

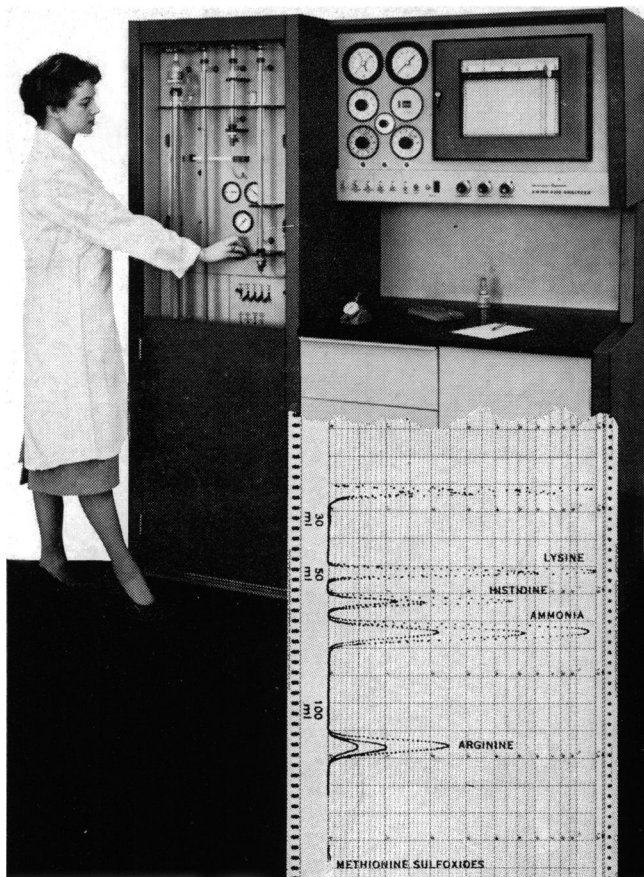
SCIENCE

22 July 1960

Vol. 132, No. 3421

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





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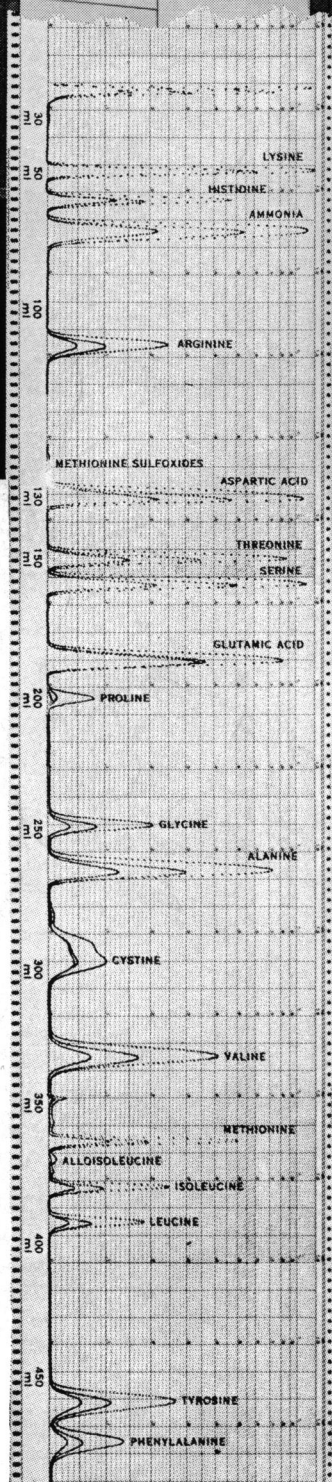
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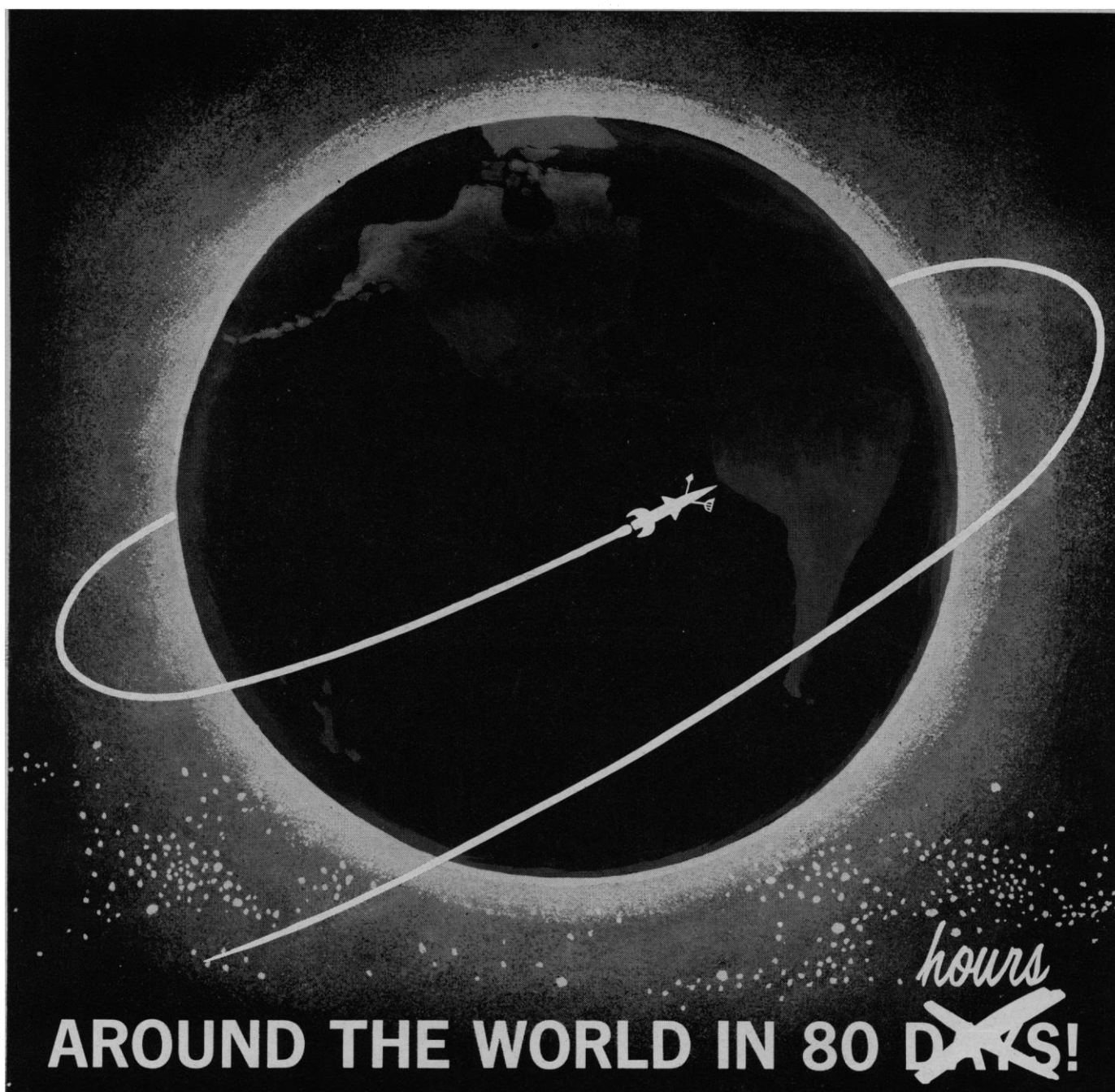
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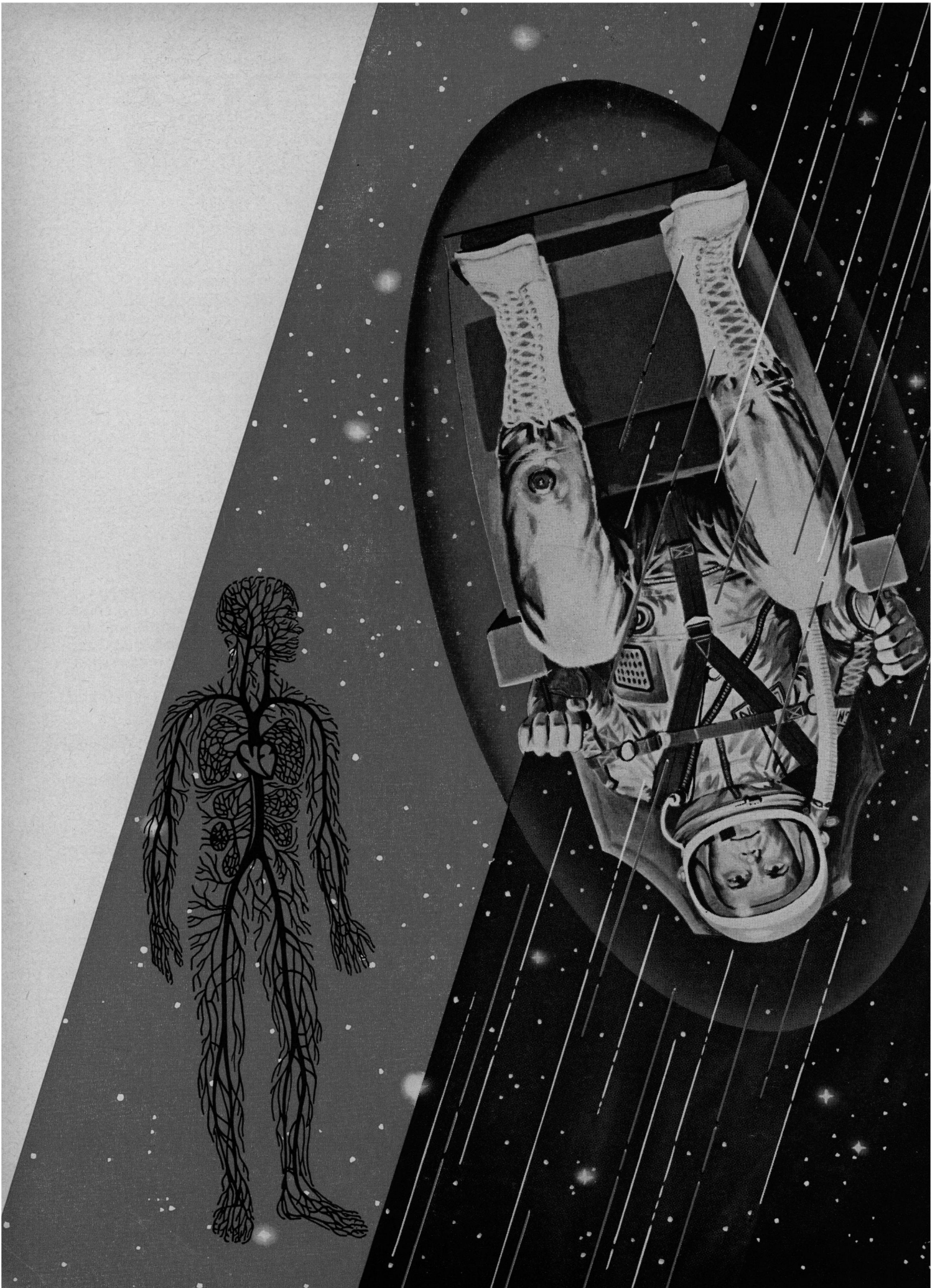
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Cover	Air photo of Meteor Crater, Arizona, and the Canyon Diablo Area where coesite has been found by scientists of the U.S. Geological Survey in the course of studying specimens of sheared Coconino sandstone. See page 220. [John S. Shelton, Claremont, Calif.]	





Pilâtre de Rozier and Marquis d'Arlandes (November 21, 1783), using a Montgolfier balloon, were the first to leave the earth to test man's physiologic reactions. This experiment was the forerunner of intensive Space Medicine studies of today.

SPACE MEDICINE

There is a relatively narrow zone above the surface of the earth in which man's physiologic mechanism can function. Hence the unrelenting search by Lockheed scientists into many aspects of Space Medicine.

Engineers already have equipped man with the vehicle for space travel. Medical researchers now are investigating many factors incident to the maintenance of space life—to make possible man's flight into the depths of space. Placing man in a wholly new environment requires knowledge far beyond our current grasp of human biology. Here are some of the problems under investigation: The determination of man's reactions; the necessity of operating in a completely closed system compatible with man's physiological requirements (oxygen and carbon dioxide content, food, barometric pressure, humidity and temperature control); explosive decompression; psycho-physiological difficulties of spatial disorientation as a result of weightlessness; toxicology of metabolites and propellants; effects of cosmic, solar and nuclear ionizing radiation and protective shielding and treatment; effects on man's circulatory system from accelerative and decelerative G forces; the establishment of a thermoneutral range for man to exist through preflight, flight and reentry; regeneration of water and food.

Exploration into unknown areas such as Space Medicine, provides endless stimulation to imaginative scientists and creative engineers. Research at Lockheed's Missiles and Space Division covers the entire spectrum—from pure basic research to development work, in support of current projects. Space Medicine is but one phase of Lockheed's complete systems capability in missiles and satellites. To maintain this position of leadership calls for an extensive research and development program—ranging from electrical propulsion research to advanced computer research, design and development. Typical current projects are: Man in space; oceanography; fuel cells; space station; space navigation; solid state electronics.

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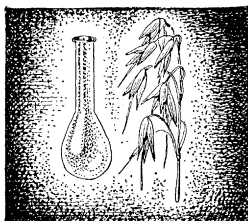
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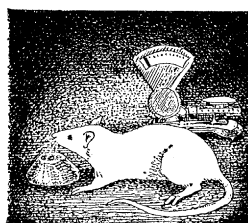
IT HAPPENED THIS MONTH...

a glance at yesterday in relation to today



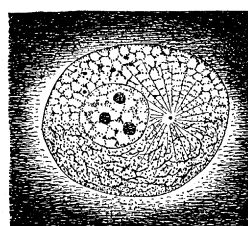
IN JULY—(1922)—the Journal of Biochemistry (Tokyo) reports the isolation and analysis of the prolamins of *Hato-mugi* (*Coix lacryma* L.). *Hato-mugi* is an Asiatic species of grass with large seeds called “Job’s Tears,” which are often strung as beads to pacify teething infants. Results indicate that it contains glutamic acid, leucine, tyrosine and the basic amino acids, arginine, histidine, and lysine, and resembles the prolamins of oats.¹

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IN JULY—(1929)—Cowgill discusses the physiology of the substance hitherto called “vitamin B.”² This has recently been shown to consist of at least two physiologically-active factors. One is unstable at high temperatures and is effective in preventing and curing beriberi; the other thermostable component is required along with the antineuritic factor for promoting growth and is probably effective in preventing and curing pellagra.

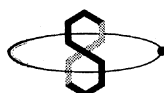
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1. Hattori, G. and Komatsu, S.: The prolamins of *Coix lacryma* L. J. Biochem. 1:365 (July) 1922. 2. Cowgill, G. R.: Recent studies in the physiology of vitamin B. Yale J. Biol. & Med. 1:353 (July) 1929. 3. Miller, S. L. and Urey, H. C.: Organic compound synthesis on the primitive earth. Science 130:245 (July 31) 1959.

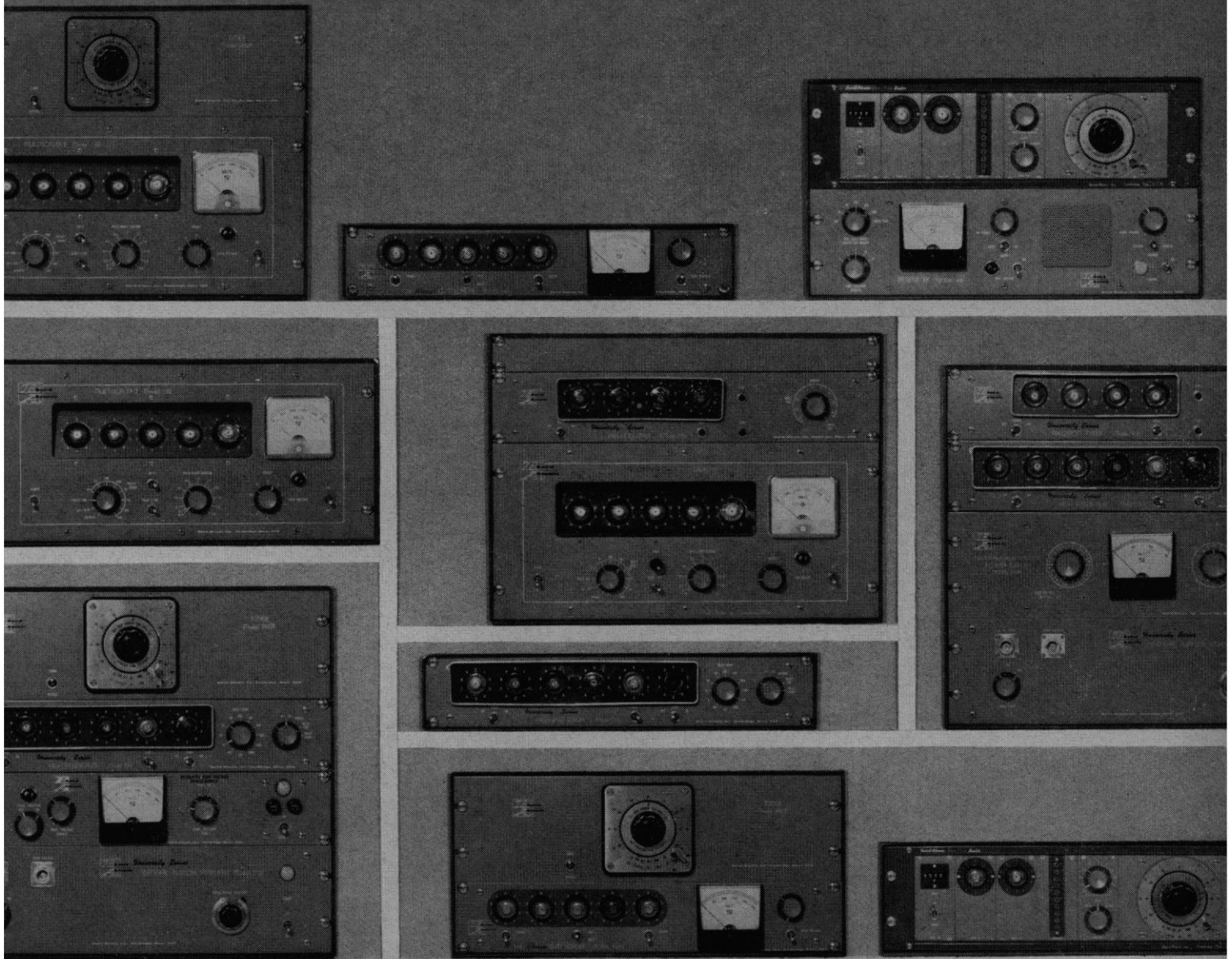


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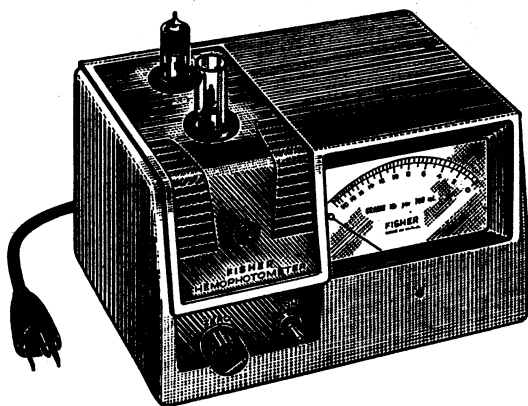


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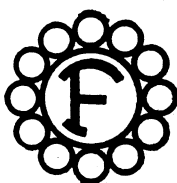
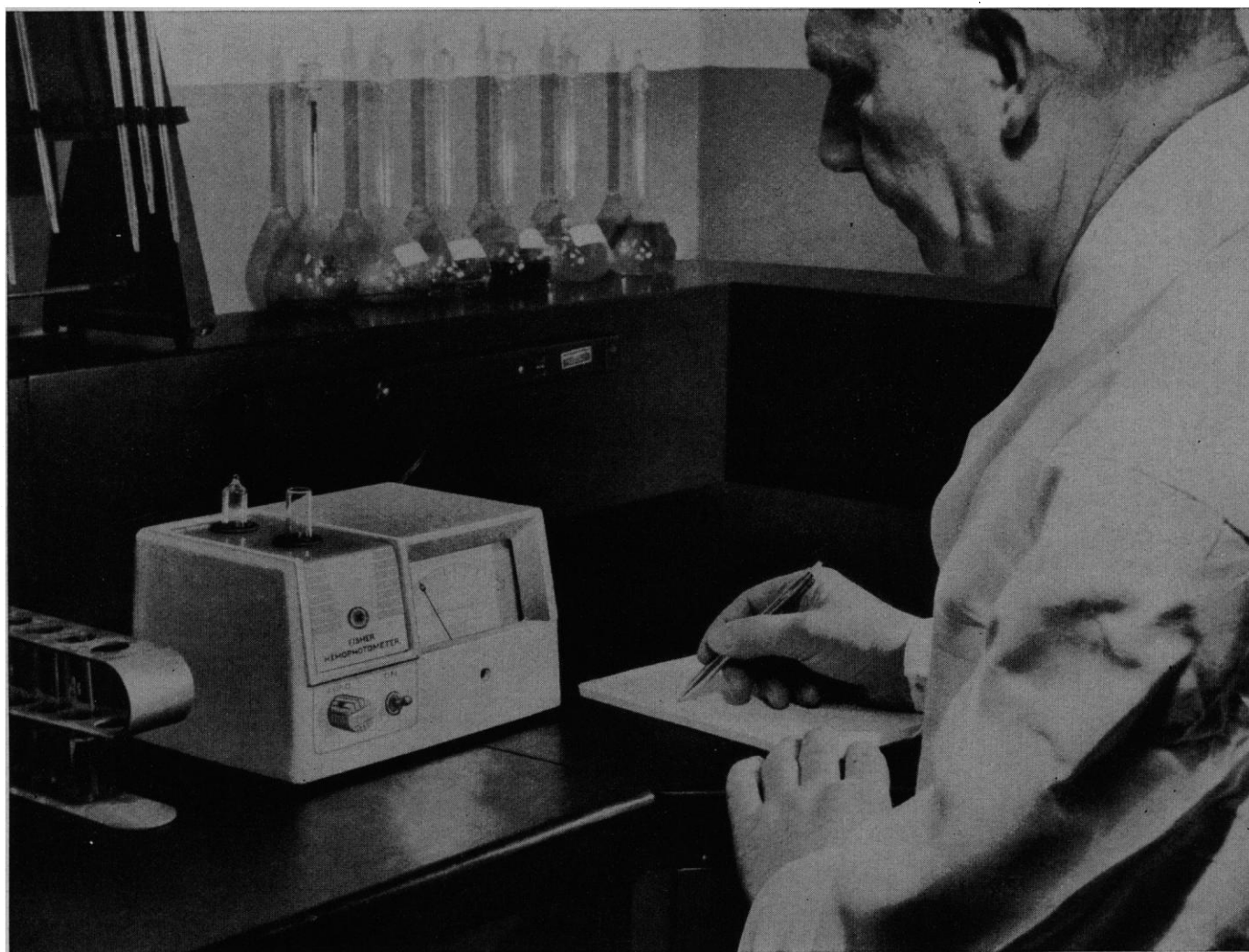
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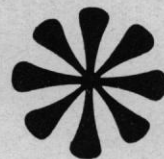
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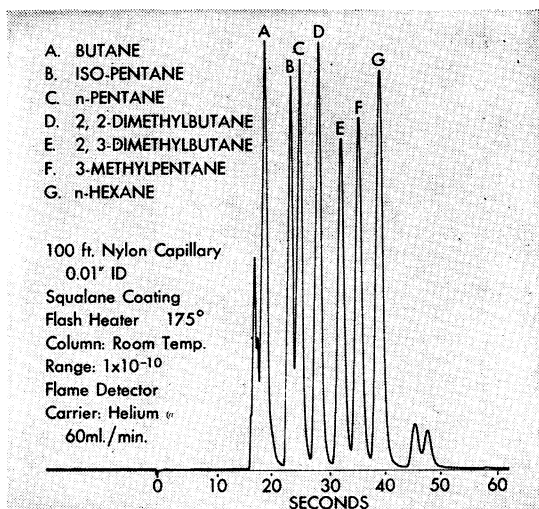
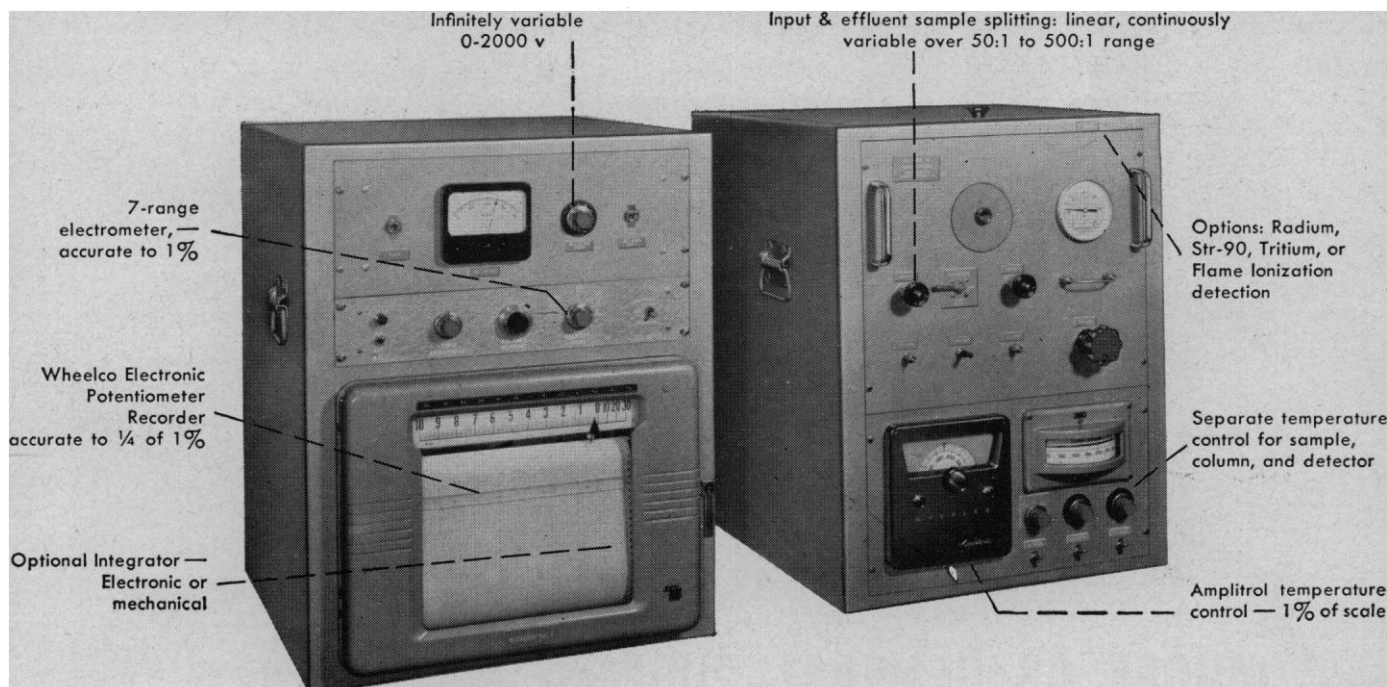
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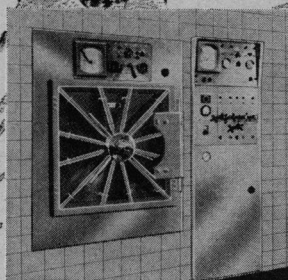
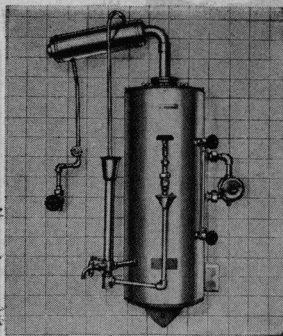
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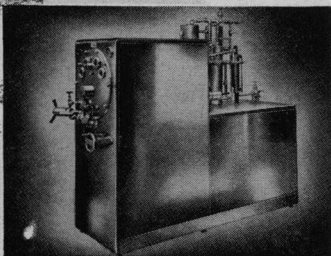
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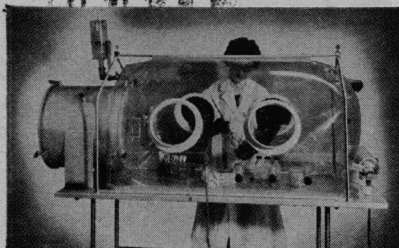
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1. The two-session AAAS General Symposium, "Moving Frontiers of Science V"—Speakers: Edward Anders, H. W. Magoun and George Wald.
2. The "Challenge to Science" evening with Sir Charles P. Snow and Theodore M. Hesburgh.
3. On "AAAS Day," the three broad, interdisciplinary symposia—Plasma: Fourth State of Matter; Life under Extreme Conditions; and Urban Renewal and Development, arranged by AAAS Sections jointly.
4. The Special Sessions: AAAS Presidential Address and Reception; Joint Address of Sigma Xi and Phi Beta Kappa; the Tau Beta Pi Address; National Geographic Society Illustrated Lecture; and the first George Sarton Memorial Address by Rene Dubos.
5. The programs of all 18 AAAS Sections (specialized symposia and contributed papers).
6. The programs of the national meetings of the American Astronomical Society, American Nature Study Society, American Society of Zoologists, History of Science Society, National Association of Biology Teachers, Scientific Research Society of America, Sigma Delta Epsilon, Society for General Systems Research, Society for the Study of Evolution, Society for the History of Technology, Society of Systematic Zoology, and the Society of the Sigma Xi.
7. The multi-sessioned special programs of the American Association of Clinical Chemists, American Astronautical Society, American Geophysical Union, American Physiological Society, American Psychiatric Association, American Society of Criminology, Association of American Geographers, Ecological Society of America, Mycological Society of America, National Science Teachers Association, New York Academy of Sciences—and still others, a total of some 90 participating organizations.
8. The four-session program of the Conference on Scientific Communication: The Sciences in Communist China, cosponsored by the AAAS, NSF, and ten societies.
9. The sessions of the Academy Conference, the Conference on Scientific Manpower, and the conference of the American Council on Women in Science.
10. The sessions of the AAAS Cooperative Committee on the Teaching of Science and Mathematics, and of the AAAS Committee on Science in the Promotion of Human Welfare.
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New York, 26-31 December 1960

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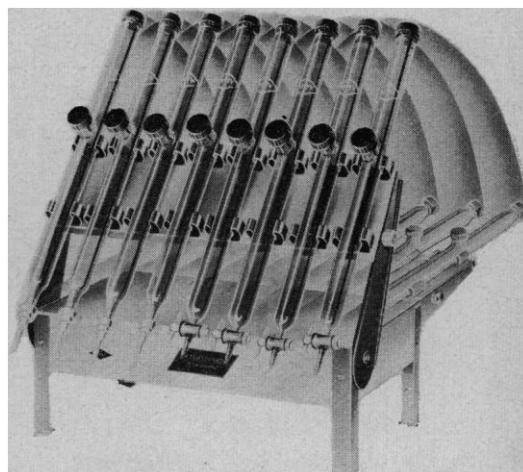
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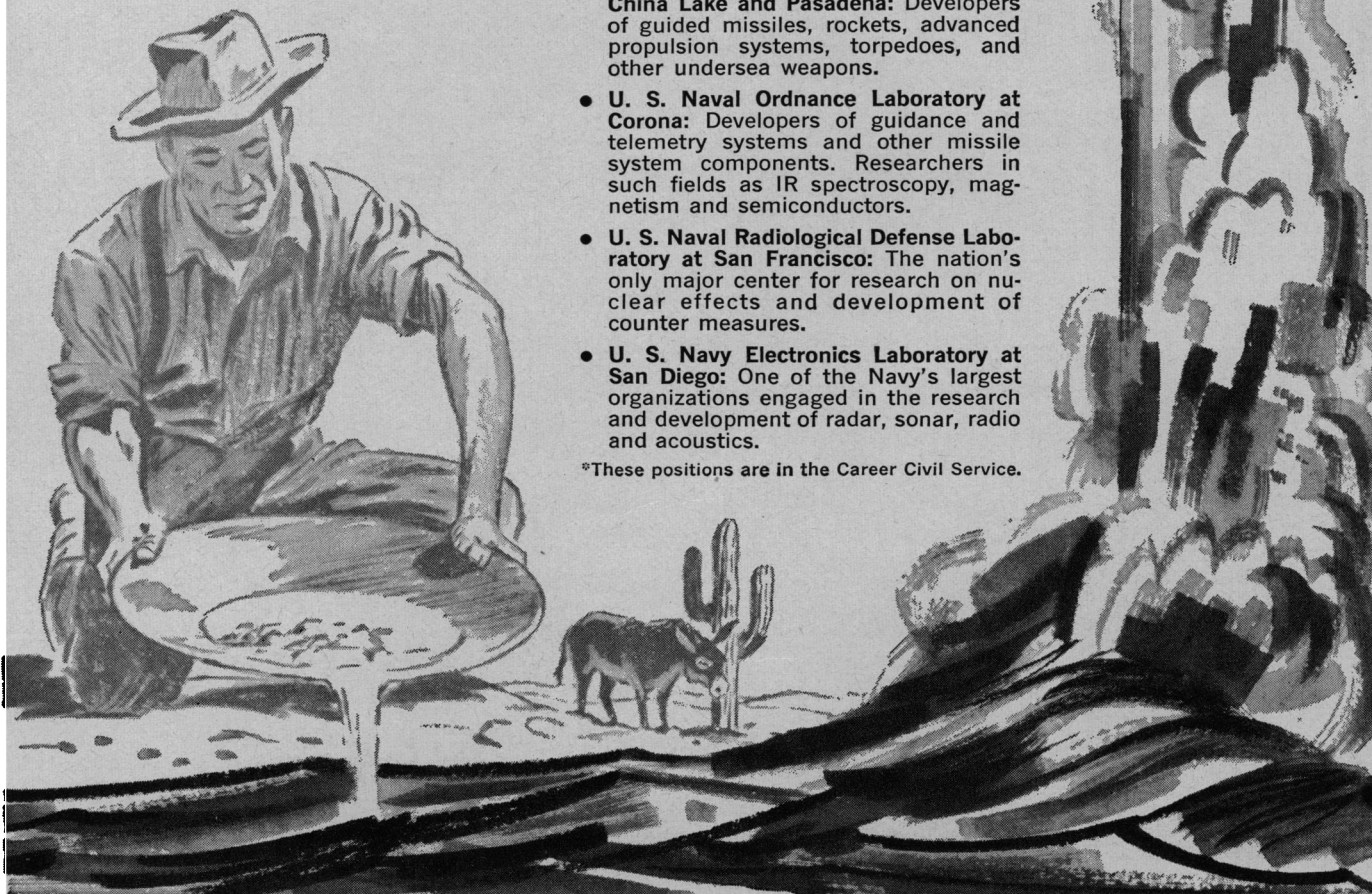
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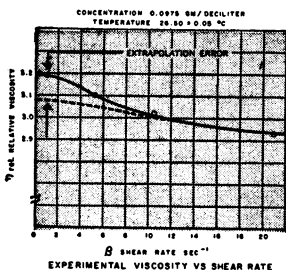
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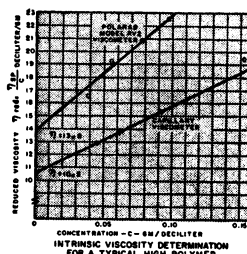
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Is There Underinvestment in Education?

Belief is widespread that we are not spending enough money on college education in terms of our needs for economic growth, but little systematic research has been done on education as a form of investment. As part of a study for the National Bureau of Economic Research, Gary S. Becker, of Columbia University, has now compared the financial return from a college education with the return from other kinds of investments. The full report is still to be published, but to judge from a preliminary account that appeared in the May issue of the *American Economic Review*, the results will challenge one of our more treasured beliefs. So far as the return to the person getting the education is concerned, Becker finds no evidence for underinvestment. The average return to college graduates is about the same as the average return to business capital.

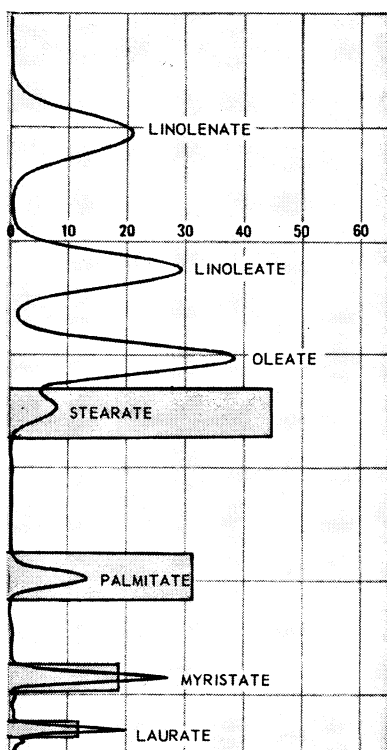
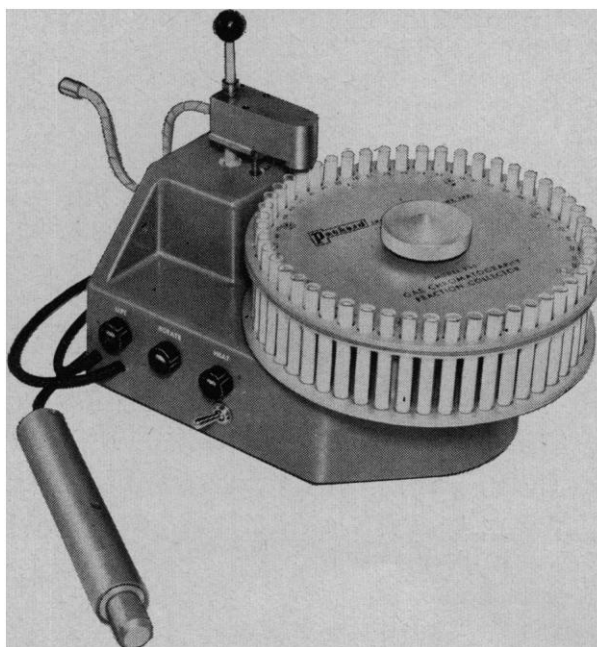
Although the preliminary account gives few details of the computation, there is some discussion of the operations performed. The return from a college education is calculated on the basis of total college costs, not just costs to the student and his family. The income of college graduates, as measured against the income of persons whose education ended at a lower level, is adjusted for such factors as differences in ability. And the study is limited to men, although Becker does suggest that even for those women who expect to do little work outside the home there may be sound economic reasons for going to college. Women who go to college probably secure husbands with higher incomes than women who do not.

Economists distinguish between direct and external returns, and in the analysis of education this distinction corresponds to that between the effect of a college education on the incomes of persons getting the education and the effect on the incomes of others. The study is concerned only with direct returns, but those arguing that too little is being spent on education can note, for example, that developments in atomic physics are necessary for atomic power and that most atomic physicists are college graduates. To this argument Becker replies that it is easier to give examples of the contribution of science and technology to economic growth than it is to assess the contribution quantitatively or to compare it to the external returns from business capital. In fact, he intimates that, generally speaking, economists know very little about external returns. Consequently, since direct returns indicate no great underinvestment, if the existence of underinvestment is to be argued, the argument must lie in the little explored area of external returns.

The American economy, not to mention American military technology, of course, needs scientists and engineers. To this particular point Becker replies that the special demand for technical experts can be met with a comparatively small increase in the total expenditures on college education. Investment in scientific training is important, but by itself such training is not so very expensive.

To be sure, college attendance offers other rewards besides economic gain; it offers personal enlightenment and preparation for effective citizenship. But restriction of the study to economic considerations no more reflects on these other objectives than it lessens the value of the study as it bears on strictly economic arguments. One comment that has been directed against the study from the economic side is that even if the return to college graduates is the same as the return to business capital, this finding does not necessarily imply that there is no underinvestment in education. The finding might just as well imply that college graduates are underpaid or, to strike an anti-inflationary note, that everyone else is overpaid.—J.T.

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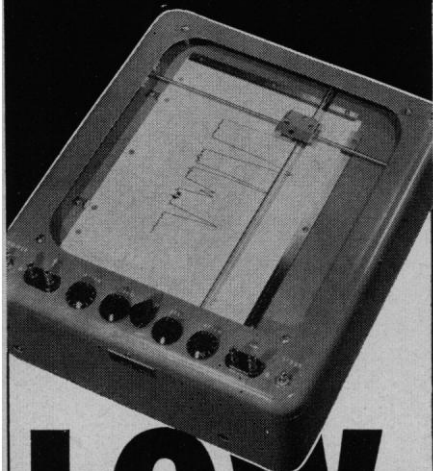
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The chairman of the Committee on Exhibits is William O. Baker, vice president for research, Bell Telephone Laboratories; he was a member of the same committee when the AAAS met in New York in 1956.

The chairman of the Committee on Public Information is Marion Harper, Jr., president of McCann-Erickson, Inc.; he headed the same committee at the previous New York meeting.

The chairman of the Committee on Physical Arrangements is Harry A. Charipper, head of the department of biology, New York University, Washington Square Center, who aided that committee in 1949 and 1956; he is also in charge of local arrangements for this year's meeting of the American Society of Zoologists.

Housing

Four of the five hotels for the AAAS meeting have established uniform flat rates, much lower than their usual rates, for AAAS members and others attending the meeting. Thus, everyone who makes room reservations through the AAAS Housing Bureau can be assured of substantial savings.

Beginning with this issue, the advertising pages of *Science* will carry, at frequent intervals, announcements of hotel accommodations and rates, together with a coupon which should be filled out and sent, *not* to any hotel directly, but to the AAAS Housing Bureau in New York. All applications for hotel rooms will be filled in the order of receipt. Those who apply early are assured of accommodations in the hotel of their first choice. Expenses can be reduced still further if two people share a room or if three or more people share a suite. Upon request, all hotels will place comfortable rollaway beds in rooms or suites at \$3 per night.

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Both the technical, or program, sessions and the special sessions are open to all interested persons. Although registration for these sessions is not mandatory, it is expected that all who attend will wish to pay the AAAS registration fee of \$3 and thus contribute their proportionate share to the heavy expenses of the meeting. (The registration fee for the husband or wife of a registrant, if a second General Program is not required, is \$1.)

Each registrant receives the General Program, convention literature, a listing in the Visible Directory of Registrants, and a Convention Badge; the latter assures him all privileges of the meeting, discounts on tickets of admission to tourist attractions, and the like. The badge is required for admission to the large-scale exhibits, the AAAS Science Theatre, the presidential reception, and the AAAS Smoker. Re-

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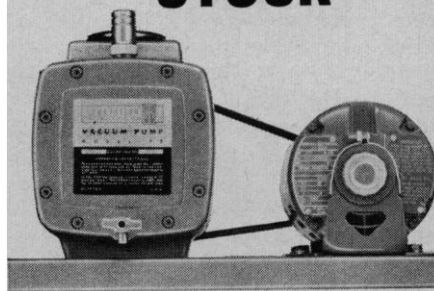
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An announcement on advance registration, with a coupon, will also be found in the advertising pages of this issue and at intervals hereafter.

AAAS Headquarters

As stated in the Preliminary Announcement, for the AAAS as a whole, there will be coheadquarters hotels. The Commodore, with its large ballroom, will accommodate the evening events, general sessions, the AAAS business sessions, and the AAAS Pressroom. The Biltmore will house the AAAS Office, the Visible Directory of Registrants, the Annual Exposition of Science and Industry, and the AAAS Science Theatre. Each of the two hotels—located one and a half blocks apart, on two sides of Grand Central Station (they can be reached by underground passages *through* the station)—will have AAAS Main Registration-Information Center facilities.

The Commodore will also accommodate the American Society of Zoologists and Section N; the Biltmore will house the other biological and medical groups and some of the physical sciences as well. The Roosevelt will be headquarters for the American Astronomical Society, for the science teaching societies, and for the social and economic sciences. The Belmont Plaza is the headquarters hotel for geology and geography, Section H, the History of Science Society, and other organizations of the "L" series. At present, no sessions are scheduled in the Waldorf-Astoria, 49th Street and Park Avenue, but 400 of its sleeping rooms are available, at minimum rates.

A detailed list of the headquarters for each section and participating organization is given below, since it is an obvious convenience for each person attending the meeting to have this information before he applies for room reservations.

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AAAS sections are listed alphabetically and societies are listed in the same sequence, by discipline.

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American Society of Zoologists.

Federation of American Societies for Experimental Biology.

Academy Conference, American Council on Women in Science, Conference on Scientific Communication, National Association of Science Writ-

ers, National Science Foundation, New York Academy of Sciences, Scientific Research Society of America, Sigma Delta Epsilon, Society of the Sigma Xi, United Chapters of Phi Beta Kappa.

Biltmore (1000 Rooms), 43rd Street and Vanderbilt Avenue.

AAAS Office; Annual Exposition of Science and Industry; AAAS Science Theatre; Visible Directory of Registrants.

AAAS Sections A-Mathematics, B-Physics, G-Botanical Sciences, I-Psychology, Nd-Dentistry, and O-Agriculture.

American Mathematical Society, As-

sociation for Computing Machinery, Society for Industrial and Applied Mathematics.

American Astronautical Society, American Institute of Physics, American Meteorological Society, Sigma Pi Sigma.

American Association of Clinical Chemists.

Society of Systematic Zoology.

American Institute of Biological Sciences, American Society of Naturalists, Beta Beta Beta Biological Society, Ecological Society of America, Mountain Lake Biological Station, Nature Conservancy, Society for the Study of Evolution, Society of General Physiologists.

Botanical Society of America, Mycological Society of America, Torrey Botanical Club.

Alpha Epsilon Delta, American Physiological Society, American Psychiatric Association.

American College of Dentists; American Dental Association; International Association for Dental Research, North American Division.

Society for Industrial Microbiology.

American Geophysical Union.

Roosevelt (1100 rooms), 44th Street and Vanderbilt Avenue.

AAAS Cooperative Committee on the Teaching of Science and Mathematics.

AAAS Sections C-Chemistry, D-Astronomy, K-Social and Economic Sciences, M-Engineering, Np-Pharmacy, and Q-Education.

American Chemical Society.

Astronomical Society, American League.

National Association of Biology Teachers.

American Economic Association, American Political Science Association, American Society of Criminology, American Sociological Association, American Statistical Association, Econometric Society, Metric Association, National Academy of Economics and Political Science, National Institute of Social and Behavioral Sciences, Pi Gamma Mu National Social Science Honor Society, Social Science Research Council.

Engineers Joint Council, Engineering Manpower Commission, Tau Beta Pi Association.

American Association of Colleges of Pharmacy; American College of Apothecaries; American Pharmaceutical Association, Scientific Section; American Society of Hospital Pharmacists; National Association of Boards of Pharmacy.

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American Educational Research Association, Council for Exceptional Children, National Association for Research in Science Teaching, National Science Teachers Association, American Nature Study Society.

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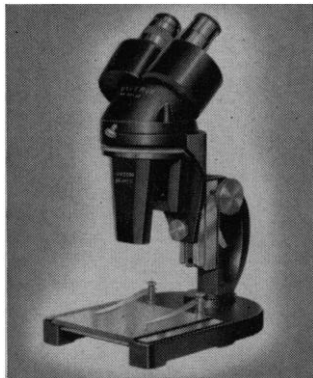
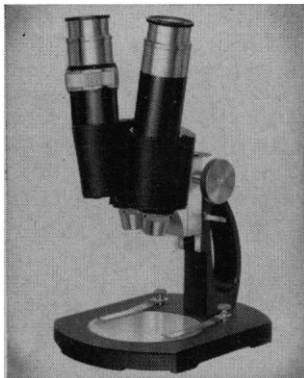
The Hyland Tissue Culture Laboratory is always at your service and welcomes your inquiries about special formulas or products you would like added to our line.



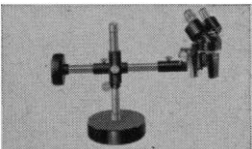
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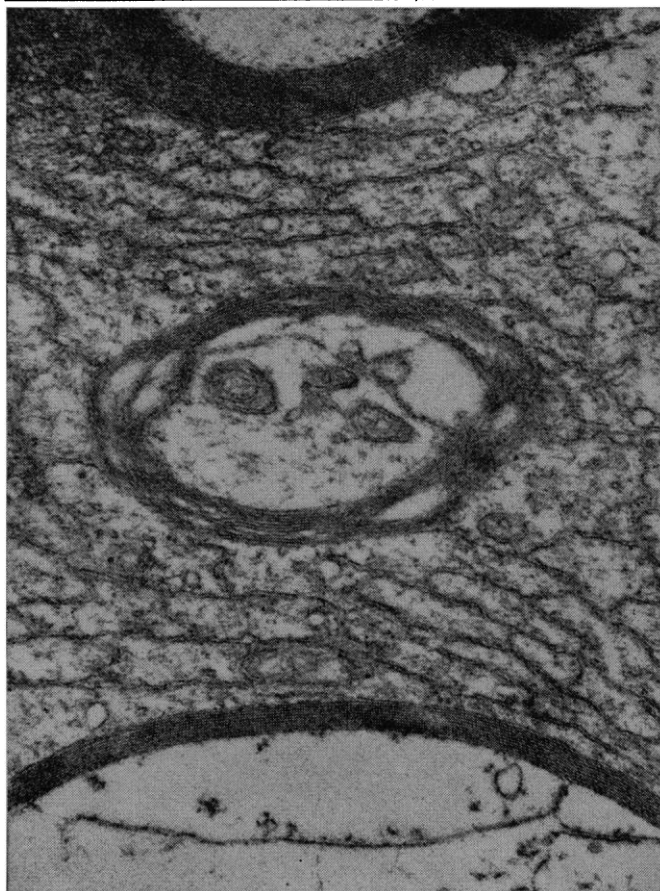
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Associate Administrative Secretary

Forthcoming Events

August

15-23. Soil Science, 7th intern. cong., Madison, Wis. (R. Bradfield, Dept. of Agronomy, Cornell Univ., Ithaca, N.Y.)

15-24. Crystallography, intern. cong., Cambridge, England. (W. H. Taylor, Cavendish Laboratory, Cambridge, England)

15-25. Chemistry of Natural Products, IUPAC symp., Melbourne, Canberra, and Sydney, Australia. (Convener, Symposium Organizing Committee, Box 4331, G.P.O., Melbourne)

15-25. International Geological Cong., 21st session, Copenhagen, Denmark. (IGC, Mineralogical-Geological Museum, Univ. of Copenhagen, Øster Boldgade 7, Copenhagen K)

15-25. International Paleontological Union, Copenhagen, Denmark. (J. Roger, Service d'Information Géologique, B.R.G.-G.M., 74, rue de la Fédération, Paris 15^e, France)

15-25. Sedimentology Cong., 6th intern., Copenhagen, Denmark. [General Secretary, IAS, c/o Institut Français du Pétrole, 4, place Bir Hacheim, Rueil-Malmaison (Seine-et-Oise), France]

16-18. Biological Effects of Microwave Radiation, 4th annual conf., New York, N.Y. (M. Eisenbud, New York Univ. Post Graduate Medical School, 550 First Ave., New York 16)

16-19. Society of Automotive Engineers, San Francisco, Calif. (R. W. Crory, SAE, Meetings Operation Dept., 485 Lexington Ave., New York 17)

17-19. Hydraulics Conf., Seattle, Wash. (W. H. Wisely, American Soc. of Civil Engineers, 33 W. 39 St., New York 18)

17-19. University Nuclear Reactors, Gatlinburg, Tenn. (University Relations Div., Oak Ridge Inst. of Nuclear Studies, P.O. Box 117, Oak Ridge, Tenn.)

17-21. Ionization Phenomena in Gases, 4th intern. conf., Uppsala and Stockholm, Sweden. (A. Nilsson, Fysikum, Uppsala)

18-19. Submarine and Space Medicine, 2nd intern. symp., Stockholm, Sweden. (H. Bjurstedt, Laboratory of Aviation Medicine, Karolinska Institutet, Stockholm, 60)

20. American Inst. of Ultrasonics in Medicine, Washington, D.C. (D. M. Stillwell, Dept. of Physical Medicine and Rehabilitation, Univ. of Colorado Medical Center, Denver 20)

21-24. Latin-American Cong. of Angiology, Rio de Janeiro, Brazil. (R. C. Mayall, Caixa Postal 1822, Rio de Janeiro)

21-24. National Council of Teachers of Mathematics, Salt Lake City, Utah. (M. H. Ahrendt, 1201 16 St., NW, Washington 6)

21-25. American Soc. of Pharmacology and Experimental Therapeutics, Seattle, Wash. (H. Hodge, ASPET Dept. of Pharmacology, Univ. of Rochester, Rochester, N.Y.)

21-26. American Cong. of Physical Medicine and Rehabilitation, Washington, D.C. (Mrs. D. C. Augustin, 30 N. Michigan Ave., Chicago 2, Ill.)

21-26. Physical Medicine, 3rd intern. conf., Washington, D.C. (W. J. Zeiter, 2020 E. 93 St., Cleveland, Ohio)

21-6. Pacific Science Cong., 10th. Honolulu, Hawaii. (Secretary-General, 10th Pacific Science Cong., Bishop Museum, Honolulu 17)

22-25. American Astronomical Soc., Mexico City, Mexico. (J. A. Hynek, Smithsonian Astrophysical Observatory, 60 Garden St., Cambridge 38, Mass.)

22-25. American Physiological Soc., San Francisco, Calif. (R. G. Daggs, APS, 9650 Wisconsin Ave., NW, Washington 14)

22-26. Plasma Physics, symp., Gatlinburg, Tenn. (University Relations Div., Oak Ridge, Inst. of Nuclear Studies, P.O. Box 117, Oak Ridge, Tenn.)

22-26. Western Resources, 2nd annual conf., Boulder, Colo. (M. E. Garnsey, Dept. of Economics, Univ. of Colorado, Boulder)

23-25. Assoc. for Computing Machinery, natl., Milwaukee, Wis. (J. Moshman, ACM, Council for Economic and Industry Research, 1200 Jefferson Davis Highway, Arlington 2, Va.)

23-25. Cryogenic Engineering Conf., Boulder, Colo. (K. D. Timmerhaus, CEC, Dept. of Chemical Engineering, Univ. of Colorado, Boulder)

23-26. American Statistical Assoc., annual, Palo Alto, Calif. (D. C. Riley, ASA, Beacon Bldg., 1757 K St., NW, Washington 6)

23-26. Biological Photographic Assoc., Salt Lake City, Utah. (Miss J. H. Waters, Box 1668, Grand Central Post Office, New York 17)

23-26. Institute of Mathematical Statistics, annual, Stanford, Calif. (W. Kruskal, Dept. of Statistics, Eckhart Hall, Univ. of Chicago, Chicago 37, Ill.)

23-28. American Ornithologists' Union, Ann Arbor, Mich. (H. G. Diegnan, Division of Birds, U.S. National Museum, Washington 25)

24-27. Forest Biology Conf., Seattle, Wash. (Miss E. N. Wark, Technical Assoc. of the Pulp and Paper Industry, 360 Lexington Ave., New York 17)

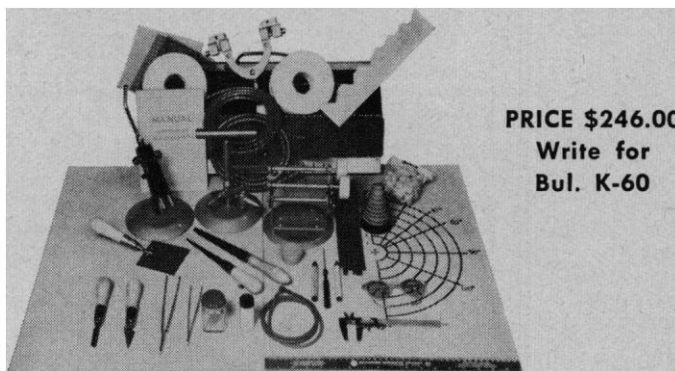
24-27. Internal Medicine, 6th intern. cong., Basel, Switzerland. (Secretariat, 6th ICIM, 13 Steinentorstre, Basel)

24-2. International Union for the History and Philosophy of Science, Stanford, Calif. (R. Taton, 64, rue Gay-Lussac, Paris 5^e, France)

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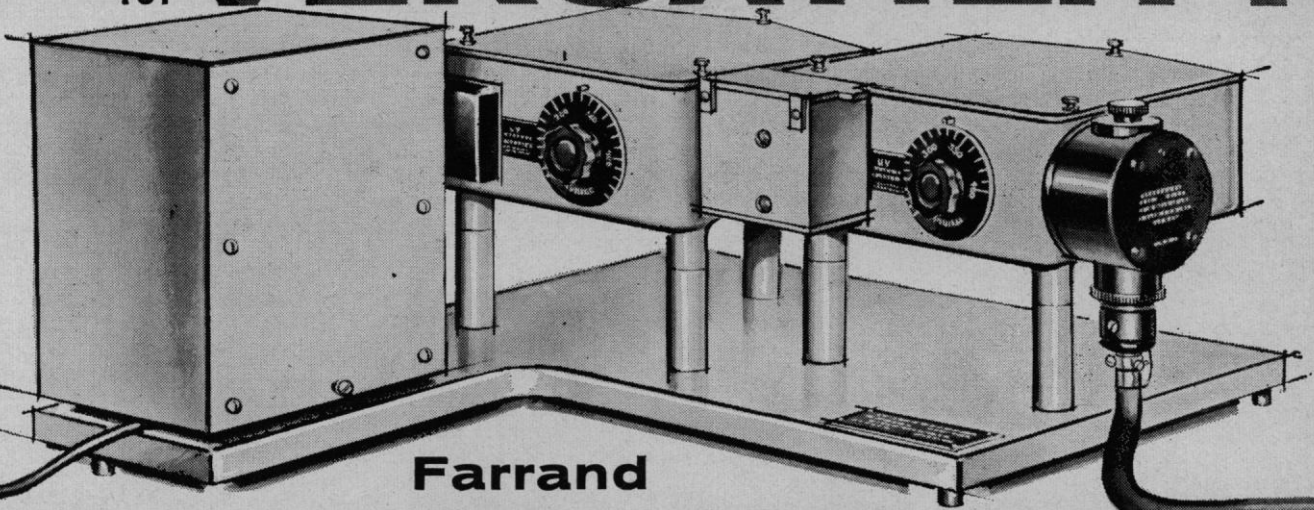
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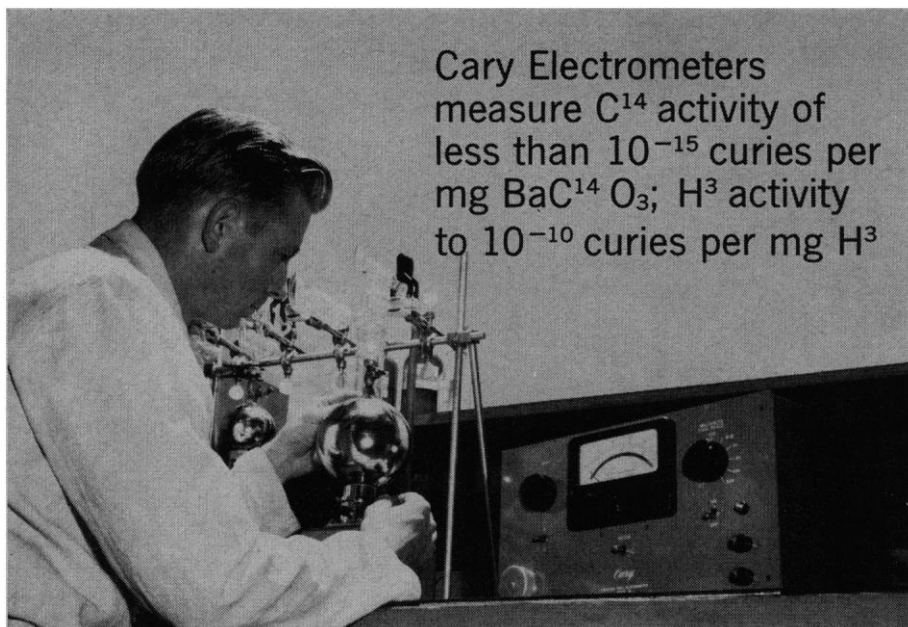
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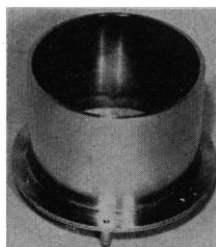
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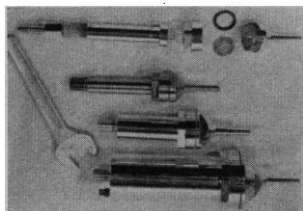


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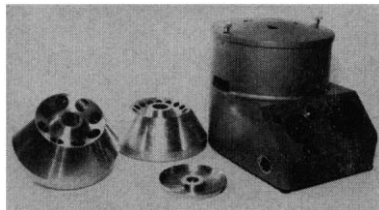
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25-27. Chemical Organization of Cells, 2nd conf., Madison, Wis. (J. F. A. McManus, Dept. of Pathology, Univ. of Alabama Medical Center, Birmingham)

25-3. High Energy Nuclear Physics, intern. conf., Rochester, N.Y. (W. A. Jamison, Dept. of Physics and Astronomy, Univ. of Rochester, Rochester 20)

27-30. International Union of Biological Sciences, section of embryology, Pallanza, Italy. (F. E. Lehmann, Kuhnweg 10, Berne, Switzerland)

28-31. American Phytopathological Soc., Green Lake, Wis. (W. B. Hewitt, Dept. of Plant Pathology, Univ. of California, Davis)

28-31. Potato Assoc. of America, Green Lake, Wis. (R. L. Sawyer, Long Island Vegetable Research Farm, Cornell Univ., Riverhead, N.Y.)

28-31. Soil Conservation Soc. of America, Guelph, Ontario, Canada. (H. W. Pritchard, 838 Fifth Ave., Des Moines 14, Iowa)

28-1. American Inst. of Biological Sciences, annual, Norman, Okla. (H. T. Cox, AIBS, 2000 P St., NW, Washington 6)

The following 20 meetings are being held in conjunction with the AIBS meeting at Stillwater, Okla.

American Bryological Soc. (G. J. Ikenberry, Dept. of Botany and Plant Pathology, Oklahoma State Univ., Norman)

American Fern Soc. (U. T. Waterfall, Dept. of Botany, Oklahoma State Univ., Norman)

American Microscopical Soc. (R. W. Jones, Dept. of Zoology, Oklahoma State Univ., Norman)

American Soc. for Horticultural Science. (D. G. White, Dept. of Horticulture, Oklahoma State Univ., Norman)

American Soc. of Limnology and Oceanography. (T. C. Dorris, Dept. of Zoology, Oklahoma State Univ., Norman)

American Soc. of Plant Physiologists. (C. L. Leinweber, Dept. of Botany and Plant Pathology, Oklahoma State Univ., Norman)

American Soc. of Plant Taxonomists. (U. T. Waterfall, Dept. of Botany, Oklahoma State Univ., Norman)

American Soc. of Zoologists. (R. W. Jones, Dept. of Zoology, Oklahoma State Univ., Norman)

Biometric Soc. (ENAR). (C. Marshall, Statistics Laboratory, Oklahoma State Univ., Norman)

Botanical Soc. of America. (W. W. Hanson, Dept. of Botany and Plant Physiology, Oklahoma State Univ., Norman)

Ecological Soc. of America. (A. Stebler, Oklahoma Cooperative Wildlife Research Unit, Oklahoma State Univ., Norman)

Genetic Soc. of America. (H. Bruneau, Dept. of Zoology, Oklahoma State Univ., Norman)

Mycological Soc. of America. (J. E. Thomas, Dept. of Botany and Plant Pathology, Oklahoma State Univ., Norman)

National Assoc. of Biology Teachers. (T. Overmire, 1709 Admiral Rd., Stillwater, Okla.)

Nature Conservancy. (A. Stebler, Oklahoma Cooperative Wildlife Research Unit, Oklahoma State Univ., Norman)

Phi Sigma Soc. (D. E. Howell, Dept. of Entomology, Oklahoma State Univ., Stillwater)

Phycological Soc. of America. (I. V. Holt, Dept. of Botany, Oklahoma State Univ., Norman)

Society for Industrial Microbiology. (R. C. Allred, Central Research Laboratory, Continental Oil Co., Ponca City, Okla.)

Society for the Study of Development and Growth. (R. W. Jones, Dept. of Zoology, Oklahoma State Univ., Norman)

Society of Protozoologists. (D. W. Twohy, Dept. of Zoology, Oklahoma State Univ., Norman)

Tomato Genetics Cooperative. (D. G. White, Dept. of Horticulture, Oklahoma State Univ., Norman)

28-1. Association of American Geographers, East Lansing, Mich. (M. F. Burrill, Office of Geography, Dept. of Interior, Washington 25)

28-1. Diseases of the Chest, intern. cong., Vienna, Austria. (M. Kornfeld, 112 E. Chestnut St., Chicago 11, Ill.)

28-2. Combustion, 8th intern. symp., Pasadena, Calif. (Office of Industrial Associates, California Inst. of Technology, Pasadena)

28-2. International Pharmaceutical Federation, Copenhagen, Denmark. (A. W. Tønnesen, Bispebjerg Hospital, Copenhagen, N.V.)

28-2. International Soc. for the Welfare of Cripples, world cong., New York, N.Y. (D. V. Wilson, 701 First Ave., New York 17)

28-3. Electron Microscopy, European regional conf., Delft, Netherlands. (A. L. Housink, Lab. v. Microbiologie, Julianalaan 67A, Delft)

28-3. Histochemistry and Cytochemistry, 1st intern. cong., Paris, France. (R. Wegmann, Institut d'Histochimie Medicale, 45, rue des Saints-Pères, Paris 6°)

29-31. American Sociological Assoc., New York, N.Y. (D. R. Young, Russell Sage Foundation, 505 Park Ave., New York)

29-31. Clinical Chemists (Canadian and American Societies), annual, Montreal, Canada. (E. Harpur, Montreal Children's Hospital, Montreal)

29-31. Electron Microscope Soc. of America, 18th annual, Milwaukee, Wis. (W. C. Bigelow, Dept. of Chemical and Metallurgical Engineering, Univ. of Michigan, Ann Arbor)

29-31. Metallurgy of Elemental and Compound Semiconductors, Boston, Mass. (E. O. Kirkendall, AIME, 29 W. 39 St., New York 18)

29-31. Water Quality Measurement and Instrumentation, PHS symp., Cincinnati, Ohio. (R. T. Hyde, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26)

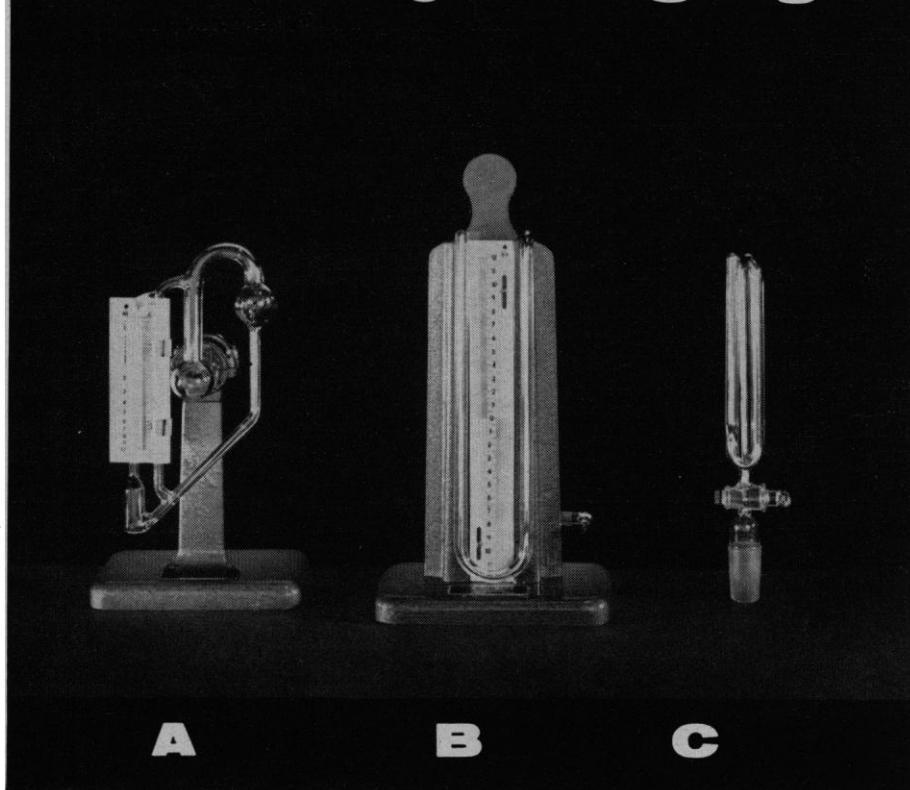
29-1. Ballistic Missile and Space Technology, 5th symp., Los Angeles, Calif. (C. T. Morrow, Space Technology Laboratories, P. O. Box 95001, Los Angeles 45)

29-1. Mathematic Assoc. of America, 41st summer, East Lansing, Mich. (H. M. Gehman, Univ. of Buffalo, Buffalo 14, N.Y.)

29-2. Semiconductors, 5th intern. conf., Prague, Czechoslovakia. (M. Matyas, Inst. of Technological Physics, Cukrovarnická 10, Prague 5)

29-3. American Mathematical Soc., natl. summer, East Lansing, Mich. (Miss L.

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29-3. International Cong. on Low Temperature Physics, Toronto, Canada. (IUPAP, 3, boulevard Pasteur, Paris 15°, France)

29-3. International Conf. on Nuclear Structure, Kingston, Ontario, Canada. (L. G. Elliott, Atomic Energy of Canada, Chalk River, Ontario, Canada)

29-16. World Forestry Conf., 5th, Seattle, Wash. (I. T. Haig, 5th WFC, Dept. of State, Washington 25)

31-6. International cong. de Sociologie, 19th, Mexico City, Mexico. (C. C. Zimmerman, 200 Emerson Hall, Harvard Univ., Cambridge 38, Mass.)

31-7. Applied Mechanics, 10th intern. cong., Stresa, Italy. (F. Rolla, Consiglio Nazionale delle Ricerche, Ufficio Relazioni Internazionali, Piazza delle Scienze 7, Rome, Italy)

31-7. British Assoc. for the Advancement of Science, annual, Cardiff, South Wales. (Secretary, BAAS, 18 Adam St., Adelphi, London, W.C.2, England)

September

1-3. Nephrology, 1st intern. cong., Geneva and Evian, Switzerland. (G. Richet, Hôpital Necker, 149 rue de Sèvres, Paris 15°, France)

1-7. American Psychological Assoc., Chicago, Ill. (L. F. Carter, 249 Mantua Rd., Pacific Palisades, Calif.)

1-7. Nutrition, 5th intern. cong., Washington, D.C. (M. O. Lee, 9650 Wisconsin Ave., Washington 14)

2-5. Astronomical League, Haverford, Pa. (R. Dakin, 720 Pittsford-Victor Rd., Pittsford, N.Y.)

3-10. International Cong. of Preventive Medicine and Social Hygiene, 8th, Bad

Aussee, Austria. (A. Rottmann, Liechtensteinstrasse 32/4, Vienna 9, Austria)

4-9. Cell Biology, 10th intern. cong., Paris, France. (M. Chèvremont, Institut d'Histologie, 20, rue de Pitteurs, Liege, Belgium)

4-9. Laurentian Hormone Conf., Mont Tremblant, Quebec, Canada. (Arrangements Committee, Laurentian Hormone Conf., 222 Maple St., Shrewsbury, Mass.)

4-10. International Soc. of Orthopaedic Surgery and Traumatology, 8th cong., New York, N.Y. (A. Bailleux, Société de Chirurgie Orthopedique et de Traumatologie, 34, rue Montoyer, Brussels, Belgium)

4-10. World Cong. of Anaesthesiologists, Toronto, Canada. (R. A. Gordon, 516 Medical Arts Bldg., Toronto 5)

4-14. International Societies of Hematology and Blood Transfusion, 8th cong., Tokyo, Japan. (S. Murakami, Blood Transfusion Laboratory, Japanese Red Cross Soc., Shibuya, Tokyo)

5-7. Society for Biological Rhythm, 7th conf., Siena, Italy. (A. Sollberger, Dept. of Anatomy, Caroline Inst., Stockholm 60)

5-9. Chemical Engineering (Czechoslovak Chemical Soc.), Prague, Czechoslovakia. (Technická 1905, Prague-Dejvice, Czechoslovakia)

5-10. Microbiology of Non-Alcoholic Beverages, 5th intern. symp., Evian, France. (D. A. A. Mossell, Intern. Assoc. of Microbiological Societies, c/o Central Inst. for Nutrition Research, Catherinejnesingel 61, Utrecht, Netherlands)

5-9. Medium and Small Power Reactors, conf., Vienna, Austria. (International Atomic Energy Agency, 11 Kärntner Ring, Vienna 1)

5-10. Operational Research, 2nd intern. conf., Aix-en-Provence, France. (International Federation of Operational Research Societies, 11 Park Lane, London, W.1)

5-12. International Soc. of Bioclimatology and Biometeorology, 2nd cong., London, England. (E. M. Glaser, Dept. of Physiology, London Hospital Medical College, Turner St., London, E.1)

5-15. International Scientific Radio Union, London, England. (R. L. Smith-Rose, Radio Research Station, DSIR, Ditton Park, Slough, Bucks, England)

5-17. Photogrammetry, 9th intern. cong., London, England. (J. B. P. Angwin, Intern. Soc. for Photogrammetry, 18 Cavendish Sq., London, W.1)

6-8. Nuclear and Radio-Chemistry, symp., Chalk River, Ontario, Canada. (R. H. Betts, Atomic Energy of Canada Ltd., Chalk River, Ontario)

6-17. Use of Radioactive Isotopes in the Physical Sciences and Industry, conf., Copenhagen, Denmark. (International Atomic Energy Agency, 11 Kärntner Ring, Vienna 1, Austria)

7-8. Canadian Textile Seminar, 7th, Kingston, Ontario, Canada. (J. M. Merri-man, Textile Technical Federation of Canada, 223 Victoria Ave., Westmount, P.Q., Canada)

7-9. Canadian High Polymer Forum, 10th, Ste. Marguerite, near Montreal, Quebec, Canada. (D. A. I. Goring, CHPF, Pulp and Paper Research Inst., McGill Univ., Montreal)

7-9. International Soc. of Geographical Pathology, 7th conf., London, England. (J. S. Young, ISGP, c/o Dept. of Pathology, Forresterhill, Aberdeen, Scotland)

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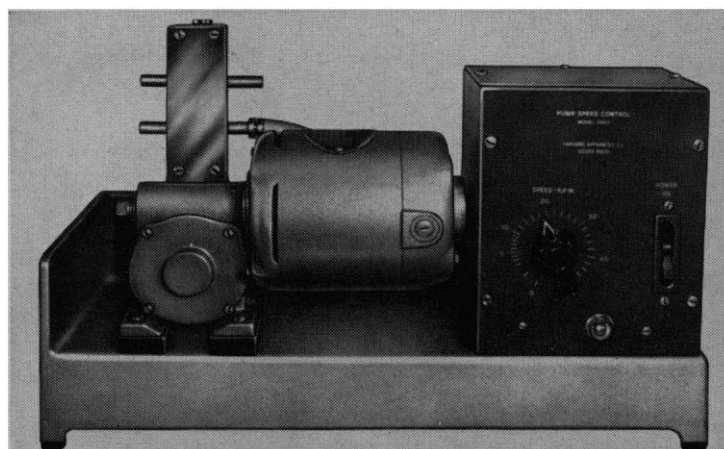
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■ **PROPORTIONING PIPETTES** use a peristaltic pump to dispense equal aliquots of liquid. One model of the device permits dial selection for automatic delivery of up to 20 multiples of a fixed aliquot per operation. A second model transfers integral multiples of the aliquot until stopped by the operator when the required member appears on a counter. Nominal volume is 0.3 ml/rev. An alternative flexible tube for 0.2 ml/rev is available. Deviation of total volume delivered by a number of revolutions is said to be less than ± 1 percent of the mean volume per single revolution. (Baird & Tatlock Ltd., Dept. Sci623, Chadwell Heath, Essex, England)

■ **GAS DETECTOR** is a portable instrument with probe-type detector connected by up to 100 ft of cable. Calibration is in percentage of lower explosion limit of desired gas. An adjustable meter trip provides buzzer alarm actuation. An adjustable current meter allows approximate classification of gas constituents in many gas mixtures. A battery and charger are built in and the instrument may also be operated from a 110-volt a-c source. (Houston Instrument Corp., Dept. Sci628, P.O. Box 22234, Houston 27, Tex.)

■ **RANDOM-SIGNAL CORRELATOR**, may be used to measure the normalized cross correlation between two signals, either random or periodic. Frequency range is 2 cy to 250 kcy/sec. Input voltage range is 20 mv to 2 v r.m.s., and gain is continuously adjustable from 1 to 100 in each channel. Accuracy is said to be ± 1 percent. An output selector permits selection of either of the two signal channels or of the correlated signal. After the two channels have been equalized, positive or negative correlation can be read directly on an r.m.s. voltmeter. (Flow Corp., Dept. Sci634, 85 Mystic St., Arlington, Mass.)

■ **VOLATILE MATTER DETERMINATION** in coal and coke, according to ASTM method D271-48, is aided by apparatus that controls automatically the rate at which the sample crucible is lowered and the length of time it remains in the

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furnace. Three dials allow selection from a variety of rates of descent and heating times. Two samples are accommodated by the apparatus at one time. (Laboratory Equipment Corp., Dept. Sci642, P.O. Box 151, St. Joseph, Mich.)

■ **THIN SECTIONING MACHINE** cuts dentive sections as thin as $35\ \mu$ and crystal sections as thin as 0.005 to 0.10 in. Sections may be cut from specimen blocks $\frac{3}{4}$ by $1\frac{1}{2}$ by 3 in. in less than 5 minutes. Sections are said to be produced with finished surfaces ready for use in routine examinations without polishing. (Will Corporation, Dept. Sci 644, P.O. Box 3927, Brighton Station, Rochester 10, N.Y.)

■ **ADJUSTABLE-LEAK VALVE** consists of a vacuum-valve body containing a sealed stem actuated by a vernier drive. A groove machined along the axis of the stem of the valve increases in depth at a controlled rate per unit length. Effective opening ranges from 0 to 0.000024 in.² and leak rate ranges to 1.8 std cm³/sec for 25 turns of the valve. (Vac-tronic Lab Equipment, Inc., Dept. Sci 646, East Northport, N.Y.)

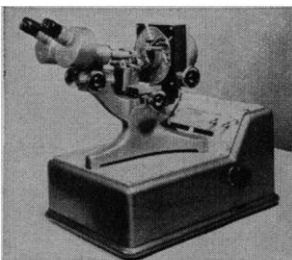
■ **PULSE GENERATOR** produces pulses of $\frac{1}{2}\ \mu$ sec duration at repetition frequencies between 0.5 and 150 Mcy/sec. Pulses can be continuously varied over a 10-to-1 range in steps up to 50 μ sec. Amplitude is 300 volts peak to peak into a 93-ohm load. The unit can be self-triggered or synchronized externally up to 30 kcy/sec. Calibrated delay ranges to 11,000 μ sec are provided. (Arenberg Ultrasonic Laboratory, Inc., Dept. Sci647, 94 Green St., Jamaica Plain 30, Mass.)

■ **ANALOG-TO-DIGITAL CONVERTER** will directly convert the amplitude of carrier system voltages to digital codes without intermediate a-c-to-d-c conversion. The unit is reversible and as a digital-to-analog converter it converts parallel digital codes to a-c carrier voltages. The amplifier, comparator, and conversion networks will accept frequencies to 100 kcy/sec yielding accuracies said to be ± 0.02 percent $\pm \frac{1}{2}$ count. Units are available for conversion of voltage to 8-to-13 bit binary or to binary-decimal codes of 2, 3, or 4 digits resolution. (Epsco, Inc., Dept. Sci649, 275 Massachusetts Ave., Cambridge, Mass.)

■ **HIGH-SPEED CAMERA SYSTEM** consists of the camera, camera control unit, light control unit, and flash lamp. In the camera a rotating mirror spun by an air turbine sends the image to the rim of a circular film box. The camera control unit contains the elements necessary for operation of the Kerr-cell



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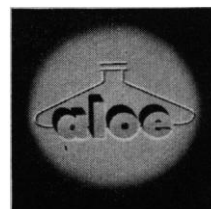
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■ **BLACK BODY INFRARED SOURCE** is a miniature unit designed for calibrating the seeking head of infrared guided missiles and other infrared sensitive elements in the 200° to 600°C temperature range. Temperature control is provided by a separate unit which senses the temperature of the radiating core by means of a platinum resistance thermometer. The radiating element is a pure silver core with a conically shaped cavity. The surface of the cone is coated with a refractory material to increase its emissivity to near unity. (Perkin-Elmer Corp., Dept. Sci658 Norwalk, Conn.)

■ **MOUSE BREEDING BOXES**, made of polyethylene, can be sterilized by autoclave. A smooth finish is said to prevent capillary action, and a built-in nesting feature prevents sticking. Punched lips for drying on washer conveyer are available. (Consolidated Molded Products Corp., Dept., Sci652, 329 Cherry St. Scranton 2, Pa.)

■ **DIGITAL DISPLAY UNIT** can also serve as a general-purpose oscilloscope. The unit provides a 6- by 10-cm raster presentation of digital data shown as cathode-ray-beam modulation by means of bistable intensity circuits. Positive-going pulses of 2 volts or greater intensify the trace while negative-going slopes of 2 volts extinguish the trace. Horizontal sweeps are generated internally at 5 to 50,000/sec. External sweeps may also be supplied with full-scale deflection produced by 300 mv. Step voltages having amplitudes from 600 mv to 30 volts with rise times up to 0.07 μ sec produce a full-scale vertical raster. (Waterman Products Co., Inc., Dept. Sci650, 2445 Emerald St., Philadelphia 25, Pa.)


■ **pH METER** is a direct-reading instrument incorporating both a 0-to-14 pH scale and an expanded scale with 2.0 pH full-scale graduated in 0.1 pH units. Any 2-pH span can be selected for full-scale expansion. pH measurements are said to be accurate to ± 0.003 pH. Millivolt readings may be obtained over any 200-mv span from 0 to 1400 mv with accuracy said to be ± 2 mv and repeatability ± 0.3 mv. (Beckman Scientific and Process Instruments Division, Dept. Sci643, 2500 Fullerton Rd., Fullerton, Calif.)

■ **TIMING SYSTEM** includes a crystal and oven-controlled frequency standard; a frequency divider which furnishes 60 cy/sec; a stroboscope on whose scale WWV signals appear visually for correction to WWV time; a power amplifier to boost the 60 cy/sec signal to 15 watts; a clock and photocell-gated programmer that provides 10-sec, 1-min, 30-min, and 1-hr timing pulses; and a control unit that provides for aural monitoring of signals. Accuracy is said to be within ± 0.1 sec/wk. Operating power is provided by 24-volt batteries. (Geotechnical Corp., Dept. Sci651, P.O. Box 28277, Dallas 28, Tex.)

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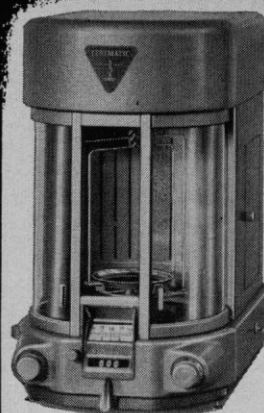
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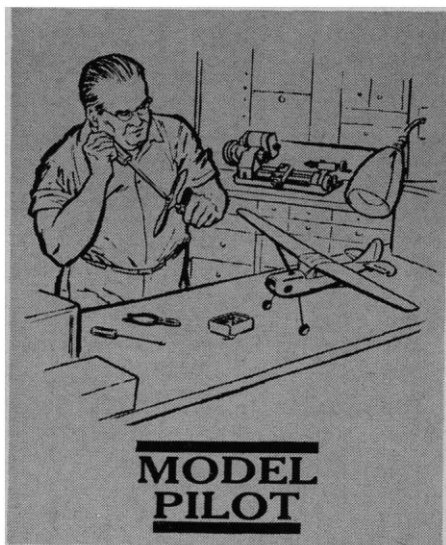
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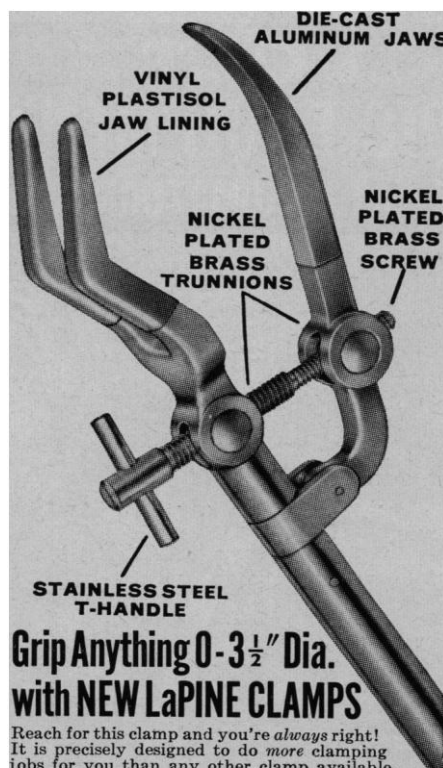
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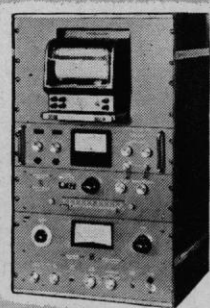
■ **RATE TURNTABLE** is a portable test unit for mounting rate gyros, antennas, guidance assemblies, and other components requiring imposition of constant rate of turn for performance checking. The basic unit provides a single rate about a vertical axis; modified units provide multiple rates, tilting to polar or horizontal axes, or servo drive. (Sterling Precision Corp., Dept. Sci656, 17 Matinecock Ave., Port Washington, N.Y.)

■ **PHASE AND RATIO METER** provides simultaneous readings of phase angle and amplitude ratio between two radio-frequency signals. Frequency response is 150 kcy to over 100 Mcy/sec, and threshold sensitivity is 50 mv. The instrument combines a frequency converter with the manufacturer's type 405 phase meter. The converter, used with an external oscillator, converts two radio-frequency signals into audio signals of identical phase relationship and proportional amplitude. Outputs are provided for input to recorders. (Ad-Yu Electronics Lab, Dept. Sci666, 249-59 Terhune Ave., Passaic, N.J.)

■ **COUNTER-TIMER**, fully transistorized, provides measurement of frequency from 0 to 10 Mcy/sec, time interval and period from $0.3 \mu\text{sec}$ to 10^8 seconds, frequency ratio to 10^7 , and phase to 0.1 deg. Readout is by means of in-line electrode tubes. Three d-c amplifiers have 1-megohm input impedance and 0.1-volt r.m.s. sensitivity. Power consumption is 50 watts. (Systron Corp., Dept. Sci661, 950 Galindo St., Concord, Calif.)

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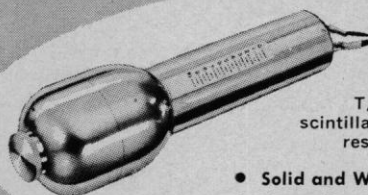
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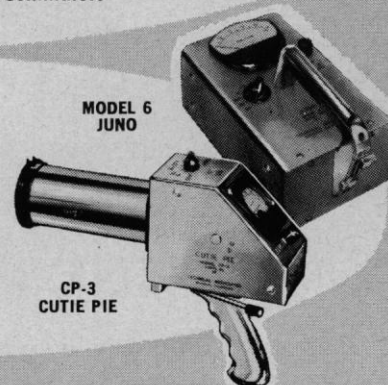
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JOSHUA STERN

National Bureau of Standards,
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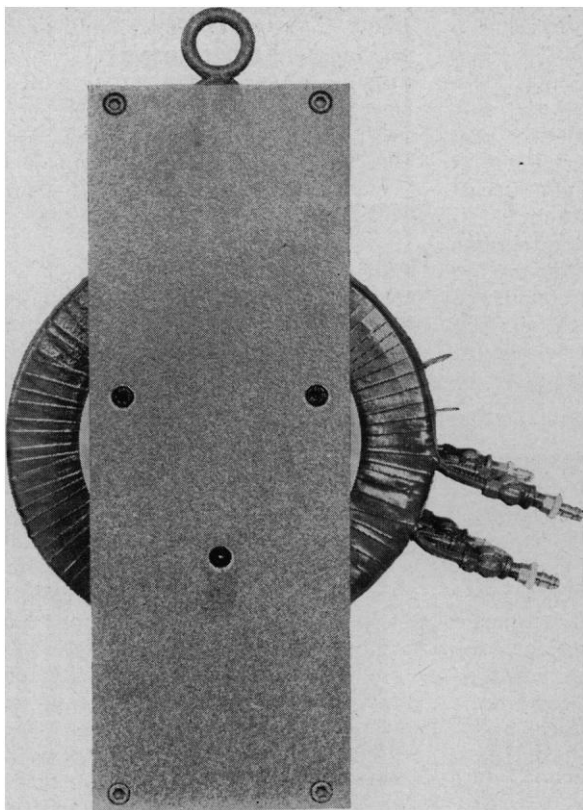
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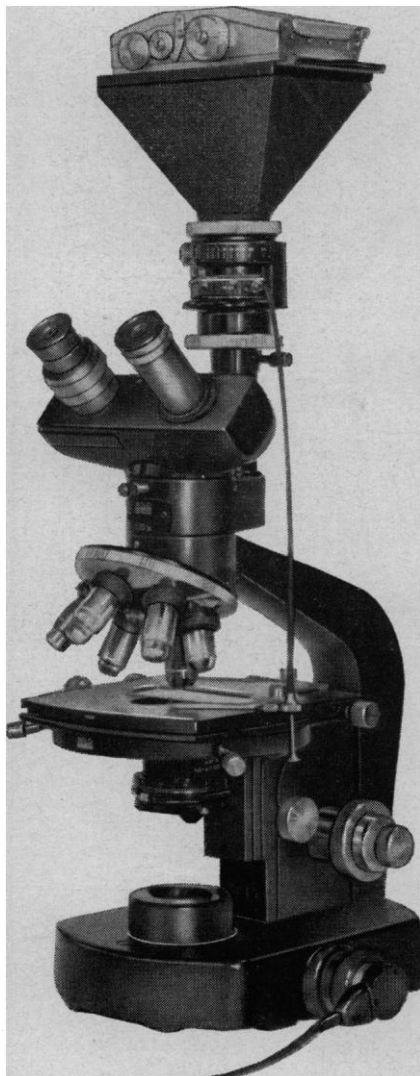
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Letters

Artificial Biosphere

It is unfortunate that Dyson's suggestion [*Science* 131, 1667 (1960)] as to how intelligent beings might survive after reaching "the limits set by Malthusian principles" does not do justice to the intelligence of these beings by explaining how they would overcome some of the obstacles which, at first sight, would seem to militate against their curious way of life.

Dyson's report describes a uniformly thick shell of fluid with a thickness of a meter or two and a radius twice the earth's distance from the sun. The shell is said to revolve about the central star, which implies that the material revolves as a whole. Presumably the material of the shell must be enclosed on both surfaces by transparent plastic sheaths of similar constructions, for self-gravitation cannot be expected to make the material cohere. However it is not conceivable that it would be possible to quarry from the material of a planet like Jupiter sufficient structural steel to keep the shell rigid against the shear forces and those that would tend to move material towards the equatorial plane.

Therefore, it must be assumed that radiation pressure must play a part in supporting the shell, so that its form will be that of an oblate spheroid rather than a sphere. For example, material at the poles of revolution of the shell would be supported entirely by radiation pressure, so that the polar radius of the shell would necessarily be less than the equatorial radius. However, a cursory calculation will show that this would be possible only at a distance from the central star comparable to but less than the radius of the sun.

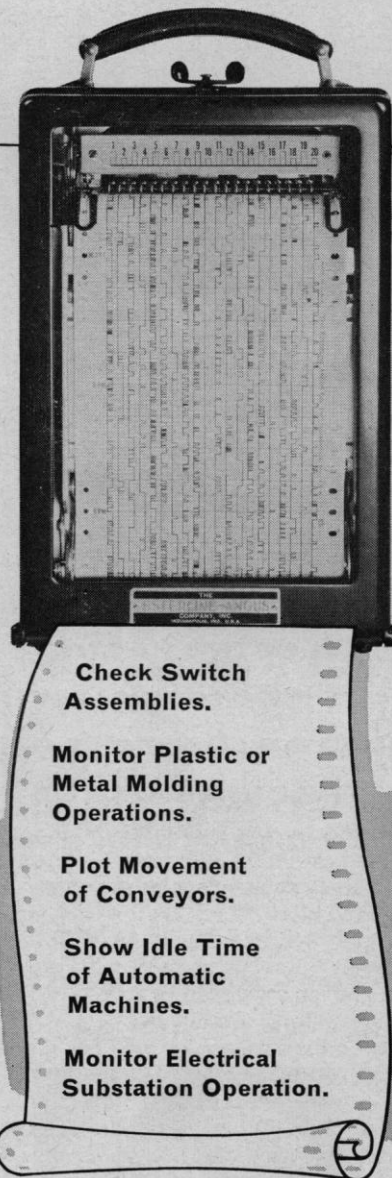
Beings of lesser intelligence, not having discovered the appropriate laws of physics, might therefore seek some other distribution of their dismantled Jupiter that would have more intrinsic stability—for example, a torus lying in a plane perpendicular to the axis of its own rotation. The mass of Jupiter distributed in this way would yield a torus whose cross-sectional area was comparable with that of the moon, but unfortunately the flux of stellar radiation would be reduced by a factor of 10^6 .

With conventional laws of physics, however, as Laplace was the first to show, even this arrangement would not be stable, and it is to be expected that the material of the torus would coalesce into one or more planetary objects. This suggests that, in the present state of intelligence, the dispersal of Jupiter into a thin shell about the sun would

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not be an effective means of escaping the consequences of continued population growth but that it might be an experiment with an important bearing on various theories of the origin of the solar system. It would, for example, be interesting to see whether the outcome of the experiment was the recreation of Jupiter or the creation of a number of asteroids.

Another point is that a search for infrared stars would be valuable even in conventional science for the light it might throw on the evolution of stars which are very young or very small as compared with the sun.

JOHN MADDOX

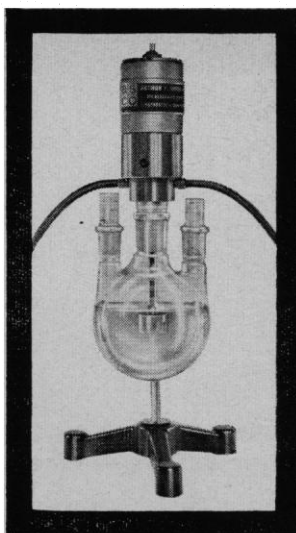
Washington Post,
Washington, D.C.

Freeman Dyson's report suggesting that intelligent life elsewhere in the universe may be detected by looking for sources of infrared radiation was delightful. However, as an old science-fiction hand, I feel obliged to sound a cautionary note to the scientists. Or am I merely too dense to recognize a satire?

The basis of Dyson's argument is that an industrial culture may eventually occupy an artificial biosphere completely surrounding its sun, thus maximizing the territory and energy available for population expansion "to the limits set by Malthusian principles." The mass of Jupiter could be converted into an inhabited "spherical shell revolving around the sun at twice the Earth's distance from it," utilizing incident solar radiation which would be reradiated into space in the 10-micron band.

Offhand, I should think rotational and gravitational stresses alone would rule out such a structure of such dimensions. But since it is admittedly dangerous to assert that anything is impossible, I shall confine myself to questions of economics. Even Dyson intimates that the project would take several thousand years to complete; he calculates the energy required as equal to the sun's total output for eight centuries, and one does have to eat meanwhile. And meanwhile, too, the population growth necessitating this project will presumably continue. As Hauser remarks in the same issue [*Science* 131, 1642 (1960)], at our present-day rate of increase we would reach "a population of one person per square foot of the land surface of the earth in less than 800 years." Thus, the economic surplus needed for the biosphere project would be consumed long before the latter got well started.

If we assume a ratio of population increase to industrial expansion low enough so that this contretemps does not occur, we must ask ourselves how



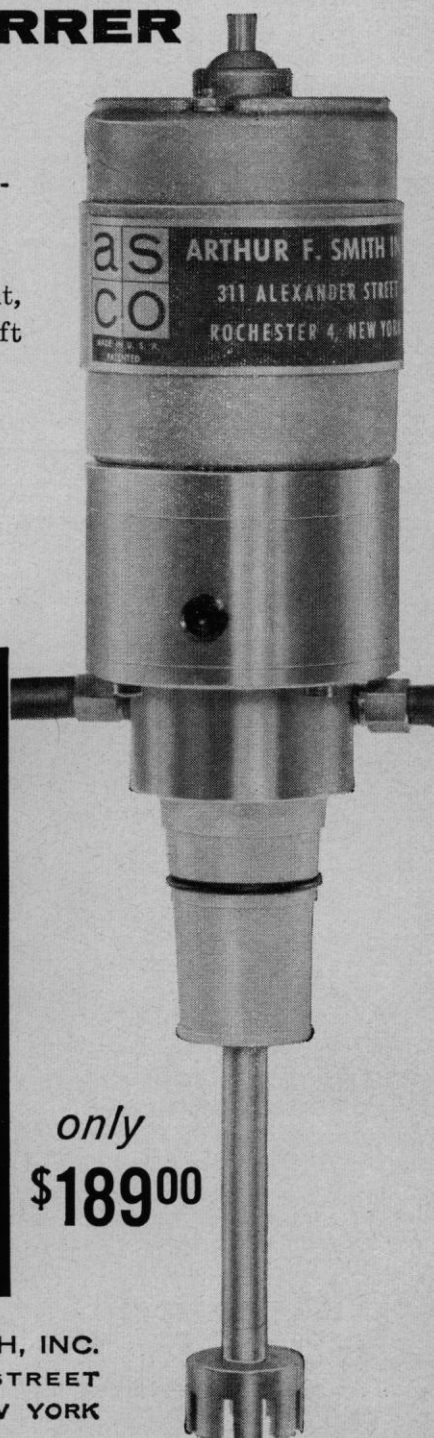
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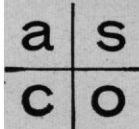
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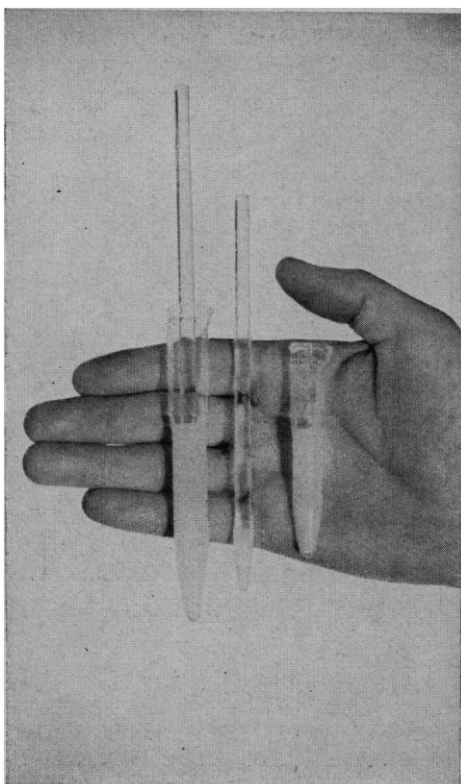


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any intelligent species could be induced patiently to continue this enormous task, millennium after millennium. True, our human history contains epochs of grandiose and useless construction, such as the pyramid building of Egypt, but they never lasted very long. Any revolutionist who promised relief from the crushing burden of the biosphere project would be well received! He could doubtless get support for some or other population-control program; those who demurred would be martyred by exasperated taxpayers, or the equivalent thereof.

Of course, the entire species *might*, by advanced psychological techniques, be conditioned into such an antlike state that its government could never be overthrown, or break down from internal stresses, or evolve into something new. But given subjects as meek as this, and no reason to breed vast armies (for only a well-established world government could seriously entertain these ideas in the first place), the masters could regulate birth and death by fiat. Thus, the population would be stabilized at some rational figure and projects such as Dyson's would never be indicated.

In short, uncontrolled population growth will make the construction of artificial biospheres impossible, and control will make them unnecessary. So astronomical discovery of infrared sources won't prove anything about the inhabitants of other planets.

POUL ANDERSON

3 Las Palomas Road,
Orinda, California

The suggestion by Freeman J. Dyson for investigating solar far-infrared radiation as one way to detect extraterrestrial intelligence sounds quite practical and sensible.

This leads me to suspect that if Dyson's assumption is correct—that intelligent beings exist of a far higher order of technological achievement than our own—it would be well-nigh impossible for such beings *not* to have detected us.

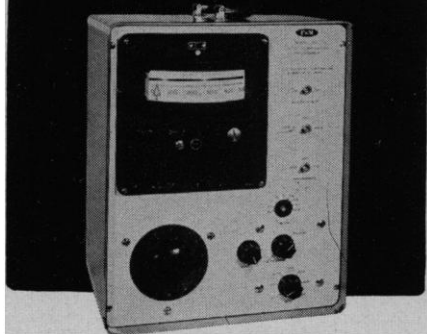
EUGENE A. SLOANE

"Air Engineering," Detroit, Michigan

In reply to Maddox, Anderson, and Sloane, I would like only to add the following points, which were omitted from my earlier communication.

1) A solid shell or ring surrounding a star is mechanically impossible. The form of "biosphere" which I envisaged consists of a loose collection or swarm of objects traveling on independent orbits around the star. The size and shape of the individual objects would be chosen to suit the convenience of the inhabitants. I did not indulge in speculations concerning the constructional details of the biosphere, since the ex-

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pected emission of infrared radiation is independent of such details.

2) It is a question of taste whether one believes that a stabilization of population and industry is more likely to occur close to the Malthusian limit or far below that limit. My personal belief is that only a rigid "police state" would be likely to stabilize itself far below the Malthusian limit. I consider that an open society would be likely to expand by a proliferation of "city-states" each pursuing an independent orbit in space. Such an expansion need not be planned or dictatorially imposed; unless it were forcibly stopped it would result in the gradual emergence of an artificial biosphere of the kind I have suggested. This argument is admittedly anthropomorphic, and I present it in full knowledge that the concepts of "police state" and "open society" are probably meaningless outside our own species.

3) The discovery of an intense point source of infrared radiation would not by itself imply that extraterrestrial intelligence had been found. On the contrary, one of the strongest reasons for conducting a search for such sources is that many new types of natural astronomical objects might be discovered.

FREEMAN J. DYSON

*Institute for Advanced Study,
Princeton, New Jersey*

Hazards and Insecticides

Philip R. White states [*Science* 131, 614 (26 Feb. 1960)] that "the problem" is much wider than "poisoned cranberries," chickens, and so on; that "the problem" is a "premature or inadequately prepared commercialization of scientific finding." White fortifies his opinion with a few cases, stating that these must be only a few of hundreds. White has presented only one side of the coin. That certain cases do represent a very dangerous trend is true, but the reverse side of the coin may be equally dangerous.

Pray let me, like White, cite a few examples. In the last few years this laboratory has tested two chemicals that came to us from Europe, highly recommended. In both cases we found the materials ineffective although not in any way dangerous. One of these was already on the market in Europe but was withdrawn because our work proved it ineffective. This case parallels the case of the French weed killers cited by White.

In the 1930's *Anopheles gambiae* was rampant in the valley of Rio Grande do Norte in northeastern Brazil. Many scientists (altogether too many) stated dogmatically that it was impossible to eradicate these mosquitoes, that

the misery, sickness, social disorders, and death visited upon Rio Grande do Norte were inevitable for the Western Hemisphere from Buenos Aires to Galveston. Fortunately a small group of scientists supported by the Rockefeller Foundation and the Brazilian Government staked their honor and reputations, but not their lives, in a scientific Thermopylae. They used the tools available—namely, pyrethrum of evanescent efficacy and paris green of extremely high toxicity. In 2 years morbidity cases among the field workers numbered 595. Compare this with statistics for the village of Caicó (some

600 inhabitants), where there were 64 fatalities in the month of May 1959 as a direct result of invasion by *Anopheles gambiae*. *Anopheles gambiae* was eradicated in the Western Hemisphere, although the only weapons available were ineffective or hazardous by present scientific standards. The incident is forgotten, although it has been fully published and the report is readily available for anyone's perusal [F. L. Soper and B. Wilson, *Anopheles gambiae in Brazil* (Rockefeller Foundation)].

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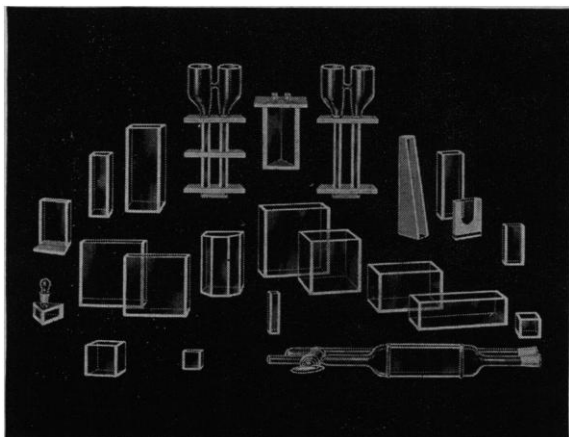


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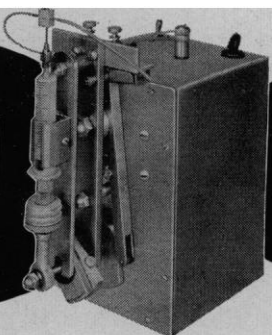
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with a new and dangerous pest—namely, *Musca autumnalis* or face fly. This insect is very closely related to the house fly, but it differs in habits. It congregates on the face of cattle, and these miserable animals have no defense. Like its close relative the house fly, it is an extremely effective transmitter of certain disease organisms, such as staphylococci, salmonellae, coliforms, and other enteric bacteria. It even likes the face of man, particularly the corners of the lips. For two summers I have watched this pest on the cattle pastured almost in my back yard. They are miserable animals with sore eyes, and I do not for one minute suppose that their milk is of the highest or most nutritious quality. We have available insecticides which are safe by any reasonable standards, and effective. However, they may not be used legally on dairy cattle because of the fanatical attitude of certain federal officials. The face fly is spreading steadily in the northeastern United States, where nothing is done to control or to eliminate this disease-bearing pest. I wish to point out that this is a very dangerous trend. We are accepting an obvious and well-proved hazard because certain individuals with legal power dream of a possible hazard connected with the use of insecticides upon dairy cattle. We grant that certain insecticides can be dangerous, but there are available today effective drugs that are not hazardous from the scientific point of view. They have been very well studied, and while they cannot be declared absolutely innocent (the absolute has no place in science) they are, when used as insecticides, as innocent as sugar, salt, or milk itself. This is all that a relative science can do, for science can never be absolute.

White's complaint, that insecticides used to control the fire ant are hazardous to wildlife, is out of proper reference. If permitted to spread throughout the southern United States, this pest species will destroy many wild species and their habitats. D. Hey, writing of Cape Providence, Union of South Africa, states, "particularly introduced forms such as the Argentine Ant" have played their part in depletion of wildlife. Evidence of the same "depletion" is recorded for the United States. We should not trade temporary loss of a few species over a small area for permanent loss of many types over a much larger area.

As Francis Bacon stated years ago, we must be willing to accept new remedies, or we must prepare ourselves for new ills. The fire ant and the face fly are merely two of the many ills that presently affect us. I know of many more. They happen to be new to this part of the world, but there are old as well as new problems. These are

scientific problems and they must be dealt with by scientific methods. This means that we must open our minds to the relative laws of science and bar therefrom the absolute nonsense that has created the cranberry scandal and is driving us toward a dairy debacle. Every new drug should be adequately tested by the relative laws of science in general and of biology in particular. The use of absolute dicta, of the philosophical zero, such as White seems to approve, will prove disastrous again as in the past. Science can never prove absolute safety—it can prove necessity and relative safety.

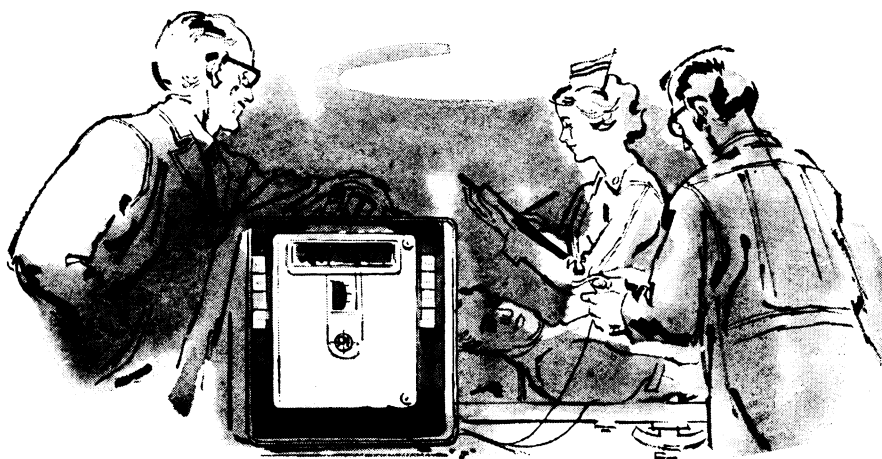
Generalization from such limited cases is of uncertain value; the conclusion that the problem is fundamentally biological seems unavoidable. Consequently, the solution must follow the laws of biological science. The virulent poisons produced by staphylococci and

other pathogens are a part of the problem. Dogmatic regulations that contravene the laws of biology will prove dangerous and even disastrous. Safety must be defined in terms of biology and not in terms of a philosophical zero, an absolute mathematical formula, or an analytical procedure.

PAUL D. HARWOOD
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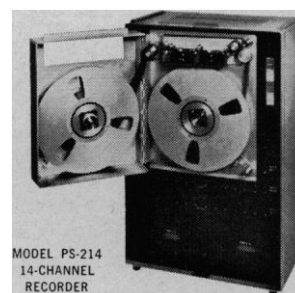
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metic operations in a predetermined sequence and could never think in any sense of the word." This cliché still represents the dominant attitude of many scientific and engineering publications on both sides of the iron curtain. An elaboration, which often follows the cliché, explains that the sequence of arithmetic and logical operations is completely predetermined by a human programmer, and any appearance of thinking by the computer is merely a manifestation of the thinking of the human programmer. (The general-purpose digital computers do carry out se-

quences of arithmetic and logical operations as specified by the programmer, but the programmer may specify that the sequence shall vary as a function of the input variable [or sensory] data.)

These projections of their own ignorance by pseudo experts may be amusing to researchers who are daily engaged in mechanized-thinking experiments on general-purpose and special-purpose computers. However, a scientist seeking employment or approval for a new project from a director of a research laboratory may not find these negativistic attitudes at all amusing.

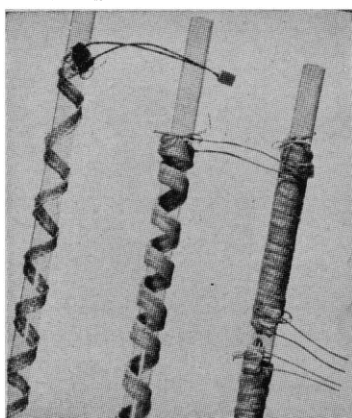
Such negativistic statements are almost invariably followed by a challenge to demonstrate the mechanized-thinking process by deriving the general theory of relativity. This seems comparable to requiring the Wright brothers to prove that they could fly by flying nonstop around the world.

It may seem improbable that research directors would be so ill informed concerning subjects relevant to their work. However, this seems to be the rule rather than the exception. It would appear that prominent scientists and engineers should be more cautious about asserting that certain things cannot be done merely because they do not know, at the moment, of any feasible method. They not only leave themselves open to ridicule in many instances but may also hinder the progress of research, for the direction of scientific research may be greatly affected by a simple, negativistic, dogmatic, cliché.

ROGER A. MACGOWAN

Army Ballistic Missile Agency,
Redstone Arsenal, Huntsville, Alabama

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Heat **WHERE** You Want It
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Electrothermal Heating Tapes consist of one or more fabric bands of resistance wire, separated or bordered by bands of high-temperature-resisting glass fiber yarn. The width and length of the various tapes are carefully determined by the current carrying capacity of the resistance wire. Temperatures of 400°C and over can be reached inside a glass tube of 2mm wall thickness.

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Length in Ft.	Width in Inches	Watts at 115 V.	Amps.	Un- Insulated Cat. #S65080	Insulated 1 Side Cat. #S65090	Insulated Both Sides Cat. #S65100
3	1	100	1.6	\$ 9.65 ea.	\$11.40 ea.	\$11.90 ea.
4	2 1/2	250	3.0	12.25 "	15.00 "	18.75 "
5	3	450	4.6	16.75 "	20.25 "	26.50 "
6	3 1/2	500	5.2	19.25 "	23.00 "	29.50 "
2	1/2	36	0.5			4.25 "
4	1/2	72	1.0			6.70 "
6	1/2	108	1.5			9.00 "
8	1/2	144	2.0			13.90 "
2	1	72	1.0			6.90 "
4	1	144	2.0			12.50 "
6	1	216	2.5			14.40 "
8	1	288	3.0			17.25 "
2	2	120	1.5			9.70 "
4	2	240	3.0			15.00 "
6	2	360	4.0			20.00 "
8	2	480	5.0			30.00 "
2	3 1/2	210	2.5			19.90 "
4	3 1/2	420	4.2			21.00 "
6	3 1/2	630	7.5			29.50 "
8	3 1/2	840	10.0			45.00 "

(Average load
of Heating
Tapes is 2 1/2
Watts/Sq. in.)

THREE TYPES AVAILABLE

1. **UNINSULATED**—Current-carrying resistance wires are in direct contact with the surface to be heated. It is possible to look through this tape and is of great value for research work when wound on a transparent surface.
2. **INSULATED ON ONE SIDE**—This tape is also applied with direct contact between the resistance wire and the surface to be heated . . . but heat losses to atmosphere are greatly reduced by the addition of a layer of a knitted glass yarn on one side.
3. **INSULATED ON BOTH SIDES**—This tape is composed of two insulation layers with current-carrying bands in the center. May be safely wound on metal making it specially suitable for heating steel tubes, valves, nozzles and other conducting surfaces.

The tape is simply wound across the body to be heated, and is held in position by glass laces at both ends. A suitable control device such as a "Powerstat" or variable auto-transformer should be used with the tapes.

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Similarly, the announced weight of the Russian "space ship" was 4 tons, 540 kg. In the *Science* article this is given as 9988 pounds, corresponding to a conversion factor of 2.2000 lb/kg. In fact, the conversion is 2.2046; the weight in English units is apparently 10,009 lb.

For the purposes of the articles in *Science*, accuracy in these details is probably not important. Nevertheless, there is a lesson to be learned about the simplicity of conversions within the metric system and about the retention of significant figures during and after conversions.

PEMBROKE J. HART

IGY World Data Center A,
National Academy of Sciences-National
Research Council, Washington, D.C.