SCIENCE

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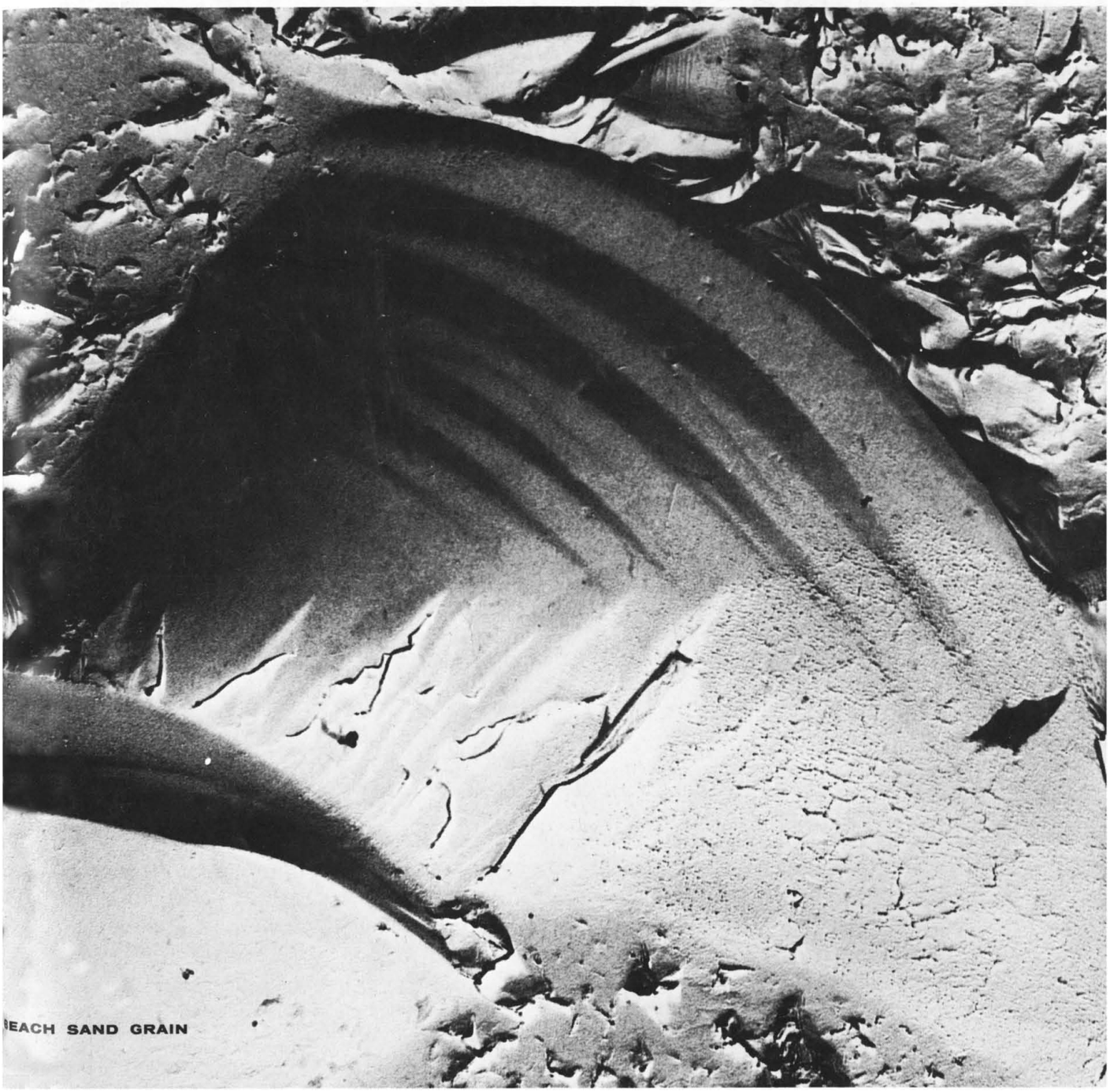
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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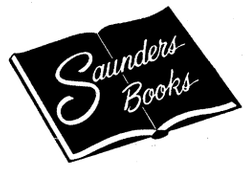

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Surface of sand from the beach at the junction of Old Montauk Highway and Washington Road on the south shore of Long Island. See page 1262.

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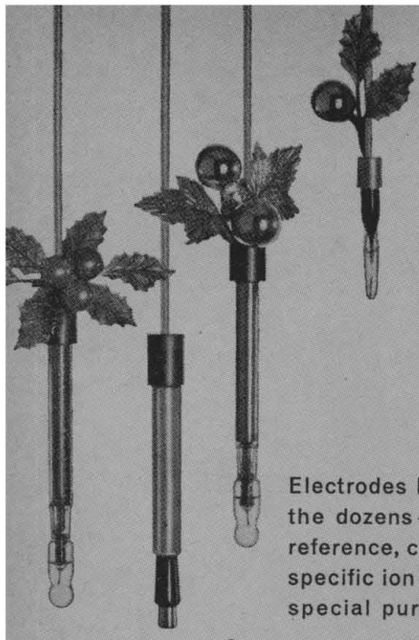

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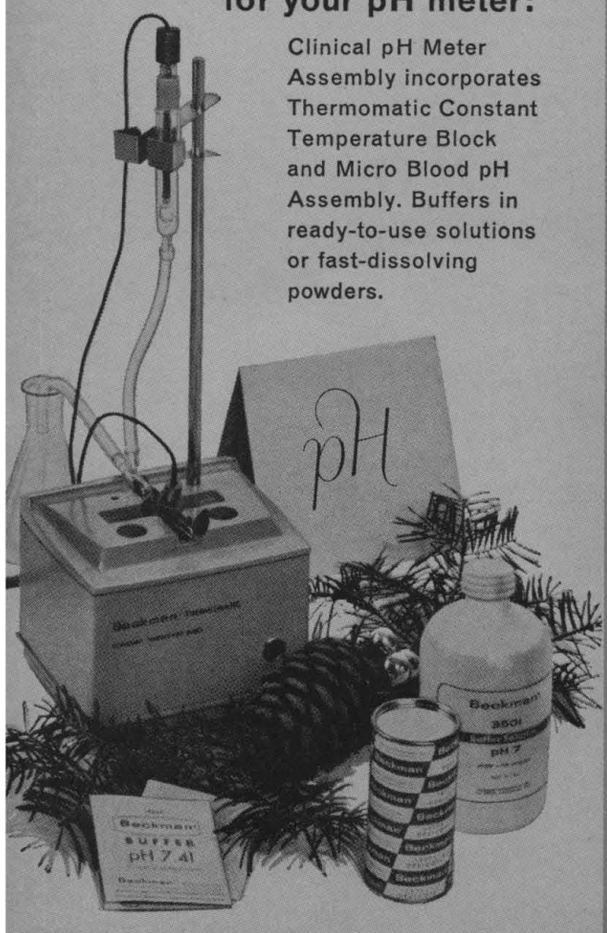

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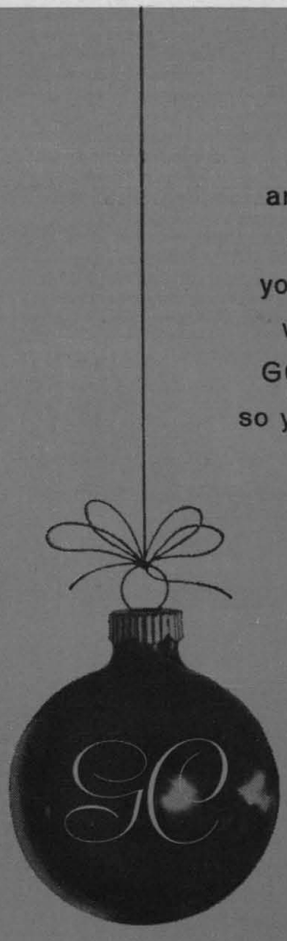

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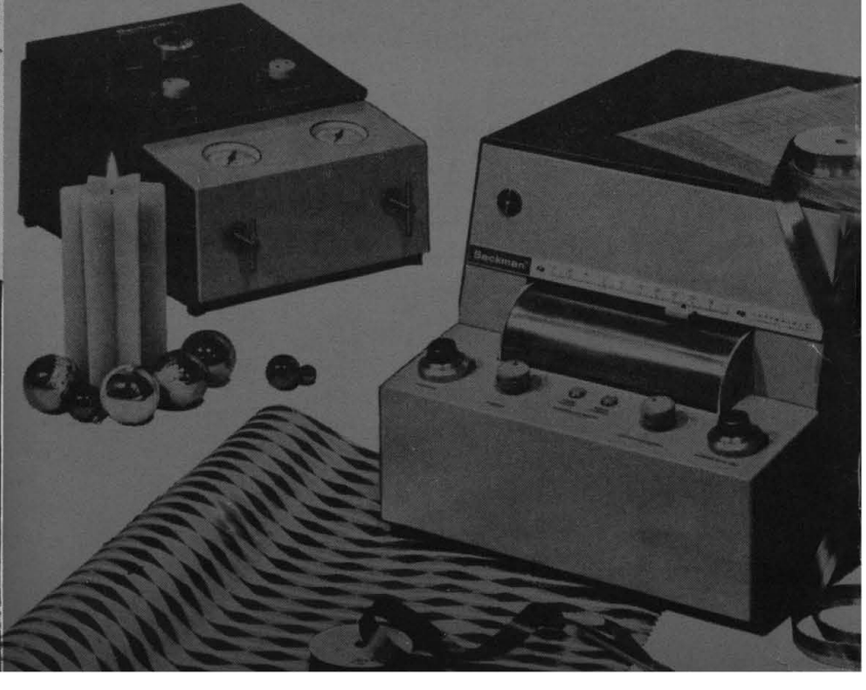

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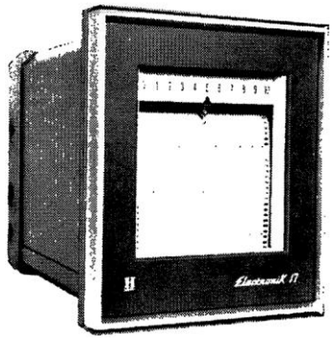

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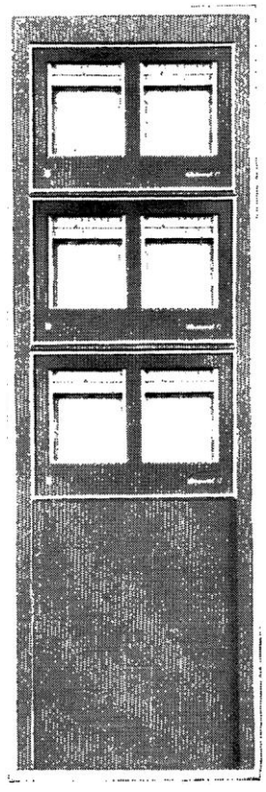

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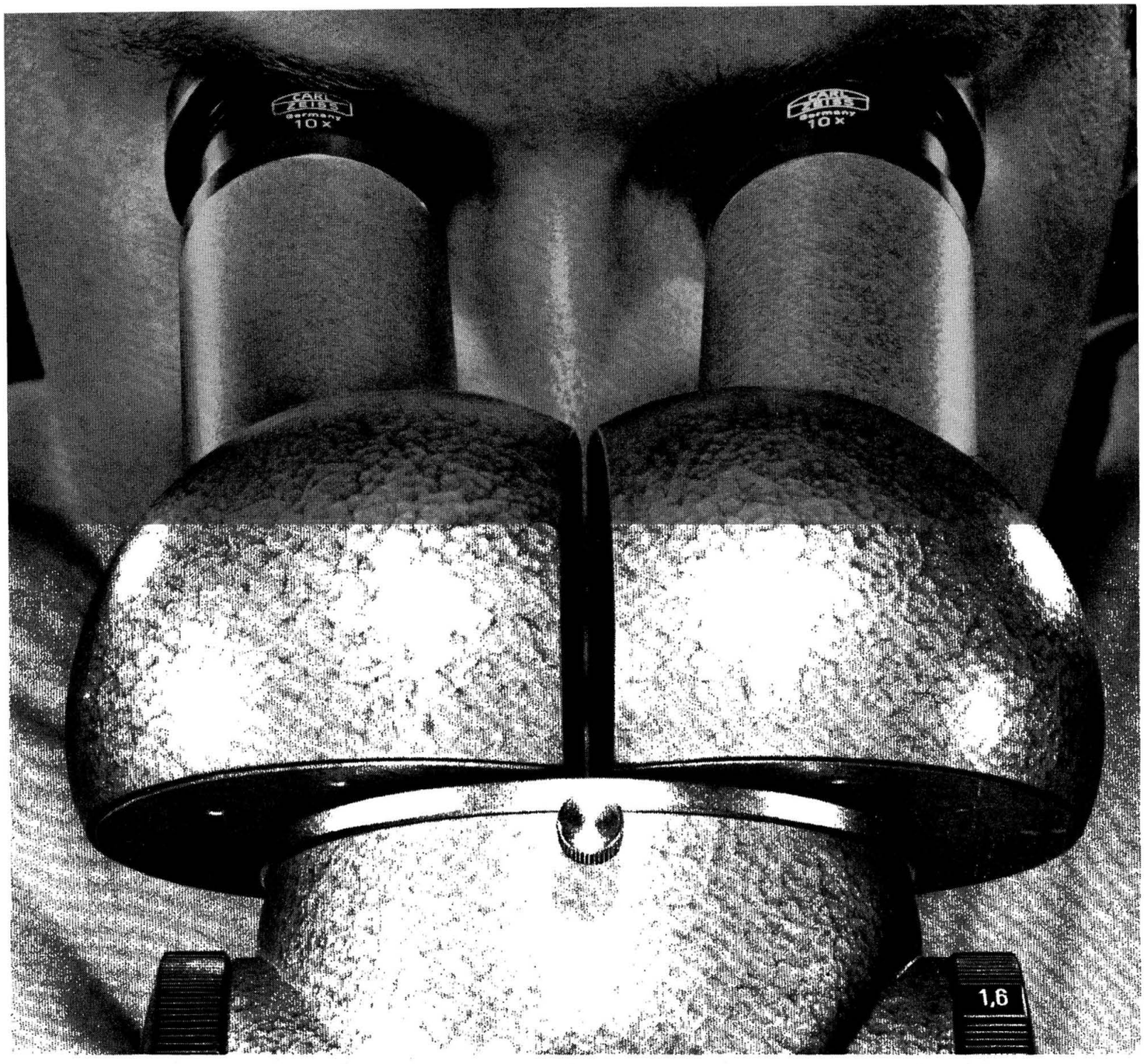

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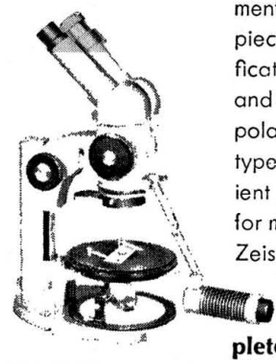

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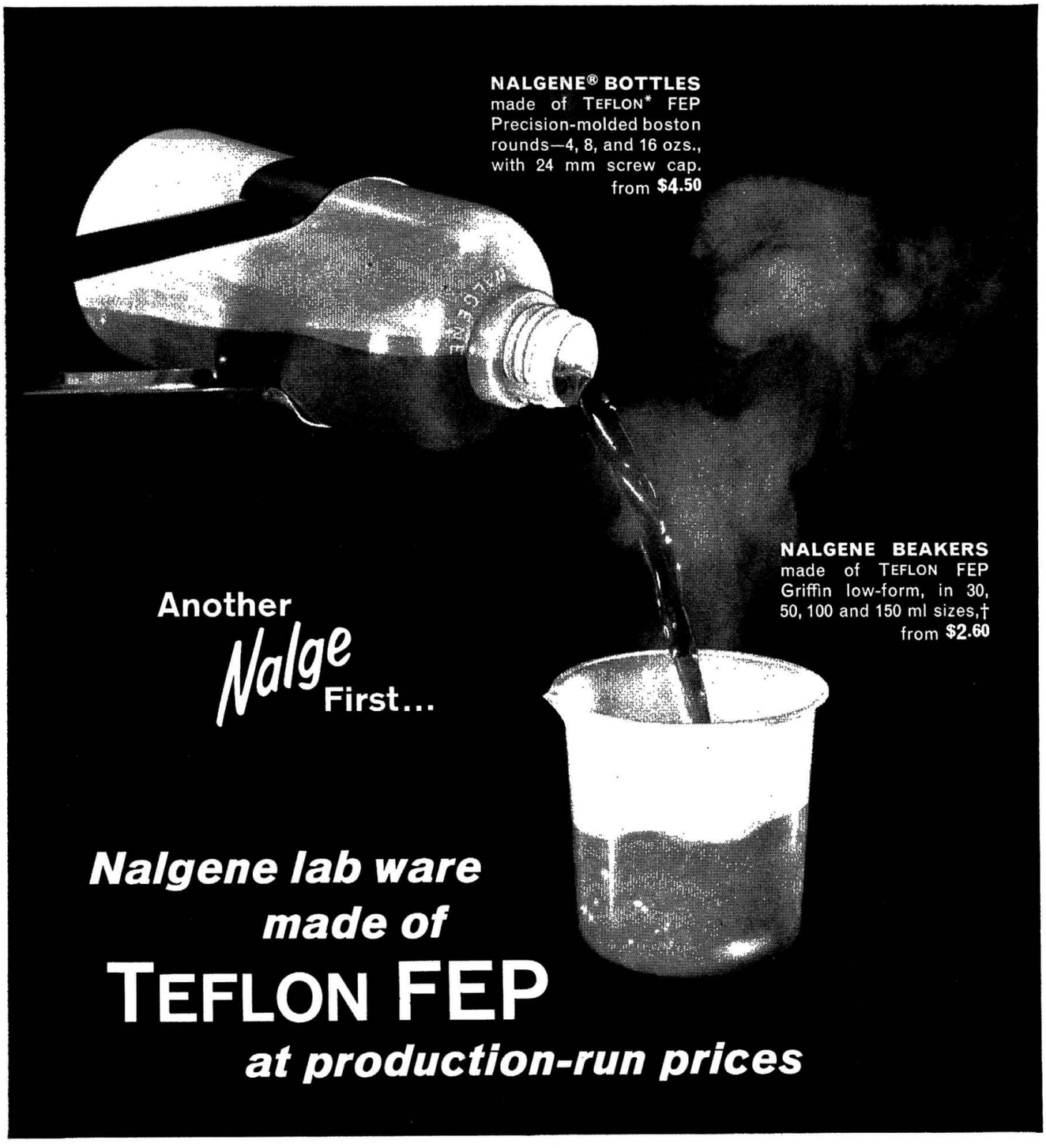

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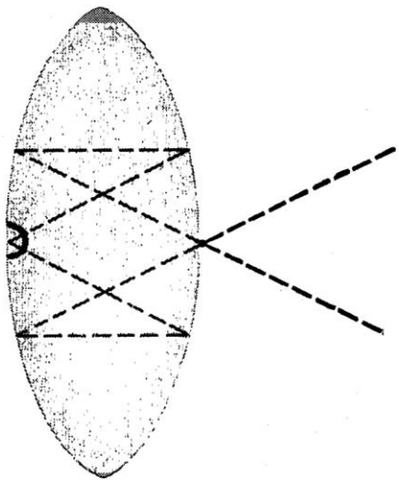

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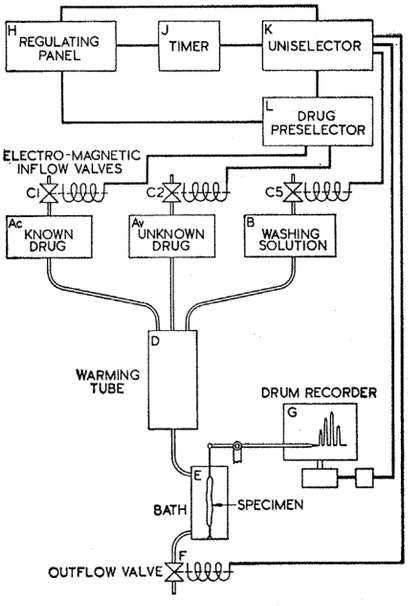
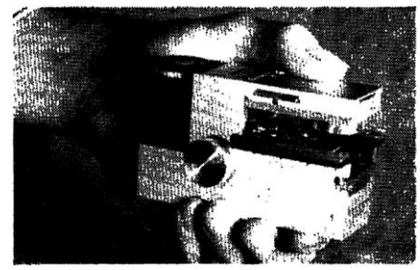


The drug and washing solutions are contained in reservoirs Av, Ac and B respectively. When one of the air-inlets is opened by its valve C, the solution flows via the warming tube D into the jacketed isolated organ bath E — which is emptied by another electro-magnetic valve F. The contractions of the specimen are traced on the drum of a standard type of variable speed recorder G.

The cycle has been divided into several stages. The time required for each of these operations is independently variable over a very wide range. This is done by adjusting those controls on panel H which regulate the intervals between the pulses sent out by timer J to the uniselector switching device K. The order in which the drugs are added is decided by the position in which plugs are placed in the preselector L.

The McArthur Microscope



The McArthur Microscope shown was originally designed for malaria diagnosis and control work in the field in Southeast Asia. It can be quite easily carried in a coat pocket, but retains all the performance advantages of a full size instrument. A full range of achromatic and fluorite objectives is available as well as dark ground accessories. Illumination can be by mirror or by a battery or transformer operated built-in light source.

Phase contrast examination of tissue cultures in test tubes

Adequate optical examination of the living cell sheet while in the test tube (in which tissue cultures for routine virology are often and most conveniently grown) has not previously been possible — chiefly because it has not been possible to apply the phase contrast method. However, this is now feasible with the McCarthy Phase Apparatus, supplied as an accessory with the Cooke M15 microscopes, designed to give a phase contrast image (up to 150X-200X) of tissue cultures in a round 6" x ⅝" (150mm x 16mm) test tube.

In the McCarthy system provision is made for correction of astigmatism caused by the test tube and a special condenser system, compensated for the tube's cylinder effect, projects the substage phase annulus in the plane of the object.

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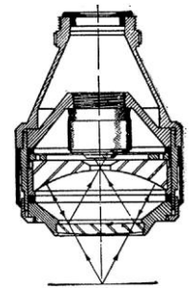
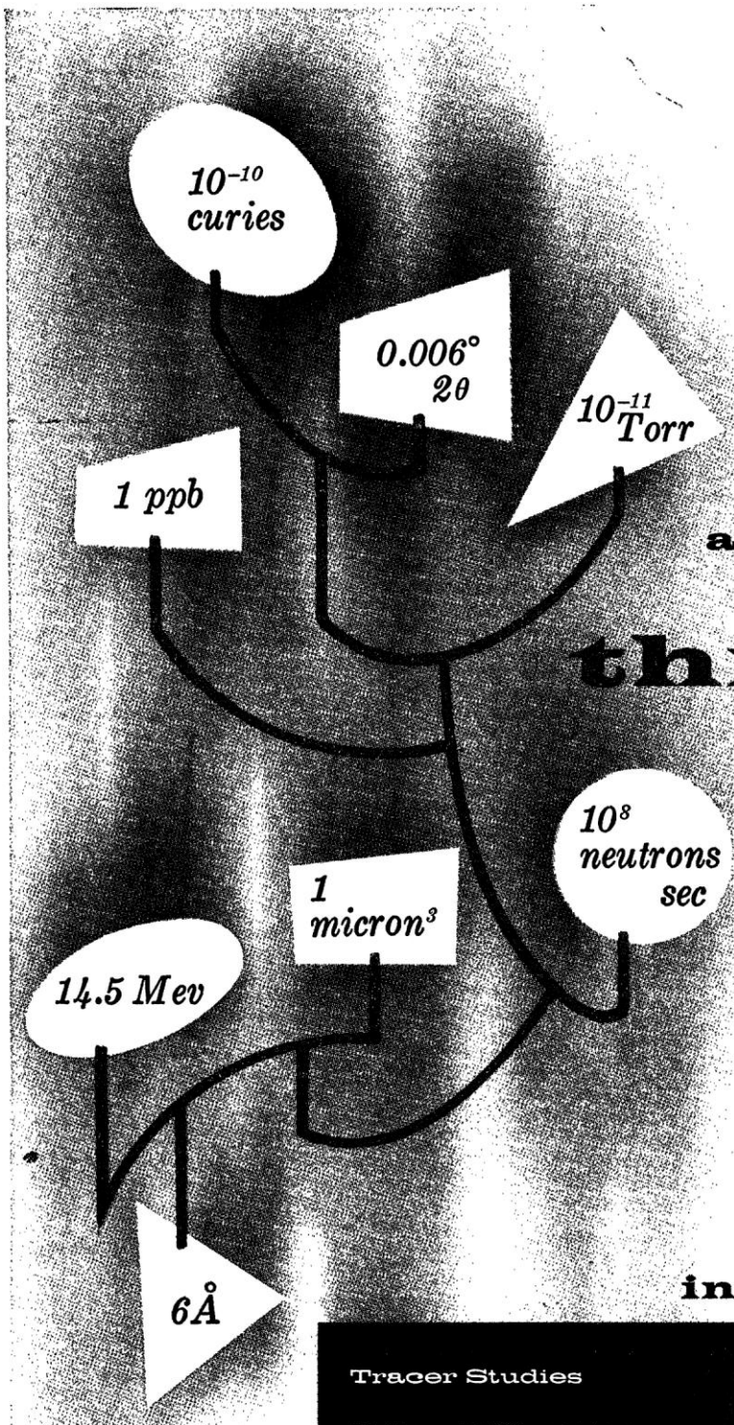
Under unusual observation conditions and for some work involving the techniques of micro-manipulation, it would be advantageous to use "high dry" objectives but with working distances many times those normally obtained. Cooke-A.E.I. special objectives with working distances more



than 15 times conventional values are sometimes used. Drawing shows the general construction, involving a mirror system which projects object image to a conventional microscope objective mounted behind. Working distance of both 20X and 40X objectives is 12.8mm, as contrasted with the normal working distance of approximately 0.71mm.

Numerical apertures are slightly reduced (to N.A. 0.57 in the case of a 40X achromat) and there is some loss of light inherent in the design. Excellent image quality is achieved, however, if cover glasses are close to the 0.18mm thickness for which the system is adjusted. Because of the mirror system, the objectives cannot be used on metallurgical specimens.



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Civilian Nuclear Power

It is a curious aspect of human nature that we are more likely to be excited by unproved possibilities than by achievements. This is exemplified by the public response to a report which the Atomic Energy Commission has just released. This document has attracted little attention, yet buried in its pages is evidence of one of the great events of all time—emergence of nuclear energy as a practical source of power and a means of conserving fossil fuels.

Immediately after World War II a rash of forecasts extolled the wonders of the coming atomic age. Optimistic pronouncements of scientists were amplified by the press. There followed a period in which public interest remained high, though progress toward production of economically competitive electric power was slow, partly because competence in reactor design was vested mainly in physicists without engineering experience. Ultimately this deficiency was corrected, and a large number of technical problems were overcome. Different types of reactors were tested; new materials were investigated; every facet of fuel handling and safety was studied. At the same time a virile, competitive atomic energy industry was created.

Trends in the cost of generating electricity are one measure of what has occurred. These are outlined in the report.

> . . . costs have been reduced, from the first actual experience of about 50 mills per kwh at the Shippingport prototype reactor in 1958 to less than 10 mills per kwh for full-scale plants now in existence and an estimated 5.5 to 6 mills for a large plant to be built in the near future at Bodega Bay, California.

This figure includes all such costs as amortization and does not involve a subsidy. The Pacific Gas and Electric Company has chosen atomic energy over fossil fuel not because of glamor but because of economics. Costs based on substantial operating experience now can be estimated with precision.

> . . . the total nuclear electric generating capacity in the country [is] approximately 850,000 kilowatts, about 0.5% of our total installed capacity. Seven other central station nuclear power plants are scheduled to start operation in the next few months.

Economic civilian nuclear power has been achieved at a comparatively low cost.

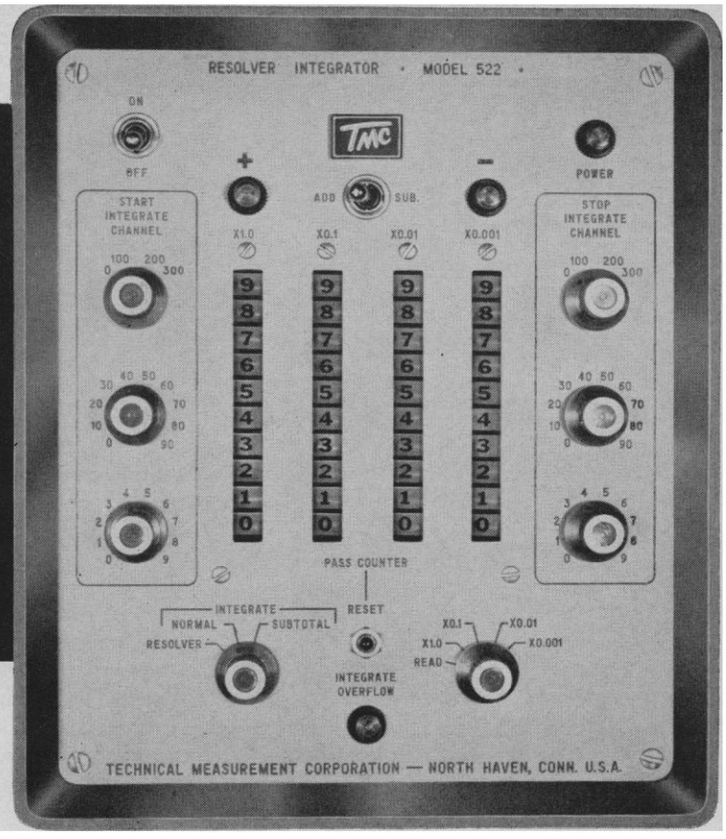
> To date, the Commission has spent approximately $1.275 billion specifically on the civilian power program. . . . The present annual rate of expenditure is approximately $200 million.

One of the aspects that the report underplays is our vanishing resources of petroleum and natural gas. A chemical industry based on petroleum resources is increasing rapidly, and its products are assuming an ever-wider role in our economy and in international trade. With current trends we might be a have-not nation in this important sphere in about 20 years, with corresponding weakening of our competitive position. It is good to know that recent developments in nuclear energy have justified the optimism of 15 years ago and that means are available for sparing our heritage of fossil fuels.—P.H.A.

Push-Button

RESOLVER / INTEGRATOR

integrates any group (0-399) in one step



This new all-electronic Model 522 Spectrum Resolver/Integrator may be used directly with TMC "400 Series" pulse analyzers to perform resolving and integration functions without the necessity of intermediate tape recording equipment.

As a Resolver the Model 522 takes information directly from any selected quarter or half of the analyzer memory and either adds it to or subtracts it from the data stored in an adjacent quarter or half of the memory. It is possible to remove individual components of a spectrum and leave only the desired elements by adding or subtracting 100%, 10%, 1% or 0.1% increments of reference spectra. The operator has precise control of the resolving process, and has an accurate visual record of the exact percentage removed.

As an Integrator, the Model 522 integrates memory-stored information within any band of channels from 0 to 399 *in one operation*. Two modes of integration are available:

NORMAL mode sums the counts in the preselected band and stores the total in the last channel.

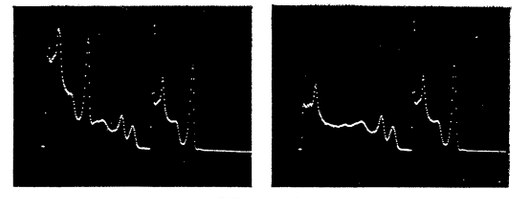
SUBTOTAL mode adds each channel count to the previous one to provide a running subtotal.

With every operation, results are displayed on the analyzer scope and may be printed, recorded or punched out by the readout method of your choice.

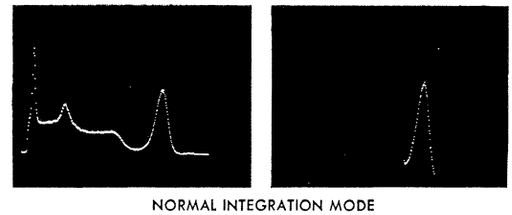
Case design of the Model 522 Resolver/Integrator is identical to that of the compatible "400 Series" fully-portable, 400-channel Pulse Height Analyzers.

TYPICAL DISPLAYS

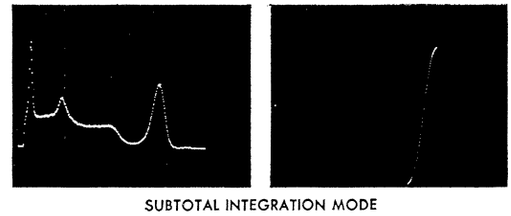
Step 1 Step 2



RESOLVING



NORMAL INTEGRATION MODE



SUBTOTAL INTEGRATION MODE

SPECIFICATIONS

Resolving Rate.....0.5 sec. for one add or subtract operation per 100 channels
% Resolved.....100%, 10%, 1% or 0.1%
Integration Rate..... 0.5% sec. per quarter memory
Channel band..... Continuous 1 — 400 channels
Integrating Modes ..... Normal, Subtotal
Blanking..... Only channels to be integrated are visible on Analyzers CRT display
Size.....8⅝" w. x 10¼" h. x 21" d., 28 lbs. (approx.)

TMC is the original designer/producer of transistorized multi-channel analyzers. Today, TMC instrumentation is delivered to every nation in the free world for use in the most advanced laboratories known to man. For full specifications, information, consultation, please write or phone your nearest Sales Office or factory direct . . . North Haven CE 9-2501.

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sensing elements, the local processing of data, the transmission of the data, and the subsequent editing.

R. Nathan described the digital processing of lunar photographs. The corrections to remove noise and geometric and photometric distortion from telemetered video data were carried out on a digital computer. Nathan illustrated the process with a number of artificial examples all of which left the audience with a much clearer understanding of how unclear the early pictures of the moon will be.

John Tukey chaired a lively, if often confusing, session on newer analytical techniques that might be employed in the reduction of geophysical data. The methods of power-spectra and cross-spectra analysis of geophysical time series are now widely used. Such methods are particularly appropriate when the process generating the time series is linear. When nonlinearities become important, for example in the near-shore development of ocean waves, then more complicated analyses are required to bring out the internal structure of the time series. G. MacDonald discussed methods by which the bi-spectra and higher order moments of time series can be estimated. This discussion was illustrated by the bi-spectra for ocean wave heights recorded in shallow water off the California coast.

The probing of the three-dimensional fields in geophysics often requires arrays of stations. Detailed studies of methods of analysis of data generated by station arrays have been carried out both in meteorology and oceanography. In oceanography the analysis of waves requires two-dimensional arrays, while in meteorology the two-dimensional distribution of weather stations is supplemented by observations taken in height at each station. G. Miller presented a discussion of the study of long ocean waves by means of an array of three bottom pressure recorders. An analysis of wave height by cross-spectral methods provides information as to the direction of waves as a function of frequency. Combined with elementary theory this permits an estimate of the distance over which the waves have traveled. Analysis of data from the triangular array of pressure recorders off the southern California coast leads to the identification and location of the wave-generating storms located off the Antarctic coast.

Von Neumann's comments of 1954 quoted above refer primarily to the use of computers in the numerical solution of three- and four-dimensional partial differential equations describing geophysical processes. Since that time remarkable progress has been made in the development of numerical methods that are capable of dealing with linear problems and some progress has been made in treating linear equations with nonconstant coefficients. A superb review of finite difference methods applicable to problems in fluid dynamics was presented by R. Richtmyer. Richtmyer dealt primarily with linear equations; however, the specter of nonlinearity was ominously present. It is clear that conditions for numerical stability of nonlinear equations can often be obtained; it is not clear that the resulting finite difference scheme represents even an approximate solution to the posed problem. The reason is intimately coupled to the fact that finite difference

schemes make use of regular grids in time and in space. The nonlinear terms in the equations result in the transfer of energy from lower harmonics to higher harmonics. At a certain point in the calculation the harmonics have no place to go in the specified mesh and are folded back into the existing mesh. As a result, energy at high frequency (or high wave number) appears under the guise of low frequencies. This is the problem familiar to time-series workers as "aliasing." The mislabeling of the energy can lead to "instability," as was first noted by Norman Phillips. Smoothing techniques which lower energy present in the higher harmonics do not always provide a solution, though they can insure ordinary "numerical stability." The characteristic of many nonlinearities is the interaction over large frequency intervals. The arbitrary destruction of higher harmonics removes possible interaction and can result in major distortions of the field.

The six working sessions were supplemented by a banquet at the IBM Thomas J. Watson Research Center at which Lloyd Berkner, chairman of the organizing committee, presented an eloquent description of the progress in geophysics and space physics during the past decade. It is clear that geophysics and computer technology have proceeded at a very rapid rate and that without the development of the computer technology much of the present-day geophysics would be impossible. It is also becoming apparent that the requirements of geophysics are of such a magnitude that they are bound to influence further developments in computers. It is an open question whether the computers will develop faster than geophysics or geophysics will outstrip the services of the projected computers.

GORDON J. F. MACDONALD
Institute of Geophysics and Planetary Physics, University of California, Los Angeles 24

Forthcoming Events

January

14–16. **Radiation Research**, intern. conf., Natick, Mass. (Army Quartermaster Research and Engineering Center, Natick)

14–18. Association of **Surgeons** of West Africa, Ibadan, Nigeria. (V. A. Ngu, University College Hospital, Ibadan)

14–19. Atomic and Molecular **Quantum Theory**, symp., Sanibel Island, Fla. (D. W. Smith, Chemistry Dept., Univ. of Florida, Gainesville)

15–15 Feb. World Meteorological Organization, Working Group on **Meteorological Transmissions**, Paris, France. (WMO, 41 Avenue Giuseppe Motta, Geneva, Switzerland)

15–17. Association of **American Colleges**, annual, Atlantic City, N.J. (T. A. Distler, AAC, 1818 R St., NW, Washington 9)

15–17. **Sesame**, intern. conf., Maracay, Venezuela. (D. G. Langham, Sesamum Foundation, Milford, Conn.)

15–19. **Immunopathology**, intern. symp., La Jolla, Calif. (by invitation). (Science Information Div., National Foundation, 800 Second Ave., New York 17)

17–19. **Engineers' Training**, conf., Strasbourg, France. (Council of Europe, Avenue de l'Europe, Strasbourg)

17–19. Royal College of **Physicians and Surgeons** of Canada, annual, Edmonton, Alberta. (J. H. Graham, RCPSC, 74 Stanley Ave., Ottawa 2, Ont., Canada)

18–19. **Blood**, annual symp., Detroit, Mich. (G. F. Anderson, Dept. of Physiology and Pharmacology, Wayne State Univ., 1401 Rivard St., Detroit 7)

21–23. Chemistry and Biochemistry of **Seed Proteins**, intern. conf., New Orleans, La. (C. H. Fisher, Southern Utilization Research and Development Div., Agricultural Research Service, U.S. Dept. of Agriculture, P.O. Box 19687, New Orleans 19)

21–23. Institute of the **Aerospace Sciences**, annual, New York, N.Y. (IAS, 2 E. 64 St., New York 21)

21–24. American **Meteorological** Soc., annual, New York, N.Y. (R. L. Pfeffer, Lamont Geological Observatory, Columbia Univ., Palisades, N.Y.)

21–24. Advances in **Gas Chromatography**, intern. symp., Houston, Tex. (A. Zlatkis, Chemistry Dept., Univ. of Houston, Houston)

22. Infectious Diseases of the **Heart and Circulation**, conf., New York, N.Y. (C. A. R. Connor, New York Heart Assoc., 10 Columbus Circle, New York 19)

22–24. **Reliability and Quality Control**, natl. symp., San Francisco, Calif. (L. W. Ball, Boeing Co., P.O. Box 3707, Seattle 24, Wash.)

23–25. **Elevated Temperature Mechanics**, intern. conf., 3rd Navy Structural Mechanics Symp., New York, N.Y. (by invitation). (A. M. Freudenthal, 624 Mudd Bldg., Columbia Univ., New York 27)

23–26. American Assoc. of **Physics Teachers**, New York, N.Y. (R. P. Winch, Williams College, Williamstown, Mass.)

23–26. American Group **Psychotherapy** Assoc., annual, Washington, D.C. (AGPA, 1790 Broadway, New York 19)

24–27. American **Mathematical** Soc., annual, Berkeley, Calif. (AMS, 190 Hope St., Providence 6, R.I.)

25–6. International College of **Surgeons**, West Indies congr., aboard *S.S. Santa Rosa.* (Secretariat, 1516 Lake Shore Dr., Chicago 10, Ill.)

26. Association for **Symbolic Logic**, Berkeley, Calif. (T. Hailperin, Dept. of Mathematics, Lehigh Univ., Bethlehem, Pa.)

26–28. **Mathematical** Assoc. of America, annual, Berkeley, Calif. (H. M. Gehman, Univ. of Buffalo, Buffalo 14, N.Y.)

27–1. American Inst. of **Electrical En-**

gineers, winter general meeting, New York, N.Y. (R. S. Gardner, AIEE, 33 W. 39 St., New York 18)

28–2. American **Library** Assoc., Chicago, Ill. (D. H. Clift, ALA, 50 E. Huron St., Chicago 11)

28–2. **Body Composition**, conf., New York, N.Y. (J. Brozek, Dept. of Psychology, Lehigh Univ., Bethlehem, Pa.)

30–1. Military **Electronics**, natl. winter convention, Los Angeles, Calif. (F. P. Adler, Space Systems Div., Hughes Aircraft Co., Culver City, Calif.)

31–1. American Soc. for **Engineering Education**, college-industry conf., Atlanta, Ga. (W. L. Collins, Univ. of Illinois, Urbana)

31–1. Society of **Rheology**, annual western regional meeting, Emeryville, Calif. (T. L. Smith, Stanford Research Inst., Menlo Park, Calif.)

31–2. Western Soc. for **Clinical Research**, annual, Carmel-by-the-Sea, Calif. (H. R. Warner, Latter-day Saints Hospital, Dept. of Physiology, Salt Lake City 3, Utah)

February

4–8. **Rice Genetics** and **Cytogenetics**, symp., Los Baños, Laguna, Philippines. (Inter. Rice Research Inst., Manila Hotel, Manila, Philippines)

4–9. Recent Trends in **Iron and Steel Technology**, symp., Jamshedpur, India. (Secretary, Indian Inst. of Metals, 31 Chowringhee Rd., Calcutta, India)

4–20. Application of **Science and Technology** for the Benefit of Less Developed Areas, U.N. conference, Geneva, Switzerland. (Science Conference Staff, Agency for International Development, 826 State Dept. Annex 1, Washington 25)

5–14. International **Radio** Consultative Committee, Plan Subcommittee for Asia, New Delhi, India. (V. Barthoni, 128 rue de Lausanne, Geneva, Switzerland)

6–9. American College of **Radiology**, Chicago, Ill. (F. H. Squire, Presbyterian–St. Luke's Hospital, 1753 W. Congress St., Chicago 12)

8–18. United Nations Committee on **Industry and Natural Resources** in Asia and the Far East, Bangkok, Thailand. (S. Santitham, Rajadamnern Ave., Bangkok)

10–15. **Management** Function in Research and Development, conf., Pasadena, Calif. (Management Development Section, Industrial Relations Center, California Inst. of Technology, Pasadena)

10–16. **Planned Parenthood**, intern. conf., Singapore. (V. Houghton, Intern. Planned Parenthood Federation, 69 Eccleston Sq., London, S.W.1, England)

11–14. American Soc. of **Heating, Refrigerating, and Air-Conditioning Engineers**, New York, N.Y. (R. C. Cross, 345 E. 47th St., New York 17)

11–14. Industrial **Lubrication**, intern. conf. and exhibit, London, England. (E. V. Paterson, Scientific Lubrication, 217a Kensington High St., London W.8)

11–15. Quantum **Electronics**, intern. symp., Paris, France. (Secrétariat, Troisième Congrès International d'Electronique Quantique, 7 rue de Madrid, Paris 8°)

12–14. **Lysozomes**, symp. (by invitation), London, England. (Ciba Foundation, 41 Portland Pl., London W.1)

13–15. **Electrochemistry**, 1st Australian conf., part I, Sydney, Australia. (F. Gutmann, Physical Chemistry Dept., Univ. of New South Wales, Kensington, N.S.W., Australia)

13–16. National Soc. of College Teachers of **Education**, Chicago, Ill. (E. J. Clark, Indiana State College, Terre Haute)

14–15. American Soc. for **Quality Control**, Textile and Needles Trades Div., annual conf., Clemson, S.C. (H. F. Littleton, c/o Charles H. Bacon Co., Lenoir City, Tenn.)

15–14 Apr. **Aeronautics and Space**, intern. exhibition, São Paulo, Brazil. (Santos Dumont Foundation, Avenida Ipiranga N°. 84, São Paulo)

16–23. Caribbean **Dental** Convention, Port of Spain, Trinidad. (A. V. Awon, 43–45 Frederick St., Port of Spain)

17–21. Technical Assoc. of the **Pulp and Paper** Industry, annual, New York, N.Y. (TAPPI, 360 Lexington Ave., New York 17)

18–20. American **Standards** Assoc., natl. conf., New York, N.Y. (ASA, 10 E. 40 St., New York 16)

18–20. **Biophysical** Soc., annual, New York, N.Y. (A. Mauro, Rockefeller Inst., New York)

18–20. **Electrochemistry**, 1st Australian conf., part II, Hobart, Tasmania. (J. N. Baxter, Chemistry Dept., Univ. of Tasmania, Hobart)

18–25. Expert Committee on **Food Additives**, FOA/WHO, Rome, Italy. (Intern. Agency Liaison Branch, Office of the Director General, Food and Agriculture Organization, Viale delle Terme di Caracalla, Rome)

19–22. **Radiochemistry**, inter-American conf., Montevideo, Uruguay. (Pan American Union, Washington 6)

20–22. Fundamental **Cancer** Research, annual symp., Houston, Tex. (L. Dmochowski, Section of Virology and Electron Microscopy, M. D. Anderson Hospital, Houston 25)

20–22. **Solid-State Circuits**, intern. conf., Philadelphia, Pa. (F. J. Witt, Bell Telephone Laboratories, Inc., Murray Hill, N.J.)

20–23. National Assoc. for Research in **Science Teaching**, Washington, D.C. (J. D. Novak, Biological Science Dept., Purdue Univ., Lafayette, Ind.)

20–24. Diseases of the **Chest**, intern. congr., New Delhi, India. (M. Kornfeld, American College of Chest Physicians, 112 E. Chestnut St., Chicago 11, Ill.)

21–22. American Soc. for **Quality Control**, regional conf., Las Vegas, Nev. (S. R. Wood, Dept. 61, Bldg. 160, Aerojet-General Corp., Azusa, Calif.)

22–23. American **Psychopathological** Assoc., annual, New York, N.Y. (F. A. Freyhan, c/o St. Elizabeths Hospital, Washington 20, D.C.)

23–28. American Soc. for **Testing** and **Materials**, annual, Atlantic City, N.J. (H. H. Hamilton, 1916 Race St., Philadelphia 3, Pa.)

(See 23 November issue for comprehensive list)