which added a great deal to the intangible value of the congress, providing an opportunity for participants to hold informal discussions with their colleagues from other countries. The delegates saw, in a relatively short time, the outstanding features of Hawaii's unusual flora and fauna, its spectacular volcanic region, and its highly developed agriculture. Oceanographic research vessels of both the United States and the Soviet Union held open house for congress visitors.

There were 15 exhibits at the congress. One, "Recent publications in Pacific science," was an exhibit of over 1800 books and periodicals contributed by about 150 institutions and publishers in 32 countries and territories throughout the world. Another was an exhibit of 65 panels of photocopied documents illustrating the history of American participation in the geographical exploration, surveying, and mapping of the Pacific Basin. The panels were prepared by the U.S. National Archives and Record Service.

The presence of such a great number of foreign delegates from so many countries was due in no small part to the indefatigable efforts of the secretary-general in publicizing the congress during his world-wide travels, and to the arrangements made for special chartered flights to Hawaii from the United States and the Pacific area. There were 33 scientists from ten Latin-American countries, 126 from Europe, 8 from Africa, 169 from the Pacific area, and 399 from Asia. The largest foreign delegations were those from Japan (144), Australia (81), the Philippines (56), the U.S.S.R. (54), Canada and New Zealand (47 each), Taiwan (43), Thailand (37), and Indonesia (27).

An appraisal of the 10th congress forced the Council to conclude that the congress has grown to such a size that the cost of holding it is a major burden on the organizers of the host country, and that any voluntary group of scientists is strained to the utmost to cope with its complexity. The Council concluded, moreover, that it is doubtful whether the main objective of the congress—the evaluation of knowledge and the planning of long-term research requiring international cooperation—can be satisfactorily attained with the numbers involved.

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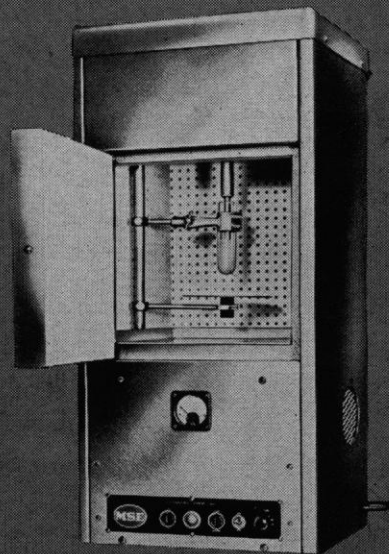
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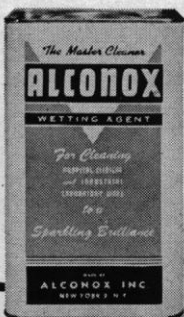
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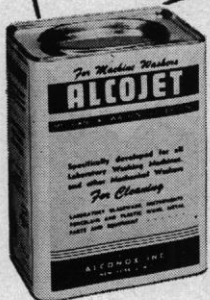
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Thus, in the future, congress activities probably will be confined to problems peculiar to the Pacific, and there will be close consultation with international organizations (such as UNESCO, WHO, and FAO) with active interest in Pacific problems. All invitations to individuals to participate in congress programs will be issued through the representative institution (a member of the Pacific Science Association) of the country of the individual invited, and will be issued at least a year in advance.

At the closing plenary session, honorary life fellowships were presented to A. P. Elkin of Australia and Carl Skottsberg of Sweden. Also, it was announced that the council had accepted the invitation of the Japanese delegation, subject to official confirmation by the Japanese government, to hold the 11th Pacific Science Congress in Tokyo in 1966.

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University of California, Riverside

## Reference

1. A. P. Elkin, *Pacific Science Association, Its History and Role in International Cooperation* (Bernice P. Bishop Museum Press, Honolulu, 1961).

## Forthcoming Events

### February

7. Chemical Suppression of the Immune Response, New York, N.Y. (W. Dameshek, New England Center Hospital, 171 Harrison Ave., Boston 11, Mass.)

8. Problems in Food Processing, Assoc. of Vitamin Chemists, Chicago, Ill. (H. S. Perdue, Abbott Laboratories, North Chicago, Ill.)

9-11. National Open Hearth and Blast Furnace Conf., American Inst. of Mining, Metallurgical, and Petroleum Engineers, Detroit, Mich. (E. O. Kirkendall, AIME, 29 W. 39 St., New York 17)

12-16. Management of Science Information Centers, Inst. on Information Storage and Retrieval, 4th, Washington, D.C. (L. H. Hattery, Center for Technology and Administration, American Univ., 1901 F St., NW, Washington 6)

12-23. Latin American Seminar on Irrigation, 2nd, Panama City, Panama. (J. Melendez, Jefe, Depto. de Ingenieria, Ministerio de Agricultura, Comercio e Industrias, Panama City)

13-14. Sanitary Engineering, 4th conf., Urbana, Ill. (B. B. Ewing, Dept. of Sanitary Engineering, Univ. of Illinois, Urbana)

14-16. Biophysical Soc., 6th annual, Washington, D.C. (D. Cowie, Dept. of Terrestrial Magnetism, Carnegie Institution of Washington, 5241 Broad Branch Rd., NW, Washington 15)

14-16. Solid State Circuits, intern. conf.,

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14-17. National Soc. of College Teachers of Education, Chicago, Ill. (E. J. Clark, Indiana State College, Terre Haute)

16-18. Medical Congr. in Honor of the Centennial of Bretonneau, Tours, France. (Directeur, École Nationale de Médecine, Tours)

17-24. Pan American Medical Women's Alliance, 8th congr., Manizales, Colombia. (C. Carthers, 1661 Riverside Ave., Suite B, Jacksonville, Fla.)

18-22. American Inst. of Mining, Metallurgical, and Petroleum Engineers, annual, New York, N.Y. (E. O. Kirkendall, AIME, 29 W. 39 St., New York 17)

18-22. Technical Assoc. of the Pulp and Paper Industry, annual, New York, N.Y. (TAPPI, 360 Lexington Ave., New York 17)

19-21. American Educational Research Assoc., Atlantic City, N.J. (G. T. Buswell, 1201 16 St., NW, Washington 6)

19-21. Tracking and Command of Aerospace Vehicles, Inst. of the Aerospace Sciences, San Francisco, Calif. (IAS, 2 E. 64 St., New York 21)

19-22. American Concrete Inst., annual, Denver, Colo. (W. A. Maples, 22400 W. Seven Mile Rd., P.O. Box 4754, Redford Station, Detroit 19, Mich.)

19-22. Industrial Ventilation Conf., E. Lansing, Mich. (Engineering Dept., Michigan State Univ., E. Lansing)

19-23. American Soc. of Civil Engineers, Houston, Tex. (W. H. Wisely, 345 E. 47 St., New York 17)

19-23. Automatic Control in the Iron and Steel Industry, intern., Brussels, Belgium. (Institut Belge de Régulation et d'Automatisme, 98 Chaussée de Charleroi, Brussels 6)

20-21. International Inst. of Sugar Beet Researchers, winter congr., Brussels, Belgium. (O. J. Kint, HSBK, 152 rue Beau-duin, Tirlemont, Belgium)

21-25. National Assoc. for Research in Science Teaching, Washington, D.C. (H. Branson, Dept. of Physics, Howard Univ., Washington 1)

22-24. American Acad. of Forensic Sciences, Chicago, Ill. (W. J. R. Camp, Univ. of Illinois, 1853 W. Polk St., Chicago 12)

22-24. Genetics Soc. of Canada, Winnipeg, Man., Canada. (Scientific Liaison Office, Natl. Research Council, Sussex Dr., Ottawa, Ont., Canada)

23-24. American Physical Soc., Austin, Tex. (K. K. Darrow, APS, Columbia Univ., New York 27)

23-24. Canadian Aeronautical Inst., mid-season meeting, Halifax, Nova Scotia. (Scientific Liaison Office, Natl. Research Council, Sussex Dr., Ottawa, Canada)

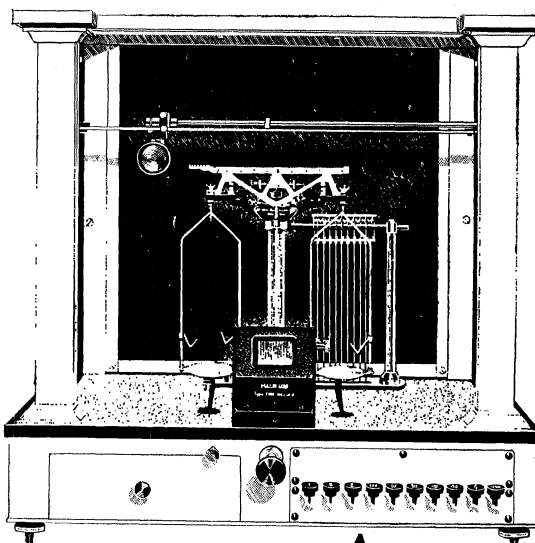
25-1. Pan American Assoc. of Oto-Thino-Laryngology and Broncho-Esophagology, Caracas, Venezuela. (C. M. Norris, 3401 N. Broad St., Philadelphia 40, Pa.)

26-28. Importance of Electricity in the Control of Aircraft, conf., Inst. of Electrical Engineers-Royal Aeronautical Soc., London, England. (Secretary, IEE, Savoy Place, London, W.C.2)

26-29. Central Treaty Organization, Economic Committee, Washington, D.C. (Office of Intern. Conferences, Dept. of State, Washington 25)

26-2. Current Trends in Nuclear Power,

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symp., Tucson, Ariz. (L. Weaver, Nuclear Engineering Dept., Univ. of Arizona, Tucson)

27-1. Application of Switching Theory in Space Technology, symp., Palo Alto, Calif. (J. P. Nach, Lockheed Aircraft Corp., Sunnyvale, Calif.)

### March

1-3. Florida Acad. of Sciences, Gainesville. (J. B. Lackey, Dept. of Civil Engineering, Phelps Laboratory, Univ. of Florida, Gainesville)

1-3. Fundamental Cancer Research, Conceptual Advances in Immunology and Oncology, symp., annual, Houston, Tex. (Univ. of Texas, Anderson Hospital and Tumor Inst., Houston 25)

1-3. Scintillation and Semiconductor Counters, 8th symp., Washington, D.C. (G. A. Morton, RCA Laboratories, Princeton, N.J.)

2-4. National Wildlife Federation, Denver, Colo. (T. L. Kimball, 1412 16 St., NW, Washington 6)

4-7. Association for Higher Learning, Chicago, Ill. (Chief of Information, Dept. of the Army, Washington 25)

4-8. Association for Supervision and Curriculum Development, Las Vegas, Nev. (Chief of Information, Dept. of the Army, Washington 25)

4-8. Conference on Gas Turbine Power-Process Industries, American Soc. of Mechanical Engineers, Houston, Tex. (A. B. Conlin, Jr., ASME, 29 W. 39 St., New York 18)

5-9. Analytical Chemistry and Applied Spectroscopy, conf. and exposition of modern laboratory equipment, Pittsburgh, Pa. (C. F. Glick, Applied Research Laboratory, U.S. Steel Corp., Monroeville, Pa.)

5-16. United Nations' Economic and Social Council, Committee for Industrial Development, New York, N.Y. (U.N., New York)

8. Problems Relating to Food and Feed Additives, Assoc. of Vitamin Chemists, Chicago, Ill. (H. S. Perdue, Abbott Laboratories, N. Chicago)

9-14. National Science Teachers Assoc., annual, San Francisco, Calif. (M. T. Ballou, Ball State Teachers College, Muncie, Ind.)

10-13. Microminiaturization Congr., New York, N.Y. (C. G. Sedan, American Watchmakers Inst., 18465 James Couzens Hwy., Detroit 35, Mich.)

11-17. American Congr. on Surveying and Mapping—Amer. Soc. of Photogrammetry, annual, Washington, D.C. (G. K. Emminizer, Jr., 106 Valley Rd., Ellicott City, Md.)

12. Wildlife Soc., Denver, Colo. (C. Gordon Fredine, 5921 Anniston Rd., Bethesda 14, Md.)

12-14. North American Wildlife and Natural Resources Conf., Denver, Colo. (Wildlife Management Inst., 709 Wire Bldg., Washington 5)

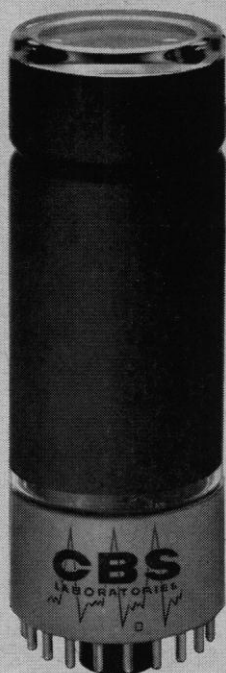
12-16. Society of Automotive Engineers, Detroit, Mich. (R. W. Crory, SAE, 485 Lexington Ave., New York 17)

12-23. International Radio Consultative Committee, Study Group on Space Systems, Washington, D.C. (Palais Wilson, Geneva, Switzerland)

13-14. Packaging of Chemical Products,



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symp., annual, St. Louis, Mo. (Manufacturing Chemists' Assoc., 1825 Connecticut Ave., NW, Washington 9)

13-15. Application of Statistics and Computers to Fuels and Lubricants Research Programs, symp., San Antonio, Tex. (R. Quillian, Southwest Research Inst., 8500 Culebra Rd., San Antonio 6)

13-15. Electronic Industries Assoc., Washington, D.C. (Chief of Information, Dept. of the Army, Washington 25)

14-16. National Missiles and Space Conf., Washington, D.C. (Chief of Information, Dept. of the Army, Washington 25)

15-16. Textile Research Inst., annual, New York, N.Y. (P. C. Alford, TRI, Princeton, N.J.)

15-16. Western Industrial Writing Inst., 7th Los Angeles, Calif. (R. M. Winters, American Industrial Writing Inst., P.O. Box 5453, Pasadena, Calif.)

15-17. Optical Soc. of America, Washington, D.C. (M. E. Warga, OSA, 1166 16 St., NW, Washington 6)

15-18. International Assoc. for Dental Research, St. Louis, Mo. (J. C. Muhler, Indiana Univ. Medical Center, 1120 W. Michigan St., Indianapolis 7)

15-23. American Soc. of Tool Engineers, annual, Detroit, Mich. (H. E. Conrad, ASTE, 10700 Puritan Ave., Detroit 38)

18-21. American Assoc. of Dental Schools, St. Louis, Mo. (R. Sullens, AADS, 840 N. Lake Shore Dr., Chicago 11, Ill.)

18-22. Bilharziasis, symp., Cairo, Egypt. (A. H. Mousa, Ciba Foundation, 41 Portland Pl., London, W.1, England)

18-22. International Anesthesia Research Soc., Bal Harbour, Fla. (Scientific Liaison Office, Natl. Research Council, Sussex Dr., Ottawa, Ont., Canada)

19-23. International Conf. on Equatorial Geophysics, Lima, Peru. (J. A. Broggi, Instituto Geofisico de Huancayo, Apdo. 46, Huancayo, Peru)

19-23. National Assoc. of Corrosion Engineers, Kansas City, Mo. (T. J. Hull, NACE, 1061 M&M Bldg., Houston, Tex.)

20-23. American Assoc. of Anatomists, annual, Minneapolis, Minn. (C. B. Hegstad, Dept. of Anatomy, Univ. of Minnesota, Minneapolis 14)

20-23. High-Temperature Solution Chemistry, symp., Washington, D.C. (J. W. Cobble, Purdue Univ., Lafayette, Ind.)

20-23. Institute of Metals, London, England. (R. E. Moore, 17 Belgrave Sq., London, S.W.1)

20-29. American Chemical Soc., natl., Washington, D.C. (A. T. Winstead, ACS, 1155 16 St., NW, Washington 6)

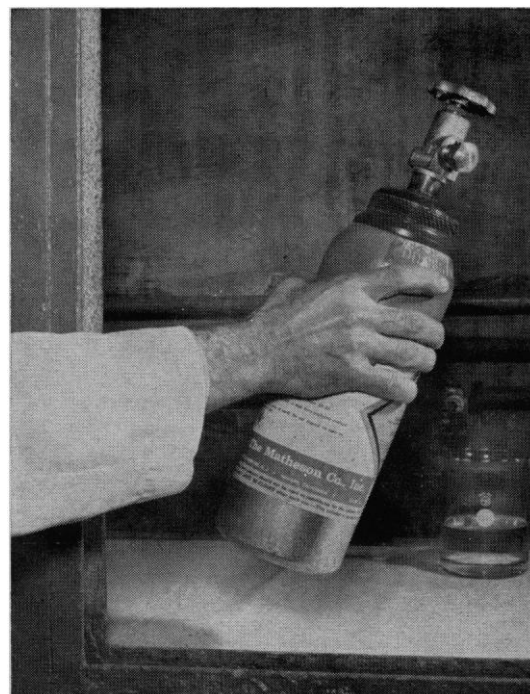
21-24. American Orthopsychiatric Assoc., annual, Los Angeles, Calif. (AOA, 1790 Broadway, New York 19)

21-24. Neurosurgical Soc. of America, Biloxi, Miss. (Scientific Liaison Office, Natl. Research Council, Sussex Dr., Ottawa, Ont., Canada)

22-24. Michigan Acad. of Science, Arts, and Letters, Ann Arbor. (F. C. Bald, 160 Rackham Bldg., Univ. of Michigan, Ann Arbor)

24-31. Symbolic Languages in Data Processing, symp., Rome, Italy. (Secretary, Provisional Intern. Computation Center, Palazzo degli Uffici, Zona dell'EUR, Rome)

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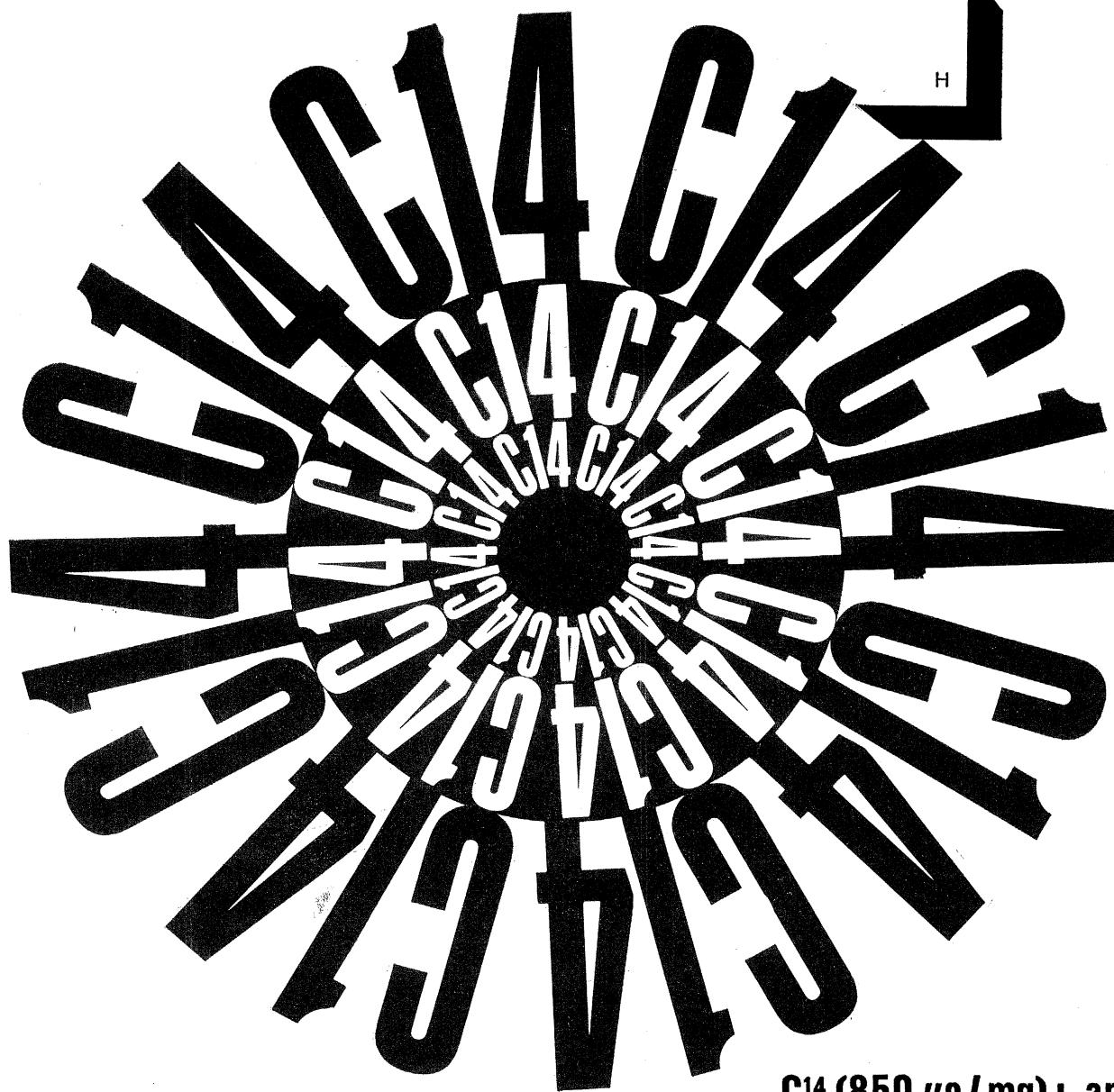
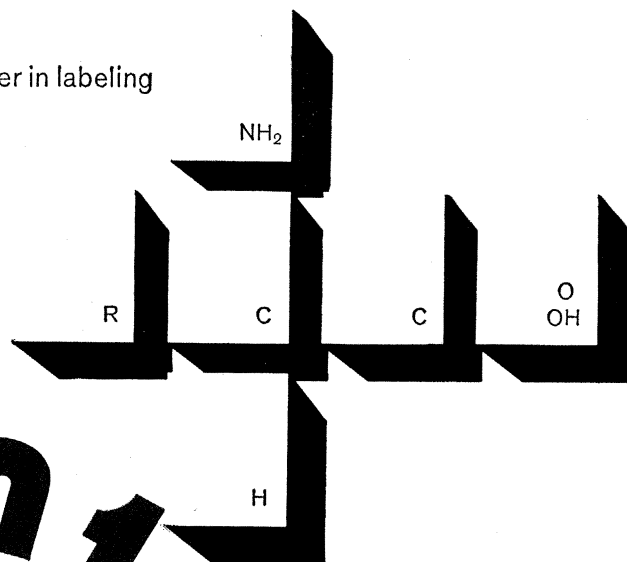
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## New Products

**Biological digital computer** is designed for simultaneous, on-line calculation of average biological responses to stimuli. The computer may be used for averaging evoked responses in the brain, nerve potentials, retinograms, cardiological data, phonocardiograms, and other biologic variables. At the end of an experimental run the average responses are already computed. Averages may be observed during any part of the run on an oscilloscope display.

The average responses are calculated for 400 ordinates that may be spaced at intervals between 155  $\mu$ sec and 0.16 sec per ordinate. Analysis time for the entire 400 ordinates ranges from 62.5 msec to 64 sec, adjustable by multiples of 2. Adjustable delay between stimulus and response analysis makes it possible to analyze in detail responses far removed in time from the stimulus. Responses may be added or subtracted at will. Graphic readout is provided for strip-chart and x-y recorders. The computer accepts a single input or up to four inputs simultaneously. In the latter case, the 400 ordinates are subgrouped in hundreds. Size of the computer is 8.5 by 22 by 10.25 in., and weight is 20 lb. (Mnemotron Corp., 45 South Main St., Pearl River, N.Y.)

Circle 1 on Readers' Service card

**Gas-phase oxygen transducer** operates by the electrochemical reduction of oxygen on a gold electrode. The overall reaction of the cell that constitutes the transducer is represented as:  $2\text{Cd} + \text{O}_2 = 2\text{CdO}$ . No power or external polarizing unit is required for its operation. The gold electrode is mounted directly beneath a thin membrane that separates the electrolyte from the gas being measured. The membrane is permeable to oxygen but pre-

vents evaporation of the electrolyte. The transducer operates in any position and withstands shock and vibration. Response is linear within a range of one atmosphere. Normal response time is given as approximately 10 sec at 25°C with the usual membrane thickness. Units are available with special membranes which give a response time of about 1 sec at 25°C. This operates into a variable resistive load to give approximately 0.25 mv/mm-Hg (oxygen pressure) between 5° and 45°C. Accuracy of  $\pm 1$  percent is said to be obtainable, and long-range monitoring of oxygen in the range 0 to 250 mm-Hg with  $\pm 5$  percent reliability is said to be possible without great attention to details. (Chemtronics, Inc., P.O. 417, San Antonio, Tex.)

Circle 2 on Readers' Service card

**Antenna contour plotter**, model No. ACP 1, maps azimuth, elevation, and amplitude coordinates in the new IRIG format. A complete contour plot can be made by scanning over the sphere of radiation of an antenna, missile, or scale model of an airframe with the manufacturer's model PCP 1 automatic position programmer and two-axis positioner. In addition to contour plots, antenna patterns can also be recorded. Contour increments are selectable at 1, 2, or 3 db; contour levels are emphasized at 0, 6, 12, 18, 24, 30, and 36 db. Graphs plotted by the instrument are either 5 by 10 or 10 by 20 in. (Scientific-Atlanta, Inc., 2162 Piedmont Rd., NE, Atlanta 9, Ga.)

Circle 3 on Readers' Service card

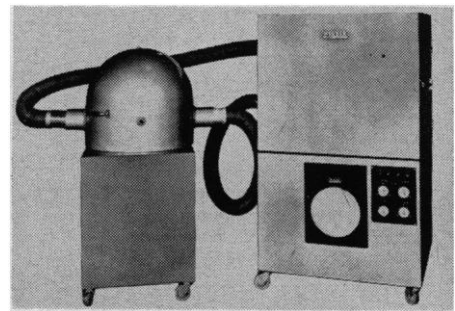
**Temperature compensator** for photographic work changes the rate of an electric timer to compensate for temperature variations in a photographic tray or tank. Over a  $\pm 4^\circ\text{F}$  temperature variation, the device is said to permit development of negatives that indicate an effective temperature variation of  $\pm 0.2^\circ\text{F}$ . (Trott Electronics Inc., Rochester, N.Y.)

Circle 4 on Readers' Service card

**Beryllium oxide heat sinks** are said to combine a thermal conductivity equal to that of aluminum and an electrical resistivity characteristic of a pure oxide ceramic. The heat sinks are available in kit form for engineering evaluation. Other properties claimed for the material are low dielectric constant and dielectric loss, infinite shelf life, high resistance to shock and vibration, immunity to moisture, and immunity to breakdown caused by surface scratches or prolonged use at high temperatures. (National Beryllia Corp., First and Haskell Avenues, Haskell, N.J.)

Circle 5 on Readers' Service card

**Portable environmental chamber** is designed for use on components and parts undergoing vibration or shaker test when it is impractical to bring the item to be tested to the chamber. A 19-in. thermally insulated dome, connected to the mobile chamber with two flexible insulated hoses, fits over the



part tested. Temperature range is  $-100^\circ$  to  $+200^\circ\text{F}$ . Time required to reduce temperature from maximum to minimum is said to be 45 min. Internal air circulation prevents temperature stratification. (Webber Manufacturing Co., P.O. Box 217, Indianapolis 6, Ind.)

Circle 6 on Readers' Service card

**Variable-area flowmeters** incorporate metal tubes for use at temperatures and pressures beyond the range of the glass-tube type. They are supplied in a variety of materials to handle a wide range of industrial chemicals. Tube diameters range from 0.5 to 3 in. with a corresponding water-flow range from 1 to 400 gal/min and air-flow range from 4.2 to 1680 ft<sup>3</sup>/min (standard). A family of interchangeable floats is available.

The flowmeters are supplied with a magnetic indicating extension or with a transmitter to operate recorders, controllers, or integrators. The follower ring of the magnetic indicator travels in a precision-bore glass tube sealed

The information reported here is obtained from manufacturers and from other sources considered to be reliable. Neither *Science* nor the writer assumes responsibility for the accuracy of the information. A Readers' Service card for use in mailing inquiries concerning the items listed is included on page 155. Circle the department number of the items in which you are interested on this card.



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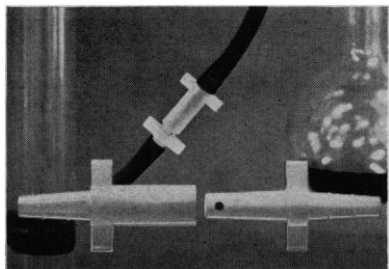
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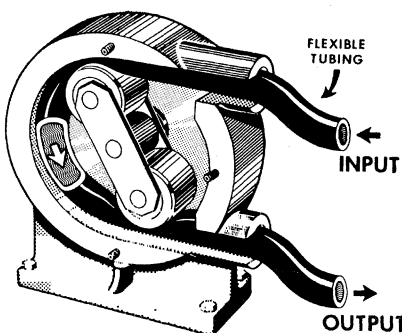
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with O-ring gaskets at each end to keep out dust and to prevent fogging and corrosion. A horizontal inlet fitting that allows removal of the float and float extension without breaking the piping is optionally available. (Wallace and Tiernan, Inc., 25 Main St., Belleville 9, N.J.)

Circle 7 on Readers' Service card

**Event recorder** is an inkless chart recorder that can operate more than 50 days without a change of chart. The instrument is available with 10 or 20 channels. Information is recorded by electrically heated stainless-steel styluses. Power to heat the styluses can be obtained from a power line or from a 12-volt storage battery. Response speed is 1/20 sec. (Esterline Angus Instrument Co., P.O. Box 596, Indianapolis 6, Ind.)

Circle 8 on Readers' Service card

**Ampere-hour meter** is a micro-coulometer consisting of a capillary glass tube containing a mercury anode separated from a mercury cathode by a small electrolyte gap. Current transfers mercury quantitatively across the gap, moving the gap along the tube at the rate of 0.96 in./ma hr. Accuracy is said to be  $\pm 2$  percent. The meter has a 6-in. active scale calibrated directly in ma hr. The device will operate continuously on currents up to 1 ma; it will operate in any position. (Curtis Instruments Inc., 45 Kisco Ave., Mount Kisco, N.Y.)

Circle 9 on Readers' Service card

**Pulse generator** features rise time of 10 nsec, repetition rates to 10 Mc/sec, and variable delay and width. Modular construction and solid-state design are used throughout the instrument. Output characteristics obtainable through interchange of standard output modules provide for peak current of 300 ma, maximum voltage of 20 v, mixing of multiple channel outputs, and addition of complementary outputs from a single channel. (Servo-Corporation of America, 111 New South Rd., Hicksville, N.Y.)

Circle 10 on Readers' Service card

**Voltage calibrator** is a two-dial instrument for calibration of voltmeters. When the left-hand dial is adjusted to the certified value of the standard-cell voltage and the input supply is adjusted so that the voltage at the calibration terminal is exactly equal to the standard-cell voltage, the voltage at the output

terminals is said to be within  $\pm 0.01$  percent of the voltage indicated by the right-hand dial. Ten output-voltage settings from 0.05 to 1000 v are provided. A calibration certificate specifies corrections for the left-hand dial for increased accuracy. Calibration data are said to be accurate to better than  $\pm 0.005$  percent at 25°C at time of measurement, and stability is said to be  $\pm 0.005$  percent, so long-term accuracy of  $\pm 0.01$  percent over the ambient temperature range from 22° to 28°C results. (Electro Scientific Industries, Inc., 7524 S.W. Macadam Ave., Portland 19, Ore.)

Circle 11 on Readers' Service card

**Thermoelectric cooling unit** is designed for use with stud-mounted diodes and transistors. The cooler consists of three thermocouples, the cold sides of which extract heat from the component case. The heat is pumped out to the other side of the cooler and rejected to a chassis, fins, or other heat sink. The device operates at 0.3 volts and up to 17 amp and is said to pump 4.2 watts (minimum) across zero temperature difference. (General Thermoelectric Corp., P.O. Box 253, Princeton, N.J.)

Circle 12 on Readers' Service card

**Temperature compensation resistor** features temperature coefficient adjustable by worm-gear lead screw over a range of +10 to +4500 parts per million per degree Centigrade. Standard fixed resistance values are 100, 200, and 500, 750 ohms and 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, and 5 kohm. The resistors are hermetically sealed in anodized aluminum housings measuring 1 by 1 by 0.3 in. Operating temperature range is -55° to +150°C. (Conrad-Carson Electronics, Inc., 1347 Broadway, El Cajon, Calif.)

Circle 13 on Readers' Service card

**Dropping mercury electrode assembly** for polarography has its basic components—glass capillary, mercury reservoir, and connecting tube—mounted in and on a rigid vertical column rising from a circular base that has a peripheral rim to retain spilled mercury. A constant mercury head is maintained by a calibrated spring balance that supports the mercury reservoir in the top of the column. The capillary holder moves freely on the column. (E. H. Sargent and Co., 4647 W. Foster, Chicago 30, Ill.)

Circle 14 on Readers' Service card

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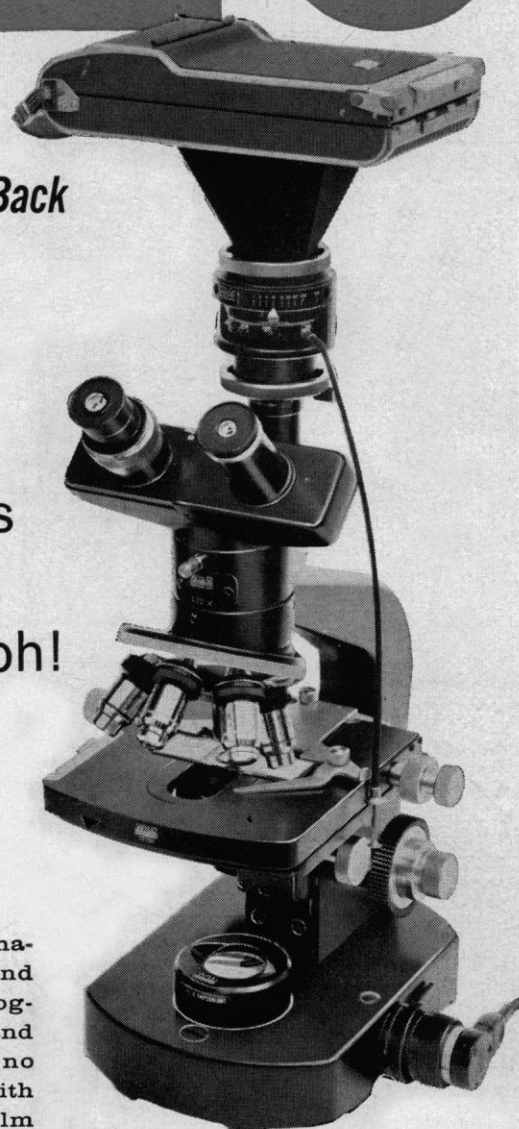
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**Atmospheric pollution tester** is designed for use in laboratories and operational areas where rocket fuels (hydrazine and UDMH) and oxidizer (nitrogen tetroxide) are manufactured, stored, transported, or used. The instrument displays the ambient fuel and oxidizer vapor levels directly on panel meters. Sensitivity is said to be one part in four million for fuel vapor and one part in one million for oxidizer. The detector provides electrical output signals proportional to concentration and may be used to actuate alarm de-

vices. Both fuel and oxidizer sensing circuits operate on the principle of generation of current in an electrochemical cell. Power is provided by a rechargeable wet battery. (American Systems, Inc., 1625 East 126 St., Hawthorne, Calif.)

**Circle 15 on Readers' Service card**

**Radioactivity scanner** is a dual instrument that produces both printed and photographic records of radioisotope distribution in body organs. A scintillation detector mounted on the instru-

ment scans the area or an organ in stepwise sweeps. Signals from the detector actuate a printer and camera mechanism. The printing device is a relay-operated solenoid tapper that produces a line image of isotope distribution. The camera mechanism is designed to disclose areas having only minor differences in isotope concentration. This is accomplished by covering the complete contrast range of the film by a slight variance in count rate. According to the manufacturer areas differing by as little as 10 to 20 percent in isotope concentration can be delineated in this way. Intensity of the light source of the photoscanner is shown on a control-panel meter for monitoring by the operator. (Nuclear-Chicago Corp., 359 E. Howard Ave., Des Plaines, Ill.)

**Circle 16 on Readers' Service card**

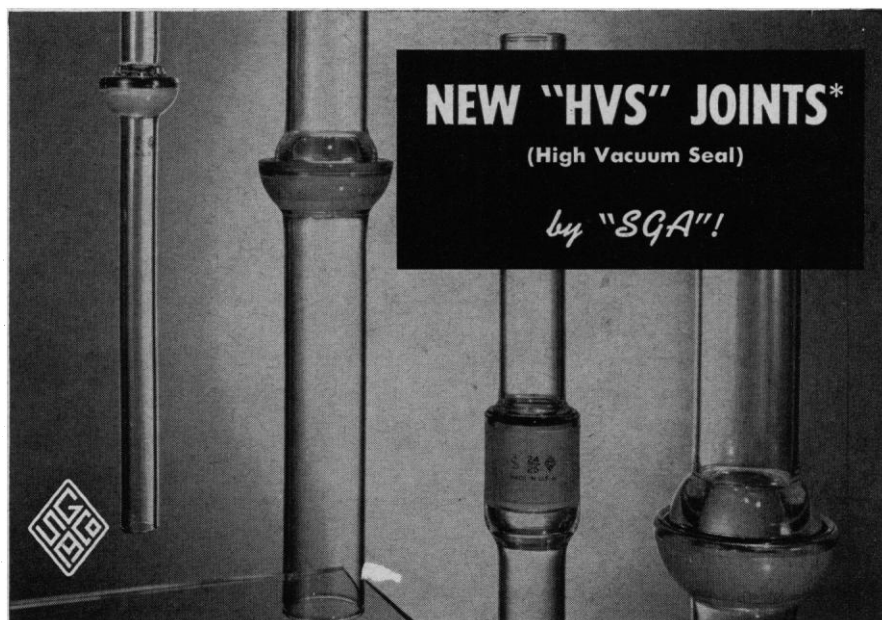
**Power supply** that can be programmed may be varied over the range 100 to 3000 volts by connection of an external resistor across a pair of terminals. Output voltage is  $100 \text{ v} + 0.001 \text{ R}$  (R is the programming resistance in ohms). Output current range is 10 ma. Regulation for line voltage changes of  $\pm 10 \text{ v}$  is said to be  $\pm 0.01$  percent, and regulation from no load to full load is also 0.01 percent. Output ripple is less than 5 mv (r.m.s.). Response to programming command is 25 v/msec. (Carad Corp., 3381 Junipero Serra Blvd., Palo Alto, Calif.)

**Circle 17 on Readers' Service card**

**Core memory systems** are transistorized, high-speed, random access systems with storage capacities ranging from 20,480 to 163,840 bits. Access times of 2.5 to 4.0  $\mu\text{sec}$  and readout cycle times of 5 to 10  $\mu\text{sec}$  are said to be obtained. Features are small size, low power consumption, modular construction, and flexibility of operation. Power supplies are an integral part of the system; indicator panels and an off-line memory tester are available as accessory equipment. (Computer Control Co., 983 Concord St., Framingham, Mass.)

**Circle 18 on Readers' Service card**

**Semi-digital volt-ohmmeter** is a solid-state instrument that combines analog and digital measurement techniques. Two conventional D'Arsonval meter movements are used in an arrangement that permits resolution of one to multiply resolution of the other. One of the meters acts as a digital indicator; associated circuitry feeds this indicator a



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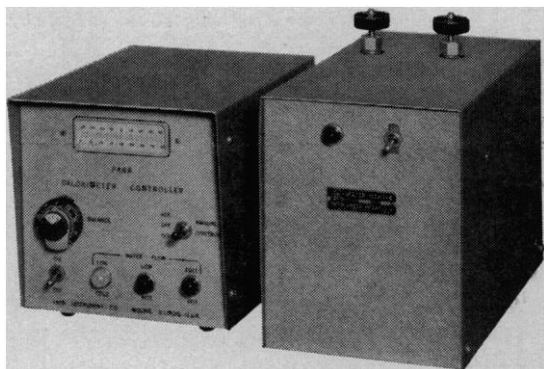
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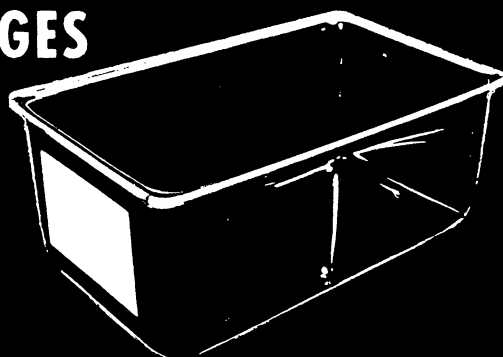


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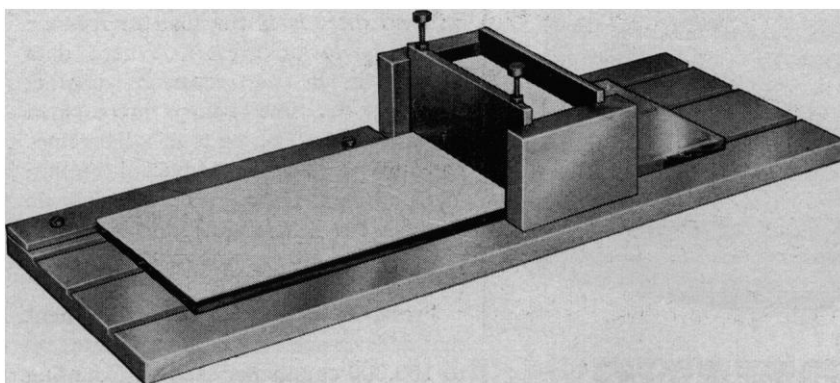
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quantized current so that it always points to one of its 32 graduations. The other meter operates in analog fashion; it is calibrated so that the span from 0 to 100 corresponds to one step of the digital indicator. In reading the instrument, the operator obtains two figures from the quantized meter and two more from the analog indicator. For voltage measurements, an additional binary circuit is used to indicate polarity. Voltage is covered from 3.2 to 3200 v in four decades. Resistance is measured from 320 ohms to 32 megohm in six decades. Accuracy is said to range from  $\pm 0.15$  percent at the top of each range to  $\pm 0.05$  percent of full scale at the bottom of each range. Response time is less than 1 sec on all except the 3.2-volt and 32-megohm ranges; it is approximately 2 sec on these two ranges. Input impedance is 10 megohms. (J. Omega Co., Los Altos, Calif.)

Circle 19 on Readers' Service card

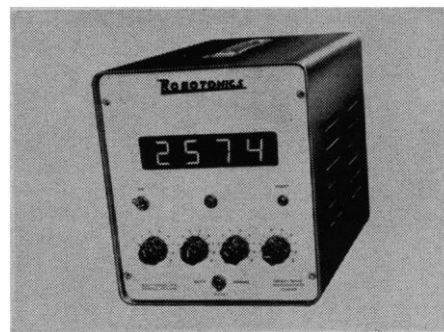
**Helium refrigerator** is a low-pressure installation that may be used to provide cold gas refrigeration at temperatures as low as 8°K to an external load. The unit may also be used for liquefying helium when no refrigeration is required. (Arthur D. Little, Inc., Acorn Park, Cambridge 40, Mass.)

Circle 20 on Readers' Service card

**Scanner** is designed to switch data points, in the form of contact closures or voltage levels, sequentially to a common output device. The scanner may be advanced at the rate of 50,000 points per second by a negative pulse of 10-volt minimum amplitude and 5- $\mu$ sec duration. For voltage-level data, all lines except the one being interrogated are inhibited; the line being interrogated will have binary levels -6 or 0. The output signal may be used directly if the load impedance is 4.7 kohm or greater. Where data storage is in the form of contact closures, the line being interrogated will have 0 volts, and all other lines will have -15 volts across a 1.5-kohm load. (Datex Corp., 1307 S. Myrtle Ave., Monrovia, Calif.)

Circle 21 on Readers' Service card

**Preset counter** is a dual instrument that adds or subtracts counts at rates up to 100,000 counts per second. Counting direction is controlled manually or with automatic electronic control by supplying input pulses to one of two control lines. Standard models are transistorized, with in-plane display,



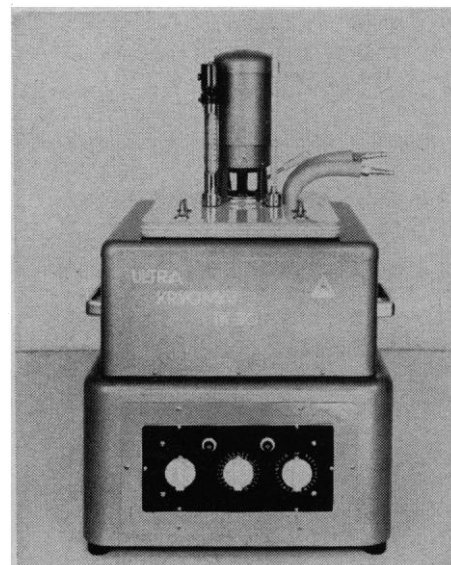
and are available with two to six displays. Relay output or pulse output is available for initiation of action when the preset counts are completed. (Robotomics, Inc., Phoenix, Ariz.)

Circle 22 on Readers' Service card

**Voice interference analysis set** measures the intelligibility characteristics of voice communication systems. In operation, a sub-unit generates a triangularly modulated tone at the input of the communication channel. This tone is fed from the output of the channel into the voice analysis set. The resulting signal is processed and divided into 14 frequency bands that are summed logarithmically and read out digitally. The result is a number called the articulation index, which is said to be a measure of the intelligibility of a transmitted speech message under the existing conditions. Testing time is approximately 30 sec. (General Electronic Laboratories, Inc., 18 Ames St., Cambridge, Mass.)

Circle 23 on Readers' Service card

**Low-temperature circulators** are designed for controlled cooling of instruments. Temperature-control accuracy within  $\pm 0.02^\circ\text{C}$  is said to be achieved by the use of secondary heat exchanger



in which an intermediate circulating liquid is cooled by a mechanical refrigerator. The intermediate coolant flow through a coil in the bath is regulated by the control thermometer. Models are available for temperatures to  $-80^{\circ}\text{C}$ . (Lauda Instruments, Inc., P.O. Box 422, Great Neck, N.Y.)

Circle 24 on Readers' Service card

**Amplifier test console** for wideband d-c amplifiers is said to provide all test equipment required for a comprehensive check of amplifier performance. Inter-unit connections are made so that the amplifiers can be tested in their operational rack modules without the possibility of errors caused by ground loops within the test setup. Included are a pair of strip-chart recorders for testing amplifier drift, a-c and d-c signal sources, meters and an oscilloscope for indication, and a precise test bridge for checking gain and phase relationships with different filters and loads. According to the manufacturer, it is possible to test eight amplifiers per hour. (Cohu Electronics, Inc., P.O. Box 623, San Diego 12, Calif.)

Circle 25 on Readers' Service card

**Strain-gage plotter** furnishes digital output for entry into computers. The system uses ten input conditioning modules of ten channels each. Any module may be eliminated from a data run by an on-off switch. The system may be programmed to stop on over-range to allow the operator to change ranges manually, or the system can read all channels and code those that are over range. Over-range conditions that require corrective action prior to the next run are indicated visually. Proper operation of the entire system is automatically checked before acquisition of data takes place. Fixed data may be entered by use of a parameter board. Outputs include a decimal lamp bank that provides continuous visual indication of varying data, a permanent recorder-produced analog record, a typewritten log sheet, and punched paper tape. (B & F Instruments, Inc., 3644 N. Lawrence St., Philadelphia 40, Pa.)

Circle 26 on Readers' Service card

**Clean room** is a mobile packaged unit complete with filtration, humidity- and temperature-controlled air conditioning, air shower, flush lighting, interlock, toilet facilities, and dressing room. The 500-ft area of the unit room can be expanded at any time, even during



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working hours, by attaching additional mobile units. Special facilities, such as shoe cleaners, vacuum cleaners, dust counters, sticky mats, fume hoods, and the like, can be factory installed. All filters and lighting bulbs are changed from the outside. (Controlled Atmosphere Enclosures Mfg. Co., P.O. Box 5864, Jacksonville 7, Fla.)

**Circle 27 on Readers' Service card**

**Continuously variable delay line** provides delay in the range 0 to 0.7  $\mu\text{sec}$  adjustable by means of a ten-turn screwdriver-slotted shaft. Resolution is said to be 0.001  $\mu\text{sec}$ ; rise time, 0.09  $\mu\text{sec}$ ; impedance, 500 ohms; attenuation, 1 db maximum; maximum distortion, 10 percent. (Valor Instruments, Inc., 13214 Crenshaw, Gardena, Calif.)

**Circle 28 on Readers' Service card**

**Preparative gas chromatograph** separates samples of up to 10 ml and recovers the separated components. The column is made up of straight sections of glass tubing 20-in. long by 1-in. diameter, connected in series by interchangeable connectors. The hot-wire thermal-conductivity detector used permits the use of nitrogen as carrier gas

without inversion of peaks. Samples are flash evaporated in a 600-ml chamber filled with metal granules kept at a temperature of up to 45°C. The column is in a thermostatically regulated oven that can maintain any operating temperature up to 150°C. Vapor leaves the apparatus through a manifold with five toggle valves, four leading into collecting traps immersed in coolant and the fifth vented. The operator actuates the valves to collect the separated components. (Fisher Scientific Co., Fisher Building, Pittsburgh 19, Pa.)

**Circle 29 on Readers' Service card**

**Transistor regulated power-supply modules** feature remote sensing and remote programming. The modules of two types provide outputs of 36 to 56 volts at 0 to 0.5 amp and of 56 to 72 volts at 0 to 0.5 amp, respectively. They operate on 115-volt (r.m.s.) single-phase input power at frequency of 55 to 400 cy/sec. Maximum ripple is 5 mv (peak to peak). Static regulation for load is  $\pm 10$  percent of line variation. Sensing leads, which are separate from the output leads, permit the unit to regulate against voltage variations at the load rather than at the output terminals. Recovery

time is 50  $\mu\text{sec}$ . Operation is continuous at 35°C derating linearly to zero at 75°C. Stability is  $\pm 0.2$  percent per day under laboratory conditions. Programming sensitivity is about 25 ohm/v. (NJE Corp., 20 Boright Ave., Kenilworth, N.J.)

**Circle 30 on Readers' Service card**

**Dual-gun oscilloscope**, with frequency response from d-c to 5 Mcy/sec, is a portable instrument weighing 22 lb. Identical amplifiers on each vertical input are said to provide identical traces over the full screen face with no phase shift. A preamplifier built into the lower vertical amplifier increases sensitivity from 100 mv/cm to 1 mv/cm. Sweep range is 1  $\mu\text{sec/cm}$  to 1 sec/cm. Both internal and external triggers are provided. (Packard Bell Electronics, 12333 W. Olympic Blvd., Los Angeles 64, Calif.)

**Circle 31 on Readers' Service card**

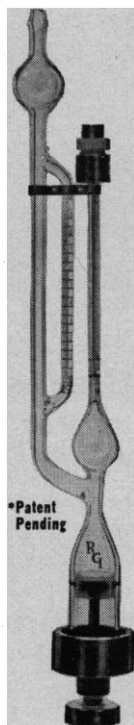
**Recorder** plots a function of time on an 8½- by 11-in. chart in the model HR-80 and on an 11- by 16½-in. chart in the model HR-87. The function axis is actuated by a null-seeking servo in response to a low-level d-c signal. The time axis is actuated by a synchronous motor. Stock motors, which plug in interchangeably, provide ranges from 10 sec to 15 min full scale. Motors with ranges up to 24 hr are available. Amplifier sensitivities are 1 and 10 mv/in. Accuracy is said to be  $\pm 0.5$  percent to 7 in./sec. on the function axis. Input impedance is 10,000 ohms with attenuator shunt. (Houston Instrument Corp., P.O. Box 22234, Houston 27, Tex.)

**Circle 32 on Readers' Service card**

**Paper electrophoresis equipment** for separation and identification of amino acids and peptides will take paper strips that are 4 ft, 3 ft, and 22.5 in. long and up to 20 in. wide. High-voltage power supplies with silicon diodes are available with the following ratings: 5000 volts, 300 ma; 2000 volts, 150 ma; and 150 volts, 50 ma. Other power supplies are available on request. (Servonuclear Corp., 28-21 Astoria Blvd., Long Island City 2, N.Y.)

**Circle 33 on Readers' Service card**

**Die-wear microscope** is capable of measuring die wear over a range of 0.020 in. with accuracy said to be  $\pm 0.0005$  in. or  $\pm 10$  percent of the depth, whichever is greater. The instrument can also be used for measur-



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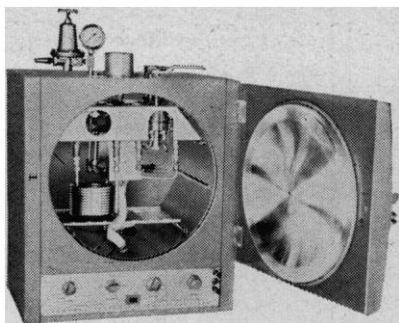
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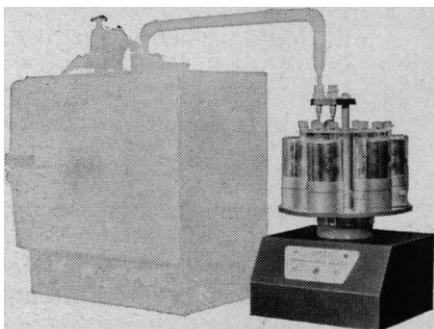
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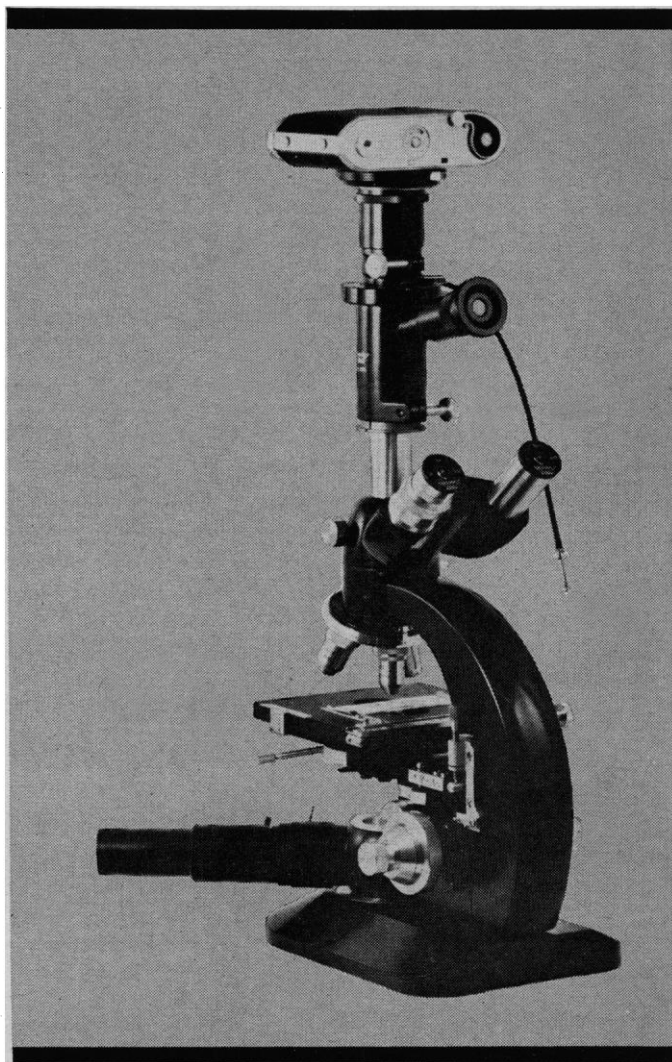
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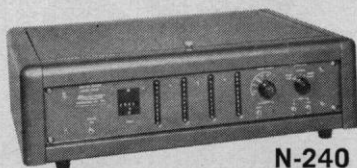
# Hamner Nuclear SCALERS



N-221

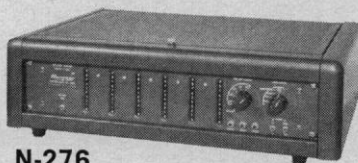
This versatile scaler performs a variety of functions. With various plug-in accessories it is a complete proportional, scintillation or GM counting system. By itself, it may be used as a system component.

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A Decade Scaler designed primarily for analytical systems requiring reliability, versatility and high speed. Positive or negative pulses, with an amplitude of 4 volts, selectable by a switch. 4 preset counts, from 10 to 100,000 also selectable by a switch. A Hamner N-850 or N-804 Timer may be used for preset time operation. Pulse pair resolution,  $1 \mu\text{sec}$ . 4 electronic decades permit a continuous repetition rate of 250,000 cps.



N-276

Ideal for high operating speed. Staircase output, compatible with HP-560A Printer, provided. 1-2-2-4 BCD code available (slight extra cost) for other types of automatic data handling accessories. The N-276, which has a pulse pair resolution of  $1 \mu\text{sec}$ , and may be operated at a continuous rate of  $10^6$  cps, has the same input requirements as the N-240. Choice of 15 preset counts, from 10 to 500,000. Provisions made for preset time operation, with a timer such as the Hamner N-803. Combined preset time-preset count operation, in which the first event to occur stops the counting system, also provided.

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ing bevels, burrs, and fillets. A hardened and ground guide at the front of the instrument contacts the die edge to be measured, automatically positioning the microscope for best viewing. The guide can be used in holes as small as  $3/32$  in. in diameter or in slots  $3/16$  in. wide. (Bausch and Lomb Inc., Rochester 2, N.Y.)

Circle 34 on Readers' Service card

**Digital recorder** is a transistorized, electromechanical device that can print up to five 11-digit lines per second. A storage feature allows data transfer to the recorder in 2 msec, after which the driving source is released to gather more information. Internal connectors route parallel-entry data to any desired digit, and different input codes may be used for each digit. (Hewlett Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.)

Circle 35 on Readers' Service card

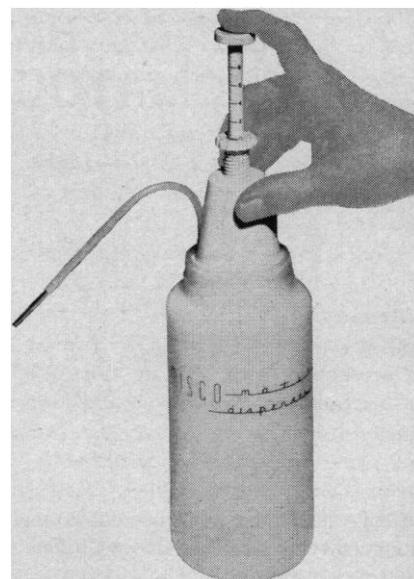
**Closed-circuit television comparator** permits examination with magnification up to 300 times. Using a single aircraft-type control stick, the operator can position the image on the screen of the cathode-ray tube and change magnification through the entire range without loss of focus. An accessory permits measurement of an object or any portion of it. (General Precision, Inc., 63 Bedford Rd., Pleasantville, N.Y.)

Circle 36 on Readers' Service card

**Square-wave power sources** are solid-state devices that feature a square-wave output of 6 v amp with rise time said to be less than 250 nsec and symmetry within 500 nsec, when driven by an external sine-wave signal or a built-in source. Output voltage is adjustable between 0 and 60 v (peak to peak), with regulation 0.5 percent from no load to full load and 0.1 percent from half to full load. The instruments furnish a single fixed frequency within the range 50 cy to 20 kcy/sec. Other models will provide 100 v amp output and 50-cy to 50-kcy/sec frequency range. (International Electronic Research Corp., Burbank, Calif.)

Circle 37 on Readers' Service card

**Portable strain-gage indicator** provides digital readout and increased gage-factor range. Strains are read directly as the sum of the digital-counter indication and an "add-to-reading" setting. The latter provides 12 intervals from 0 to 60,000  $\mu\text{in./in.}$ , and the counter reads from 0 through 5000  $\mu\text{in./in.}$  in



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Circle 38 on Readers' Service card

**Memory storage unit for analog computers** stores answers to problems for presentation at a later time when the operator wishes to compare new values with those previously computed. This analog-computer component is a transistorized device about half the size of a carton of cigarettes. Two values can be stored in each memory unit for future recall. Up to ten of the units can be plugged into the manufacturer's Pace 231R general-purpose analog computer without disturbing the use of existing summing amplifiers. (Electronic Associates, Inc., Long Branch, N.J.)

Circle 39 on Readers' Service card

**Power supply with overvoltage protection** is a transistorized device that provides regulation within 0.01 percent from zero to full load and for 10-percent line change and 1-mv ripple. Automatic cutoff is said to operate in 50  $\mu\text{sec}$  for internal or external malfunction causing short circuits, overloads, overvoltages, transients, surges, and the like. Overvoltage protection is provided down to 0.5 volt above the set point. A pushbutton switch permits reset. (Systems Research Corp., P.O. Box 251, Northridge, Calif.)

Circle 40 on Readers' Service card

**Line driver** is designed for distribution of a locally generated, amplitude-modulated, time-code signal over a land-line distribution system to remote instrumentation sites. The instrument, model No. EECO-863, is a 12-channel buffer amplifier designed primarily for use with a-c signals in the frequency range 100 to 20,000 cy/sec. Each of the 12 channels has a high-impedance input and a balanced low-impedance output. (Electronic Engineering Company of California, 1601 E. Chestnut Ave., Santa Ana, Calif.)

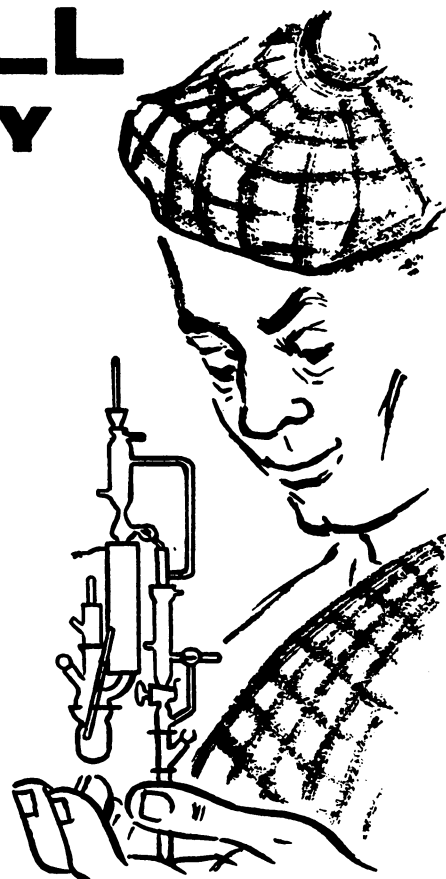
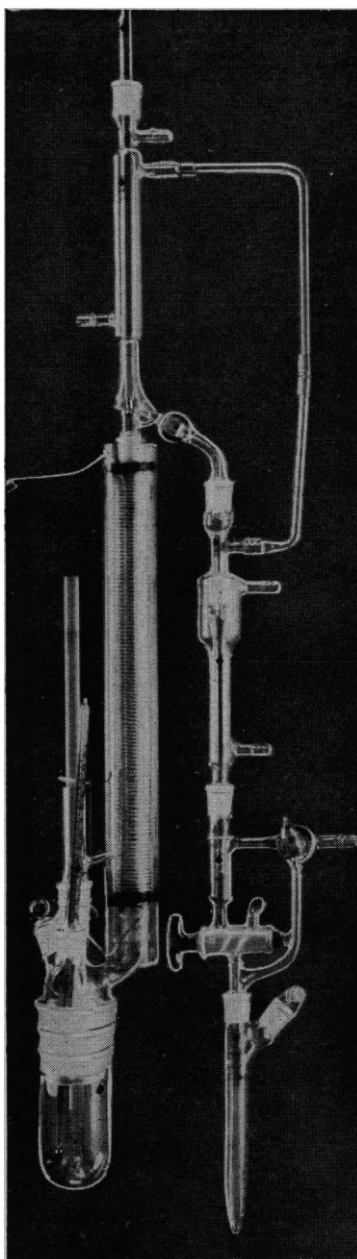
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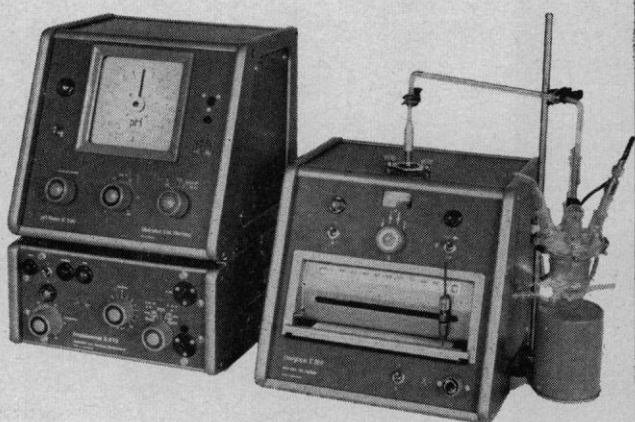
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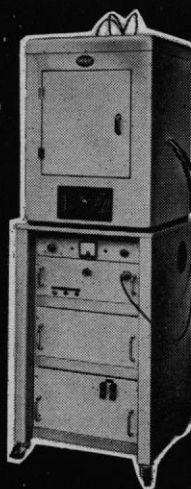


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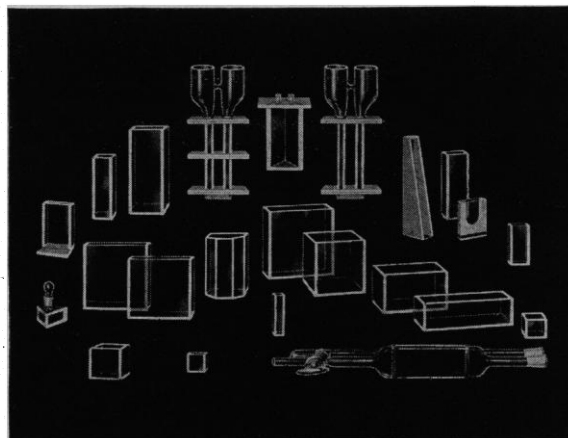
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inated with oral vaccine do spread virulent virus to contacts soon thereafter." Since this was the only place in my article where the consequences of spread to contacts could have been appropriately discussed, I should have explained more forcibly the significance of the fact that vaccinated persons do not spread vaccine virus to contacts but spread progeny virus which may be virulent, especially as shown for type III. On the occasion of the 5th International Poliomyelitis Congress in Copenhagen in July 1960, Gard expressed the feelings of many at the Congress in the following words: "The unquestionable capacity of live vaccine virus to spread in the community by contact infection is considered by some to be advantageous as a means of immunizing a larger fraction of the population than was actually vaccinated. To others, including myself, it represents a hazard, as Dr. Francis [Thomas Francis, Jr.] has just pointed out, as do all procedures over which we cannot exercise full control."

Edsall's comments on efficacy seem to me to support my contention that the Council report repeatedly understated the capabilities of the formalized vaccine while presenting the most optimistic view of the oral vaccine. I must especially object to the implication that three doses of formalized vaccine represent the accepted schedule, since four doses have been recommended for several years and this course is accepted as standard. He also omits mention of the fact that the two types of vaccine cannot be compared as to efficacy until good field data on live poliovirus vaccine are available.

His comments on the acceptance of oral vaccine in community-wide programs indicate that he has missed this crucial point altogether. The data needed before one could reasonably expect a successful result in a nationwide mass immunization program would indicate the proportion of nonimmunized individuals in a community who fail to respond to the program. A sweeping proposal such as that of the AMA should have awaited the results of surveys such as that now in progress in Harrisburg.

Edsall's final comments are puzzling, unless they are interpreted as evidence of pique on the part of a member of the Council on Drugs, rather than considered opinion. It seems obvious that my article was not intended to be a review of the extensive literature on formalized or live poliovirus vaccines,

but rather a clarification of issues and literature overlooked in the Council's report. He continues with the wholly unwarranted comment: "Bodian states that the introduction of a new vaccine under these circumstances would be unscientific." On the contrary, my criticism was of the premature call for a "change-over," of poorly presented comparisons of the properties of the two types of vaccine, and of the course of action proposed. My statement clearly focuses on the manner of introduction of the new vaccine: "the proposal

to introduce live oral poliovirus vaccine by means of country-wide mass immunization programs is irresponsible in the sense that such a procedure would eliminate the possibility of a definitive evaluation of either vaccine in this country, and moreover is unlikely to accomplish more than can be accomplished by a more conservative approach."

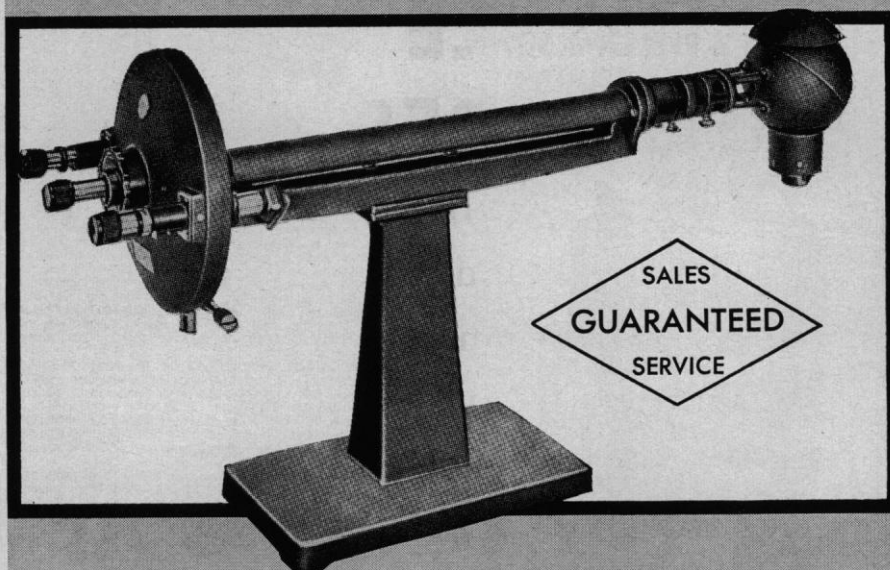
As a member of the Ad Hoc Committee on Live Poliovirus Vaccine, I recommended licensing of Sabin's type I oral poliovirus vaccine to the Surgeon

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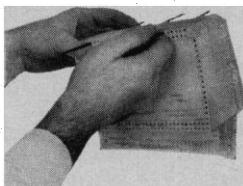
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General of the U.S. Public Health Service. I did not recommend the licensing of Sabin's type II vaccine, which fulfilled all the purely technical requirements, because of doubts about the effects of uncontrolled widespread use of type II on the efficacy of the type I strain. Since I have devoted as much committee effort on behalf of the live poliovirus vaccine as I have on behalf of the formalinized vaccine, I cannot take seriously an implied charge relating to the "inhumane" aspects of "withholding" a new vaccine. My article did not plead for inaction but for more considered action, which would make possible a continued attack on paralytic poliomyelitis. The existing evidence clearly indicates that the residual poliomyelitis problem in this country will be solved not by reimmunizing the adequately immunized, which is obviously going to be the major effect of mass programs sponsored by local medical societies, but by directing an equivalent effort to immunizing the nonimmunized. The particular vaccine used is a secondary issue, perhaps, but the energetic use of the formalinized vaccine would have made possible a better evaluation than will be possible with the now inevitable use of both vaccines. Edsall's experience with typhoid vaccine should convince him of the practical as well as the scientific importance of adequate evaluation of public health procedures.

DAVID BODIAN

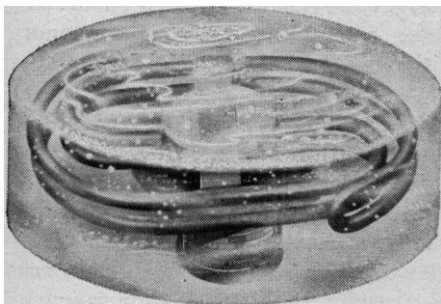
*School of Medicine, Johns Hopkins University, Baltimore, Maryland*

### Inheritance in Soviet Medicine, Psychology, and Education

In a recent letter entitled "Soviet commitment to Lysenkoism" (1), Lincoln Pettit, discussing the influence of Lysenko on "other areas of knowledge" in the U.S.S.R., writes: "in the fields of education, psychology, and medicine, inheritance is ignored. Aptitude tests are unusable; deafness, mental disorders, and low intellectual capacity are attributed, respectively, to accidents, birth trauma, and laziness." This statement is so sweeping and so much at variance with my own information that a documented perusal of the topic would seem to be in order.

1) No mention at all is made of Lysenko or of inheritance of acquired characteristics in the closely documented and well illustrated 56-column ar-

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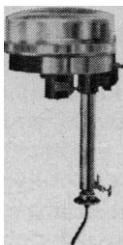


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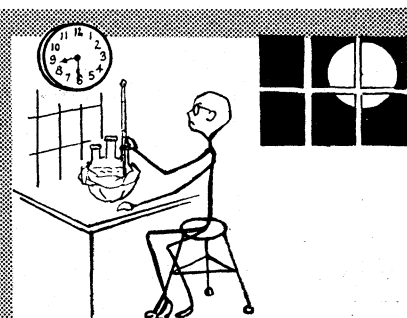
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ticle "Human inheritance" in volume 19 of the *Bol'shaya Meditsinskaya Entsiklopediya* (Large Medical Encyclopedia), published in 1961. Instead, we find in the article—in the midst of a thorough discussion of the main tenets and findings of classical genetics, including 30 references to the most recent American and Western publications—a listing, classification (by dominant, recessive, and sex-linked characters), and description of 87 inherited diseases. Deafness is one of the 87, and what is said about it is this: "Early total deafness leading to deafmutism is in the overwhelming majority of cases inherited autosomally and monorecessively. There are several different genes independently capable of producing deafness. Sex-linked deafness occurs more rarely. About half of the cases of deafness are inherited, the other half being caused by various external factors. The incidence of inherited deafness is about  $2-3 \times 10^{-4}$ . Late otosclerotic deafness is inherited dominantly" (2).

There is no entry for Lysenko in the *Entsiklopediya* (vol. 16, 1960), but there is an entry of two columns on Mendel (vol. 17, 1960), and there is one of a column and a half on T. H. Morgan (vol. 19, 1961).

2) Feeble-mindedness is defined in the 1958 *Uchebnik Psikhatrii* (Textbook of Psychiatry) by Kerbikov *et al.* as follows (3): "By oligophrenia (feeble-mindedness) we mean forms of underdeveloped mentality which are either innate or acquired in early childhood and which, while different in etiology and pathogenesis, are to a considerable extent similar in their clinical symptoms. Oligophrenia is a collective concept and not a uniform clinical unit." And current Soviet views on mental abilities are summarized by Leytes in 1960 as follows (4): "Abilities as such are not given to us ready-made at birth. Native capacity or talent is significant but is only one of the factors in the complex process of the development of abilities. . . . Characteristics of types of nervous systems are the innate basis of psychological differences among individuals." Needless to say, the two statements are a far cry from a view that in the U.S.S.R. "low intellectual capacity" is "attributed" merely to "laziness." (Note, however, that inadequate stimulation, particularly in early childhood, may well be a cause of mental retardation.)

3) Present-day Soviet psychology and psychiatry are, as is known, wholly Pavlovian in outlook. A basic tenet of the outlook is Pavlov's doctrine of con-



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stitutional types of nervous systems as determined by innate strength, mobility, and balance of neural excitation and inhibition. In recent years, the "types" doctrine has been much extended by B. M. Teplov, the editor of *Voprosy Psikhologii*, and his many followers to include analysis of human personality structures—an extension and an analysis which, I venture, would, among other things, be much too hereditarian for the majority of our personality psychologists. Likewise, as might be suspected, the Russians make wide use of

Pavlovian types of nervous systems in etiological psychopathology. There is absolutely no evidence that they "attribute" mental disorders to "birth trauma" (whatever Pettit means by it) more frequently than we do.

4) Not a single statement on the inheritance of acquired characteristics appears in the panoramic 2-volume, 1656-page, 39-article survey of current Soviet psychology, *Psikhologicheskaya Nauka v SSSR* (The Science of Psychology in the U.S.S.R.), published in 1959 and 1960 (5). Nor did the topic arise,

formally or informally, in the recent 3-day Pavlovian Conference on Higher Nervous Activity (6), in which six prominent Soviet psychophysicists and psychiatrists participated. There is only one short reference to behavioral experiments on inheritance of acquired characteristics in the long, informal, and very specific report on the state of current Soviet psychology made by three outstanding American psychologists who visited the U.S.S.R. in the summer of 1960—a largely negative reference: The Soviet experimenters told the American psychologists that so far no evidence of such inheritance was found (7). Likewise, I noted no significant Lysenkoist trends among psychologists and psychophysicists in my visit last summer. Indeed, a number of Soviet scientists have written to me to express agreement with an article, "Pavlov and Lamarck" (8) in which I argued that Pavlov was not a Lamarckian. I have heard no disagreement.

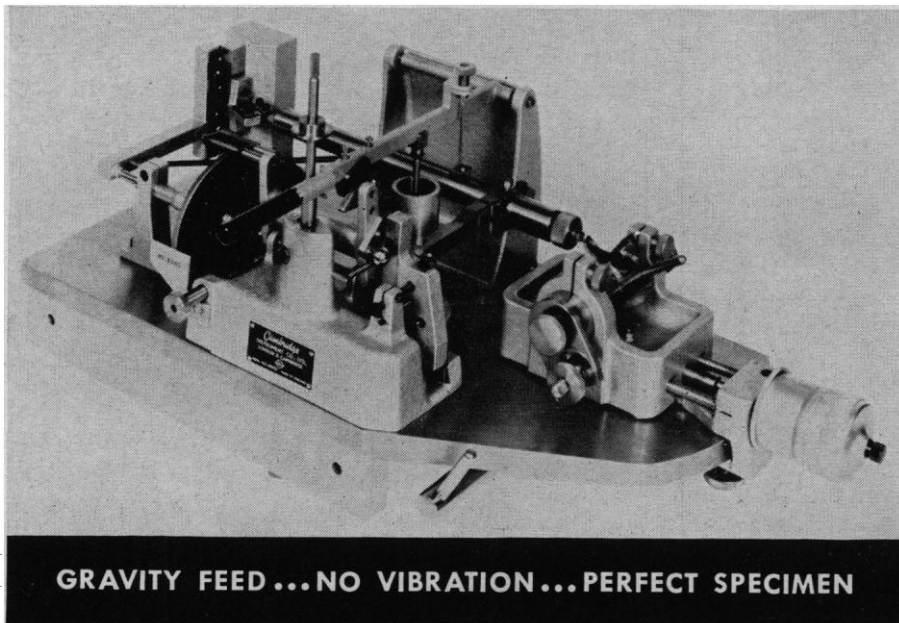
5) Intelligence testing was discontinued in the Soviet Union in 1936, years before Lysenko's star had risen. It was discontinued, as is well known, in the wake of a resolution by the Central Committee of the U.S.S.R. Communist Party on "Pedological Inversions." The event was, by all tokens, a result of a complex of causes, involving largely such problems as putative interference with ideals of ethic and occupational equality, alleged dangers in creating I.Q. castes, validity of the tests, teacher responsibility, best ways of accelerating education, and the like. General views on heredity and environment were, to be sure, also operative, but really much more in relation to ease of modifying native endowment than to denials of its existence. To reduce it all to the simple formula that giving up intelligence testing leads to giving up the role of heredity in educability is quite fallacious, if for no other reason than that one may be a 100-percent Lysenkoist and believe that mental tests have much merit or be a 100-percent hereditarian and discredit them. Incidentally, it is my impression that there are signs that, in a modified form and a different framework, psychometrics may again become a part of Soviet psychology.

What has been said so far should suffice to demonstrate that whatever direct influence Lysenko may have on present-day Soviet genetics per se—and I am quite sure that Pettit greatly overestimates this influence (though space permits no documentation)—the indirect effects of Lysenkoism on present-

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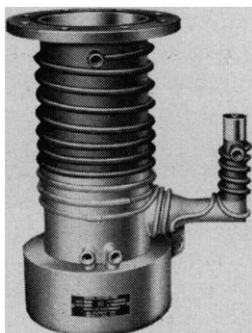
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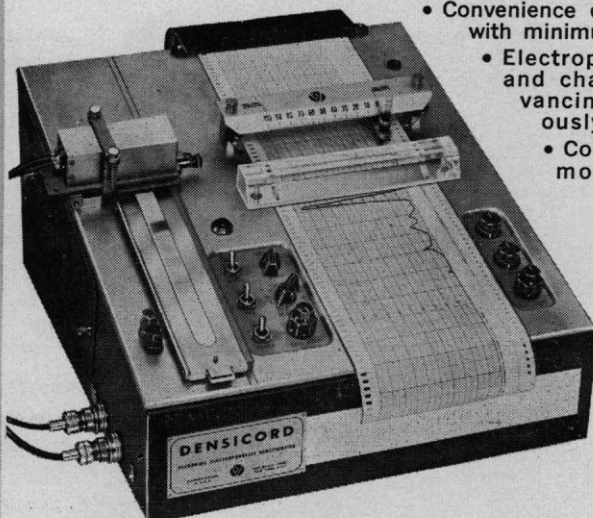
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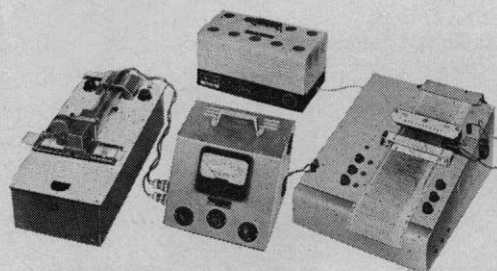
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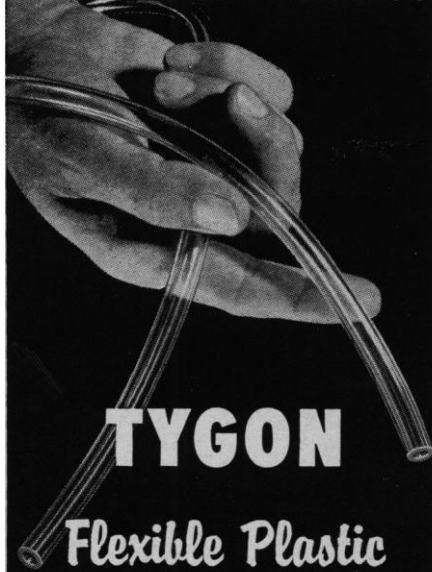
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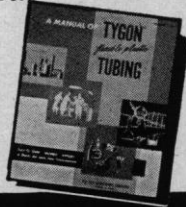
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day Soviet medicine, psychology, and education are quite limited (9). The fact that there is no entry for Lysenko in the *Bol'shaya Meditsinskaya Entsiklopediya* while there are substantial entries for Mendel and Morgan, and the lack of any discussion of the inheritance of acquired characteristics in the encyclopedic *Psikhologicheskaya Nauka v SSSR*, are by themselves highly indicative. The role of inheritance is surely not ignored in present-day Soviet medicine, psychology, and education—indeed, the emphasis may well be comparable to what it is in the United States. The quoted statements on deafness, amnesia, and mental abilities are hardly distinguishable from American homologs, while differences between Soviet and American psychiatry are not within the bounds of the heredity-environment problem. Not once have I come across, in recent Soviet educational and psychological writings, sharp criticisms of “sociologism”—overestimation of the role of environment in training and education—alongside criticism of “biologism”—the tendency to overestimate heredity.

Finally, it might be noted that, at least historically, environmentalism is by no means a Marxist-linked position. I know of no Soviet psychologist who would fully subscribe to the dictum of the late John B. Watson, founder of American behaviorism and long vice president of J. Walter Thompson and Company, that, given any healthy baby whatsoever and his (Watson's) own specified world to bring it up in, he could train it to become “doctor, lawyer, artist, merchant-chief and, yes, even beggar-man and thief, regardless of his talents, penchants, abilities, vocations, and race of his ancestors” (10).

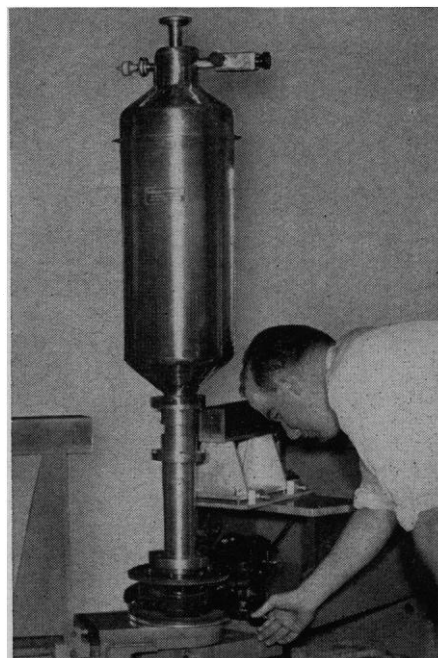
GREGORY RAZRAN

*Department of Psychology,  
Queens College, Flushing, New York*

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6. *Ann. N.Y. Acad. Sci.* **92**, 813 (1961).
7. N. E. Miller, C. Pfaffman, H. Schlosberg, personal communication.
8. G. Razran, *Science* **128**, 758 (1958).
9. One finds, to be sure, a number of general

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Lysenkoist statements in the literature of the three fields in the late 1940's and early and even middle 1950's. However, on the one hand, these statements seem to be rapidly disappearing from present-day writings, and on the other, there is no evidence that in the fields under discussion the statements were ever anything more than formal lip-service, without significant relation to concrete research and practice.

10. J. B. Watson, *Behaviorism* (Norton, New York, 1924).

## Communication Satellites

The entirely reasonable point of view expressed in your news note "Space communications" [*Science* 133, 1812 (1961)] elicited from a Bell System executive, J. R. Pierce, a quite misleading criticism [*Science* 134, 527 (1961)].

It is misleading to say, as Pierce has on several occasions, that to stop to consider the issue of who should own and control communication satellites implies delay in achieving the technological triumph of an operative communication satellite system. Granted that speed is essential, it happens that public ownership of communication satellites is consistent with the earliest and most urgent use of such satellites—that for national defense. The Advent program (a synchronous, equatorial system) for the military is just such a project, built by private contractors for government ownership and control. Surely the less urgent civilian uses of communication satellites will not be delayed if a similar ultimate ownership and control situation is considered while the satellites are being perfected under private contract.

Pierce asks, "Must the very first satellite communication system connect us with all the underdeveloped countries, where internal communication itself is poor? How long should we wait to make sure that these will be included? Until the Russians have satellite communication first?" This is typical of the misleading arguments on this issue advanced by Pierce and his associates.

If the highest priority communication satellite system now under development in this country—and also in the Soviet Union—namely, the Advent system, proves operational, it will permit but not require interconnection between points in any countries of the world. This includes all the underdeveloped countries as well as the United States and countries in Western Europe where the transoceanic communication facilities are presently overburdened and inadequate. Unlike the low-altitude satellite system which Pierce favors,

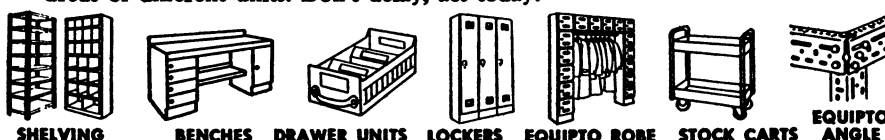


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### REFERENCES:

- (1) Goldthwait, D. A.: Nucleic Acids and Cancer. Amer. J. Med., XXIX, 1034-1059, 1960.
- (2) Herriott, R. M.: Infectious Nucleic Acids, a New Dimension in Virology. Science, 134, 256-260, 1961.

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however, the synchronous satellite system does measure up to the second policy "requirement" stated by President Kennedy in his remarks on national policy on communication satellites, 24 July 1961: "Make the system global in coverage so as to provide efficient communication service throughout the whole world as soon as technically feasible, including service where individual portions of the coverage are not profitable." It also fits the concluding sentence of that policy statement, in which the President expressed his desire that "development of this new technology to bring the farthest corner of the globe within reach by voice and visual communication, fairly and equitably available for use, proceed with all possible promptness."

As against this, the low-altitude system which Pierce is developing is suited to a *limited* service. Because of their low altitude, between 40 and 50 satellites would be needed to link *by pairs* the major communication centers of the world. Because of the rapid revolution of these satellites around the earth, expensive tracking and movable-antenna equipment, in duplicate or triplicate, would be needed at each of the ground stations. The rigid barrier to multilateral global use of communication satellites which this Bell System plan would impose is evident from testimony by Herbert Trotter. He points out that with the low-altitude system, if each of only ten surface points were to be equipped to communicate *directly* with the other nine, more than 400 satellites and at least 180 large moving antennas and associated tracking equipment would be required.

Pierce, both in his letter in *Science* and in his article in the May issue of the *Bulletin of the Atomic Scientists*, tries to give the impression that technology gives a mandate to the Bell System to which the economic and political institutions of our world should render dutiful obeisance. "Non-technical obstacles," "political monsters," and the like lead to "embroilment" of scientists in "windy, empty, but terribly dangerous debate."

Thirty-five Congressmen, however, in their letter to the President of 24 August, have undercut this rather arrogant position. Noting that a number of different types of communication satellite systems are now in the research and development stage, they observe that we do not know which system can be put into use first or which will be most efficient. Given this technological un-

certainty, the complicated issue of ownership and control is even more uncertain. Prudence, they urge, requires a further investigation of the broadest aspects of the ownership question. They support the conditions set forth in the Presidential policy statement and condemn the Federal Communications Commission's efforts to create a consortium, dominated by the Bell System, as "contrary to the policy established by you . . . [and] contrary to the principles of the antitrust laws." They request that no decisions concerning ultimate control be made until the entire system becomes fully operational. And they propose that during the interim, while all possible speed is made on research and development contracts, all possible questions of international agreement, cooperation, control, and ownership related to other nations and the United Nations be thoroughly explored. This proposal would seem to make good sense to anyone not blinded by the interests of private privilege.

DALLAS W. SMYTHE  
*Institute of Communications Research,  
University of Illinois, Urbana*

In the letter on which Dallas W. Smythe comments I criticized what seemed to me to be a rather misleading account of the satellite situation. Since Smythe has raised somewhat broader issues, I think it only fair that in reply I should state my views (which are not necessarily those of other Bell System employees).

The first step in satellite communication should be to meet real and pressing human needs by providing more circuits between our own country and other countries which have highly developed communication systems. An extension to less technologically advanced countries could follow quickly with either high or low satellites, despite the peculiar figures ascribed to Herbert Trotter, which are misleading if nothing else. Today, by means of Bell System and cooperating foreign facilities, you can call over 160 different political areas, and it seems to me ridiculous to believe that the Bell System would abandon this policy of widespread telephone communication if it were allowed to use satellites as well as cables and short-wave radio.

I favor any sort of satellite that can provide useful, practical communication first. We still have much to learn, and we may learn a great deal, not only through Advent but also through

NASA's Relay and Syncom satellites and the Bell System's Telstar I satellite, all to be launched in 1962. Certainly we'll have synchronous satellites, but lower-altitude satellites may come sooner, and according to W. Meckling [*Science* 133, 1885 (1961)] they may even be more economical.

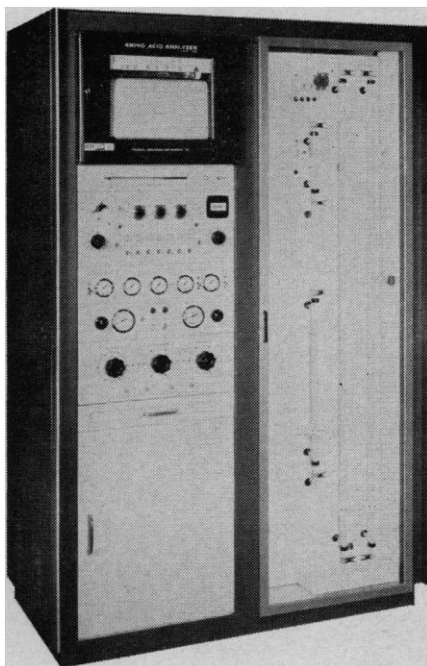
In regard to the use of satellites, the Bell System finds itself in a novel and peculiar position. In the past the Bell System has been able to use any new science and technology that would give better and cheaper communication. Sometimes the science and technology have been of Bell System origin (for example, the transistor and the negative-feedback amplifier) and sometimes of outside origin (the triode and the traveling-wave tube). In this way the communication provided by the Bell System has steadily improved, through such advances as automatic switching, multiplex transmission, coaxial cable, microwave radio relay, long- and short-wave transoceanic radio, and submarine telephone cables. It seems to me that it would be very unfortunate if the Bell System, which has shown itself very effective in improving communication through new science and technology, should be denied any new science and technology that could be used to improve its service, and I include the science and technology of space. I believe that thinking of a particular area such as space as in some way set apart from the rest of science and technology is wrong and a bar to progress.

The uncertainty as to whether or not telephone systems, here and abroad, will be allowed to incorporate satellites as well as short-wave radio and transoceanic cables into their pattern of international communication will, if it persists, discourage research and development of satellite communication by those most skilled in the art. And, if those who now provide international communication are not allowed to operate satellite communication systems, who will? I find it hard to believe that an entirely new organization, whether under the control of the United Nations or the Government of the United States (would the latter be acceptable to other nations?), can be brought quickly and harmoniously into operation. But perhaps 35 Congressmen can work miracles that are beyond the understanding of this one somewhat bewildered engineer.

J. R. PIERCE

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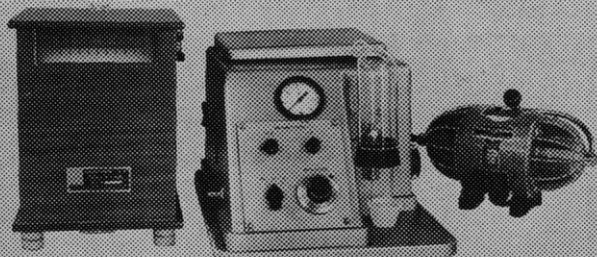
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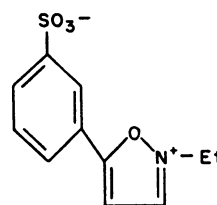
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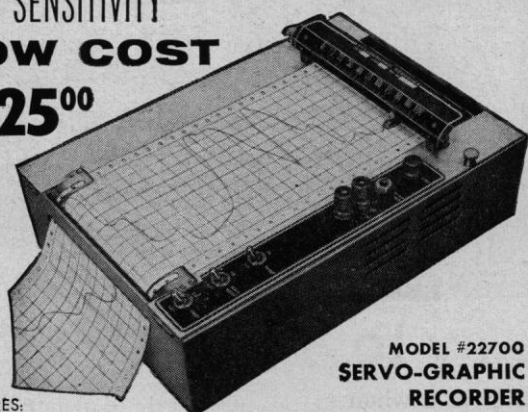


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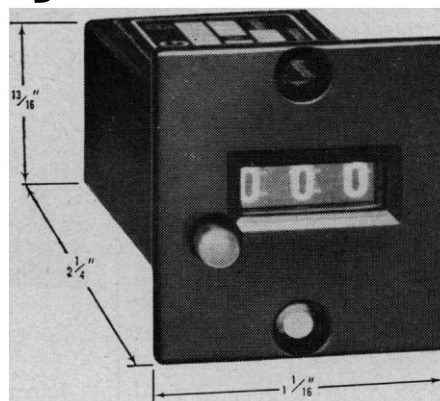
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## Principles, Politics, and Patent Policy

In a discussion of the Kefauver drug bill in "Science and the news" (1), your commentator concludes with the statement: "the basic issue at this point in the drug inquiry [is] . . . What is the relationship between the patent system and the economics of research and how would that relationship be affected by the senator's proposed revision?" Your commentator has not dug deeply enough and has limited his question to a very small part of a series of incidents bearing on the patent system.

The Supreme Court of the United States has always regarded (2) the grant of a patent as a reward to one who has benefited the public by a novel creation. The Constitution of the United States, as a basis of our patent system (3), sets out the inducement for such reward.

The reward theory is based on the apparent and well-established belief that an inducement for early disclosure outweighs any disadvantage in according a property right for a limited number of years (4). Other industrial countries, such as the Netherlands, Switzerland, and Germany—after much debate and vacillation (5)—have followed the lead of the United States in recognizing this principle.

In more recent years, members of one school of thought have been vociferous in direct or indirect attacks on this principle. These attacks have appeared in many forms, such as denial that a patent constitutes a personal property right; allegations that the grant of a patent takes something away from the public; and insistence that there must be commercialization of patented subject matter for a patent to continue to be effective, that patented subject matter should be shared with commercial competitors, that selected industries should be circumscribed in obtaining or using patent rights, that areas of invention, apart from private initiative and enterprise, should belong to the government, and that even partial contribution of government dollars to private efforts in research or development should be cause for depriving private enterprise of potential patent rights. Some in this school would go even further by proposing that earlier independent patent rights and accumulated know-how be swept in, on one basis or another, insofar as they relate to the subject matter under consideration.

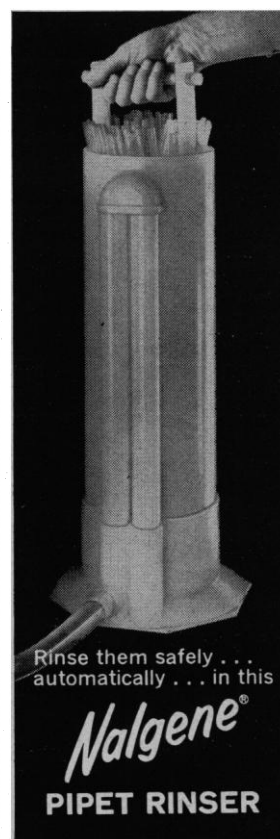
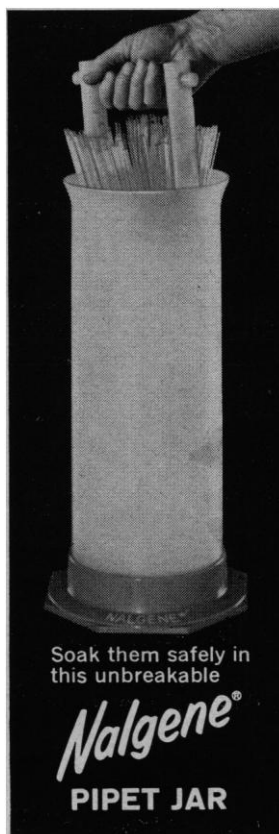
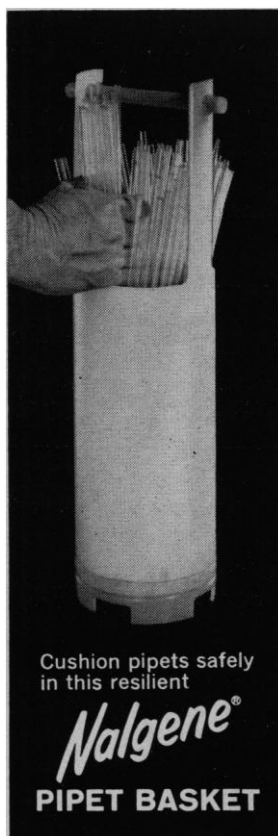
All things considered, there are ever-increasing signs of mounting attacks on

the U.S. patent system and of desire on the part of individuals to eliminate or whittle down the reward motive supportive of the patent grant. In enlisting the support of some legislators, certain politicians and economists, by their testimony or writings, make it abundantly plain that they are moved more by emotional attitudes or academic beliefs than by facts. Actual and proposed legislative acts in response to such motivation can only serve to prevent the public from obtaining the benefits of early disclosure.

It is time, if not past time, to revert

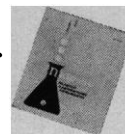
to fundamentals. What is the main drive behind these attritional legislative acts or proposals? Who can be expected to benefit from them? Is the public aware that patent legislation is becoming more and more a form of punishment rather than of reward? Is it clear that pending proposals to charge more for patent applications, to add new taxes on patents, to limit the life of selected patents, to require that patent assets be shared, and to deny grant of, or title to, patents in prescribed areas are all forms of penalty?

The attritional effect, besides affect-

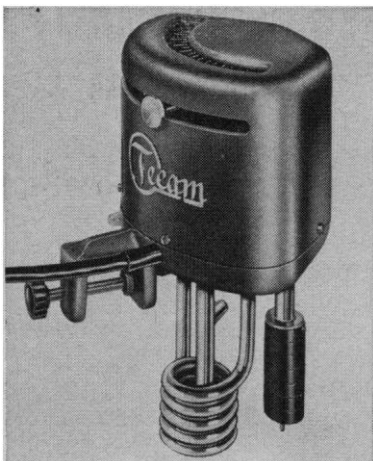


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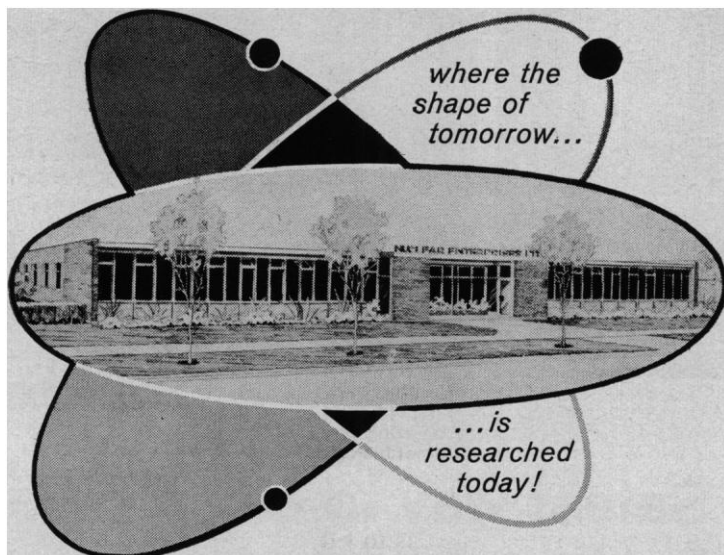
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ing industrial concerns, will be felt in time by the individual inventors. In the case of free-lance inventors, their burdens will be increased and their incentives lessened. In the case of inventors within industrial establishments, it may be predicted that they will have fewer opportunities to disclose and to receive new knowledge, and that the stimulation and challenge supplied by the patent system as originally conceived and constituted will thus be diminished.

In "Patents and the corporation (1958)," a report by students at the Harvard Business School, there is reference to a survey which was undertaken of 288 U.S. corporations. It is clear from this report that the importance of a patent varies with the branch of industry, the stage of growth of the company, and the proposed end use of the patent. Seven out of 91 companies indicated that patent protection plays a very important role in their decision to undertake research and development, while a majority indicated it was of some significance. Thirty-four of these companies named profits gained through exclusive sales of products developed through research and development as a most important source of revenue for supporting research and development programs, while 14 named such profits as a second most important source of revenue.

Let us consider the case of compulsory licensing on a reasonable royalty basis. According to the report cited above, out of 91 companies, 18 would decrease their research and development effort under such legislation, three would discontinue their effort, and 21 would patent only inventions which would necessarily become known to competitors. The willingness to undertake research and development would lessen with increase in the need to rely upon secrecy.

Since technological secrecy results in a serious waste of scientific manpower and since an overall reduction in the research and development effort has an inhibiting effect on advances into new channels of inquiry, the price paid for the changes proposed in the patent system would be too high.

To put it mildly, it is time to ask whither are we bound. It is time to oppose legislative proposals that emasculate, step by step, our patent system. It is time to stop changing our patent system into one that is punitive and/or one that involves increasing risks. The present steady erosion of our patent sys-



tem can only lead, in time, to its eventual demise and to the loss of its favorable effects. Thus, through inaction, the system can be destroyed by proponents of unproved economic or social theories. Let us make sure that reason and reward prevail, instead of revolutionary revision and punitive measures.

A. B. BAKALAR

Shell Development Company,  
Emeryville, California

#### References

1. *Science* 134, 1349 (1961).
2. *Seymour v. Osborne* (1870).
3. *U.S. v. Dubiler Condenser Corp.* (1933).
4. *Pennock and Sellers v. Dialogue* (1829).
5. G. Doorman, *J. Patent Office Soc.* 30, 225, 258, 347 (1948).

#### Diet and Fallout Hazards

Over and above the long-term hazard from long-lived isotopes, such as strontium-90 (half-life 28 years) and cesium-137 (half-life 33 years), there is the more immediate hazard from a number of short-lived isotopes, such as, for example, iodine-131 (half-life 8 days). It is the purpose of this letter to suggest a relatively simple modification in the dietary pattern that will appreciably reduce the hazards from the short-lived isotopes.

A large part of the radiation from fallout isotopes consists of  $\beta$ -radiation. Because of its short range,  $\beta$ -radiation becomes of significance primarily when ingested in food. Because the  $\beta$ -radiation is thus incorporated in human tissue, its short half-life becomes a hazard rather than a help, since the radiation is concentrated in the immediately surrounding tissue. Further complication is provided by the body's inclination to concentrate certain elements in specific tissues. Many of these tissue-radioisotope links are known (the concentration of iodine by the thyroid is a good example). Others, however, may yet be discovered. The hazard arises from the abnormal concentration of an isolated isotope in a small tissue mass.

A considerable reduction in the radiation hazard from short-lived isotopes can be achieved by simply taking advantage of the short-lived nature of the radiation. As an example, iodine-131 has a half-life of 8 days. This means that in 56 days the radiation is only  $(\frac{1}{2})^7$ , or  $1/128$ , its original value.

The solution, therefore, involves a simple modification of the established nutritional pattern of eating foods that are as fresh as possible to a pattern of

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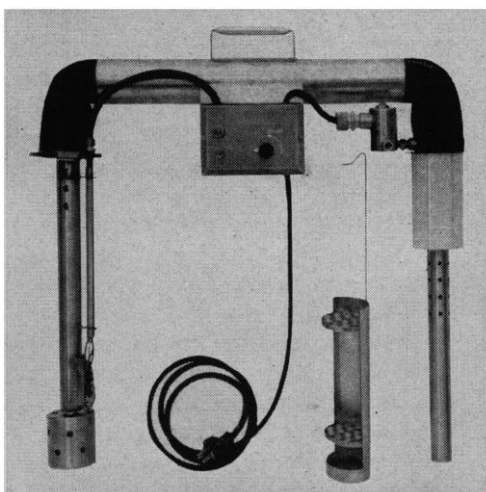
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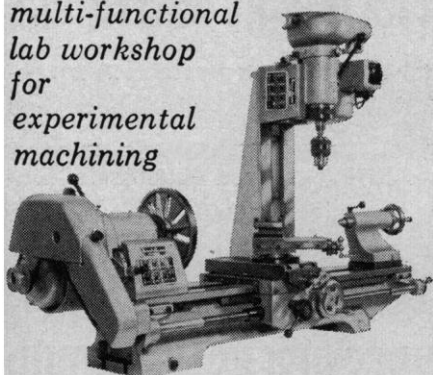
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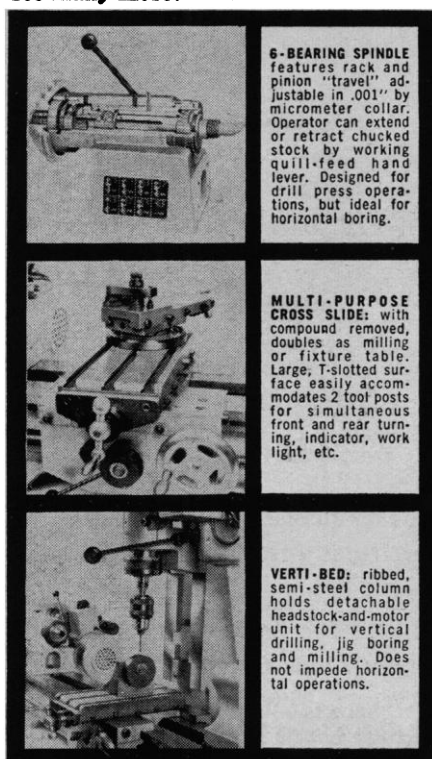
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eating foods that have been stored as long as practicable. For many foods available in frozen or canned form, this presents no real problem. For others, such as fresh milk and rapidly growing and perishable fresh vegetables, the solution is to minimize or eliminate these from the diet until the present rash of atmospheric nuclear tests has ceased. Fortunately, the great majority of fallout isotopes are short-lived. Only a few, such as strontium-90, cesium-137, and carbon-14, are long-lived. These latter present a problem not so readily solved.

H. A. POEHLER

Eau Gallie, Florida

## Welfare Agencies

I am writing in connection with the brief notice [*Science* 134, 1058 (1961)] regarding the Rockefeller Foundation Report entitled "Voluntary Health and Welfare Agencies in the United States," in which you say the report states that voluntary health and welfare agencies "often compete wastefully among themselves." You further say, "The agencies, the report states, do much good but often fail to tell the truth about their programs and financing" (italics mine).

I know it is difficult to excerpt from an 88-page report and condense it accurately, but I think that your negative statement fails to touch the true emphasis of the report. The significance of this report, in my estimation, is that it shows the tremendous participation of the American public in voluntary health and welfare activities, and shows an increasing financial support from the public. The report calls for measures which would essentially introduce more standardization, better methods of evaluation, and greater application of management principles to agencies that have grown through the philanthropic impulses and personal concern of the American people. In my 22 years in this field I have found that most agencies have done everything possible "to tell the truth about their programs and financing" but that they have a practical limitation in that they attempt to put as much of the contributor's dollar as possible into carrying out the programs rather than telling about them. I would certainly commend the report to all of my fellow readers of *Science*, and I believe it will have a profound effect upon this field for many years to come.

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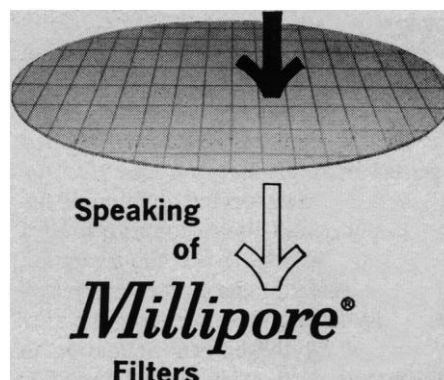
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Applied Microbiology, 9:376-379, September

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SCIENCE, VOL. 135

Angeles County Heart Association has, for a number of years, been carrying out the activities recommended by the report and has been a leader in analyzing and applying the best management and community-organization principles to operations in the health field. We have regular agency evaluation and have pioneered in the application of uniform accounting principles. I know also that we are not unique in this respect. We welcome increased interest in the very complex problem of finding ways to achieve scientific management and administration and still maintain "voluntary" efforts.

I do wish to comment that many of the observations of the report have the limitations of generalizations and that some are of questionable validity. Uniform accounting may be convenient for research investigators but is not essential for honest reporting of different programs of different organizations. This is certainly a more complex problem than many amateur administrators realize.

CHAUNCEY A. ALEXANDER  
Los Angeles County Heart Association,  
Los Angeles, California

### Pitfall

Ann Roe, in her recent article, "The psychology of the scientist" [*Science* 134, 456 (1961)], discussed at some length the personal commitment of a scientist to a hypothesis he has formulated. A warning of this emotional pitfall has nowhere been better expressed than in the words of Francis Bacon (in his *Novum Organum*): "In general let every student of nature take this as a rule—that whatever his mind seizes and dwells on with peculiar satisfaction is to be held in suspicion; and that so much the more care is to be taken, in dealing with such questions, to keep the understanding even and clear."

F. G. WOOD, JR.  
Marineland Research Laboratory,  
St. Augustine, Florida

### Fluoridation

Some of the letters on fluoridation (1-3) which appeared in response to Levine's thoughtful note (4) merit attention. They tend to perpetuate a number of misconceptions about fluoridation which I believe it is important to correct.



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The scientific basis of fluoridation has been discussed competently and extensively (5, 6). It is, of course, impossible to cover briefly all the arguments proposed in the past by anti-fluoridationists, but I should like to review certain fundamentals that are pertinent to the correspondence.

The fluoridation program is founded on the observation that people who have lived continually from birth in areas where the domestic water contains fluoride ion in a concentration of approximately 1 part per million de-

velop substantially fewer carious lesions than comparable populations whose water contains only trace amounts of fluoride. This observation has been confirmed repeatedly by independent investigators in many parts of the world, in communities where the fluoride is present either naturally or as a controlled supplement to a fluoride-deficient water supply.

The mechanism of the fluoride effect is still under study, but available evidence supports the hypothesis that, in populations exposed to fluoridated wa-

ter, such water exerts a beneficial influence upon the teeth themselves during the period of their development and calcification (6). The effect is produced during childhood, but it persists throughout life, even though the individual may in later years live in an area where the fluoride content of the water is suboptimal.

Several correspondents revive the suggestion that fluoride could be provided in tablet form or in salt, milk, bottled drinking water, and other vehicles. The suggestion appears reasonable until one recalls that the efficacy of such alternatives to fluoridation has not adequately been demonstrated and that there are cogent reasons to suggest that they should not be expected to yield comparably good results.

A bottle of fluoridated water in the refrigerator will provide only a fraction of the water normally consumed in the diet. Important sources, such as the water used in cooking, canning, and the manufacture of bottled beverages, would be by-passed. The child would not receive fluoride in the water that he consumes at school or elsewhere when he is away from home.

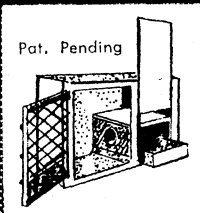
Fluoride provided solely in milk or table salt would not reach infants in appropriate amounts, because these products are not usually fed to babies until they are several months old. Moreover, the distribution of fluoride-fortified milk or salt would have to be controlled carefully to insure that the products would not be available in communities or rural homes where the water already contained enough fluoride; the possibility of inducing mild dental fluorosis must be considered, even though that condition is undesirable only from the standpoint of appearance, not of health. A child who continually received adequate fluoride from water and food and additional amounts from milk and salt might develop signs of dental fluorosis. Manufacturers are not presently prepared to cope with these problems on a wide scale.

The diligent use of tablets or extemporaneously prepared water under careful supervision has been recognized conditionally by the Council on Dental Therapeutics of the American Dental Association to be a safe procedure when community fluoridation programs are not operating (7). But the council emphasizes that evidence for the efficacy of these procedures, even when they are carried out conscientiously by

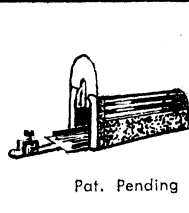
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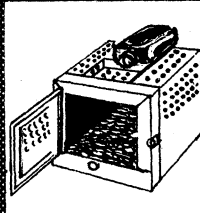
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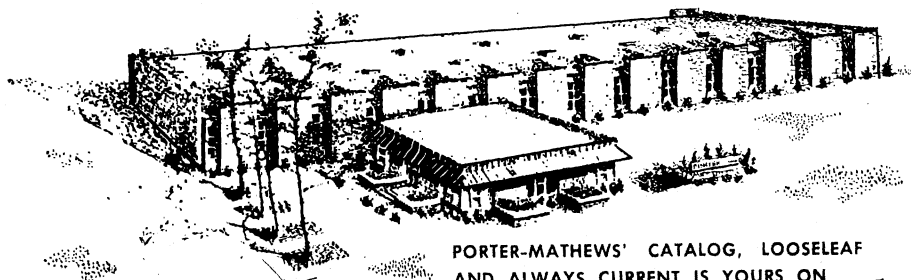
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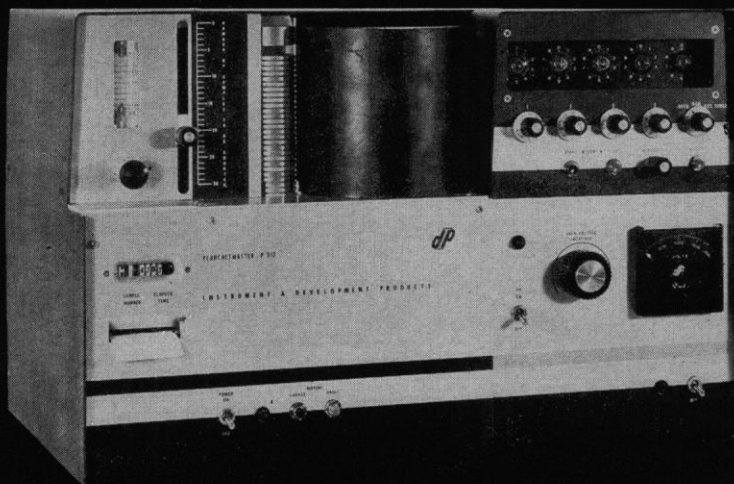
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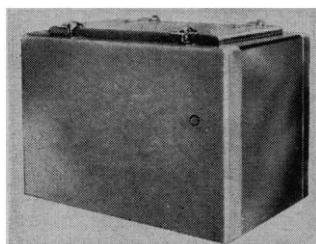
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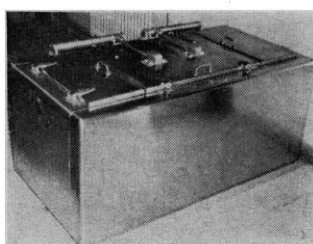
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responsible parents, is meager. Sufficiently large groups of individuals have not yet been studied, and the investigations that have been reported were not satisfactorily controlled. Many did not cover a suitably long period of time. The studies demonstrated clearly, however, that the administration of fluoride by these means produced no harmful effects. Economically, water fluoridation remains the least expensive method for providing fluoride supplements appropriately. This fact stands, despite the juggling of figures and the many misinterpretations which have been employed to challenge it.

The concept advanced by Court (2) that fluoridation should not be accepted "until . . . [it] is demonstrated to be the only feasible method of reducing dental caries" is patently absurd. No hungry man would rationally refuse to accept a wholesome meal until he had been shown that there was no other source of nourishment.

Those who continue to charge that the use of fluoridated water is harmful have yet to produce supporting evidence that will withstand scientific scrutiny. Proponents of fluoridation as a health measure have studied the aspect of safety with extreme care and have found no evidence of harm. One pioneer of fluoridation programs said many years ago that the opponents tell us, in effect, "We know you haven't found any evidence of harm but we know it's there; keep looking." Vigilance has not slackened, but all responsible health organizations are convinced that the use of water fluoridated at the recommended level is safe for all populations and all age groups.

Arguments concerned with mass medication, deprivation of individual liberty, invasion of privacy, infringement of religious freedom, and the like have been weighed repeatedly in the courts and invariably have been rejected.

Rodale's remarks (3) should be considered against the background of the many quaint but hardly scientific notions about "natural" foods, "organic gardening," and the like which are promoted through the articles and the abundant pages of advertising in his magazine, *Prevention*. The "reputable and capable scientists," and the "evidence indicating that fluoridation is a potentially harmful practice" which he says these scientists have produced, evidently failed to impress evaluating agencies of the American Dental Association, American Medical Association,



National Research Council, American Public Health Association, and many other groups acknowledged to be reputable, including the Council of the American Association for the Advancement of Science.

The opposition to fluoridation has awakened the interest of behavioral scientists, who see in it an excellent opportunity for field study (8). It is to be hoped that psychologists and sociologists will succeed in explaining why fluoridation is resisted so frequently in spite of the overwhelming evidence of its safety and benefits. Perhaps, too, the more vociferous opponents of fluoridation will search their souls more closely and consider whether they are morally justified in satisfying their emotional needs by striving to deny relief from dental pain and disease to millions.

SHOLOM PEARLMAN

Council on Dental Research, American Dental Association, Chicago, Illinois

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With the publication of Pearlman's letter, Science concludes the current series of letters on the fluoridation issue. For the time being, no further comments on this subject will be accepted.—Ed.

19 JANUARY 1962



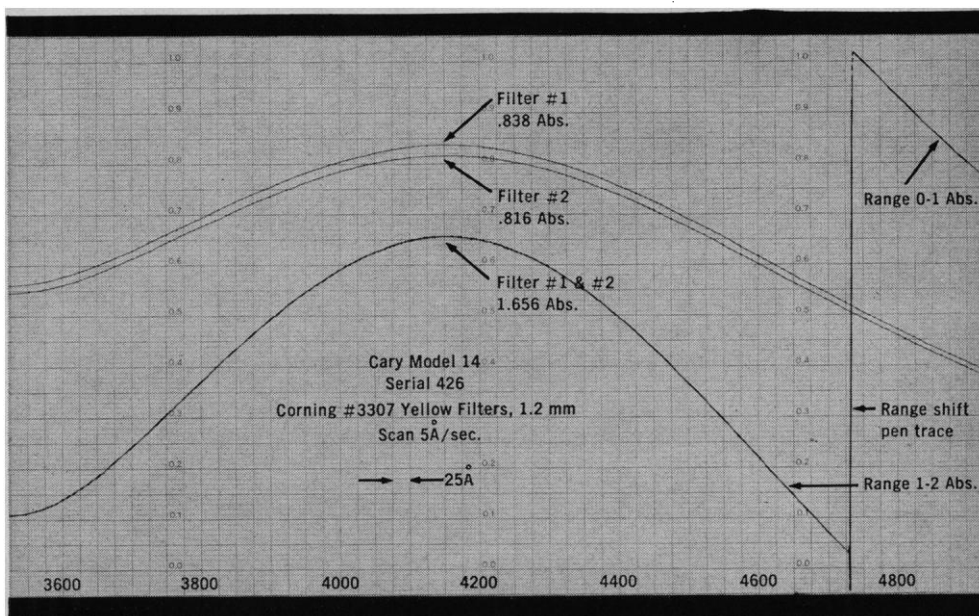
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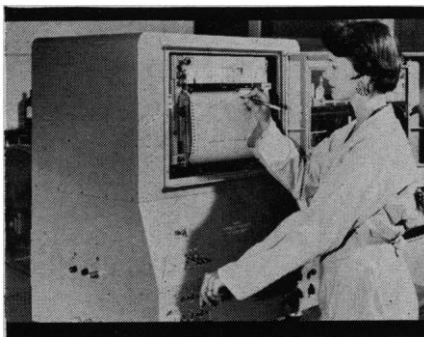
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