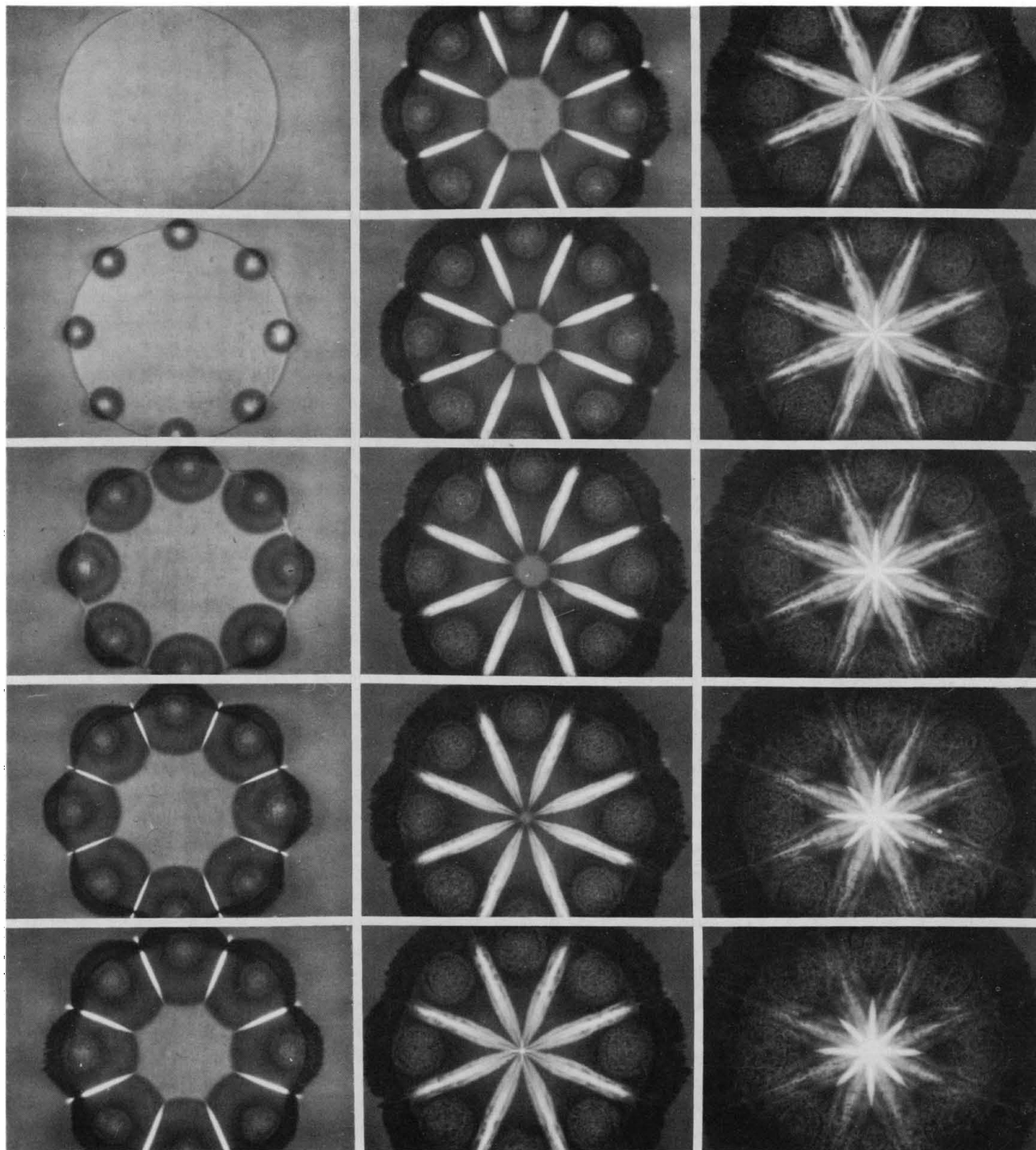


SCIENCE

25 December 1964

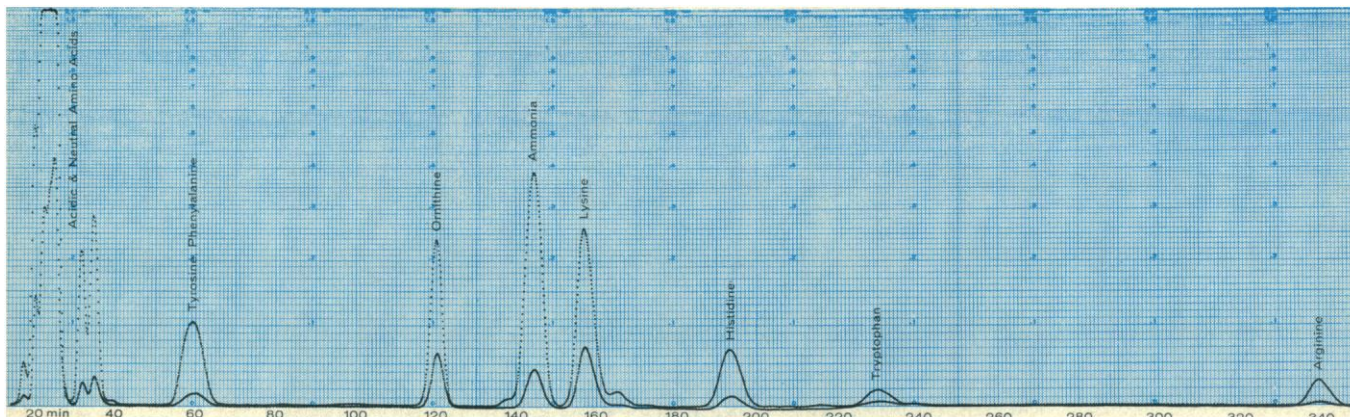
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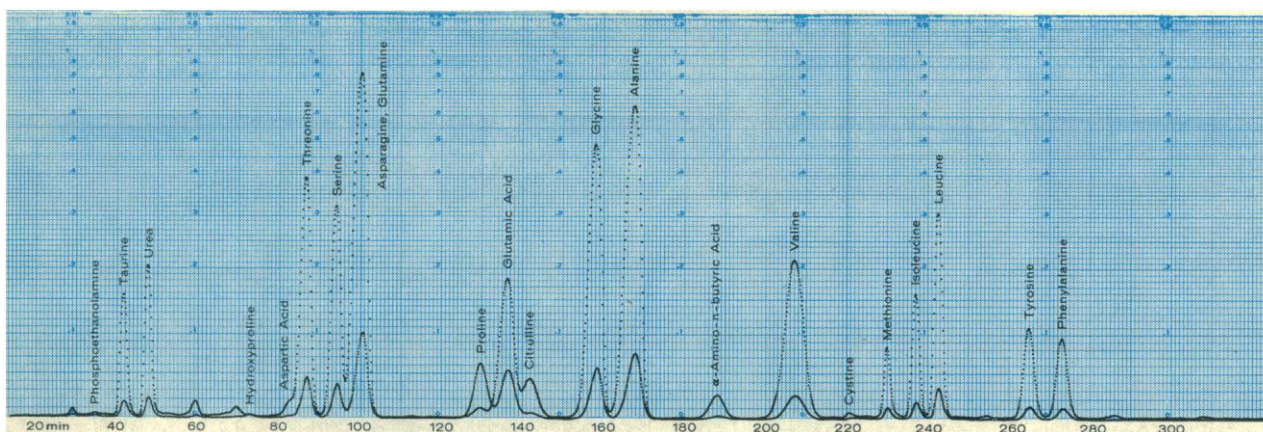


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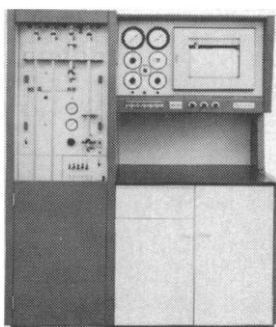
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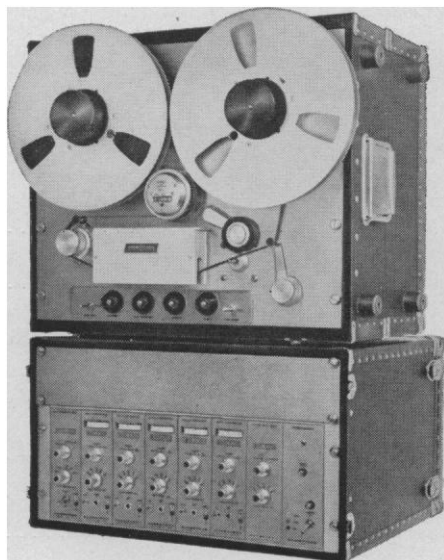
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COVER

Patterns produced by simultaneous initiation of a thin explosive disk at eight equidistant points. Picture sequence (at 600,000 frames per second) shows expansion, collisions, and interactions of detonation wave fronts. Symmetry of the wave patterns throughout the sequence is evidence of the remarkable uniformity in both initiation timing and detonation rate of the explosive. See page 1635. [U.S. Naval Weapons Laboratory]

The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

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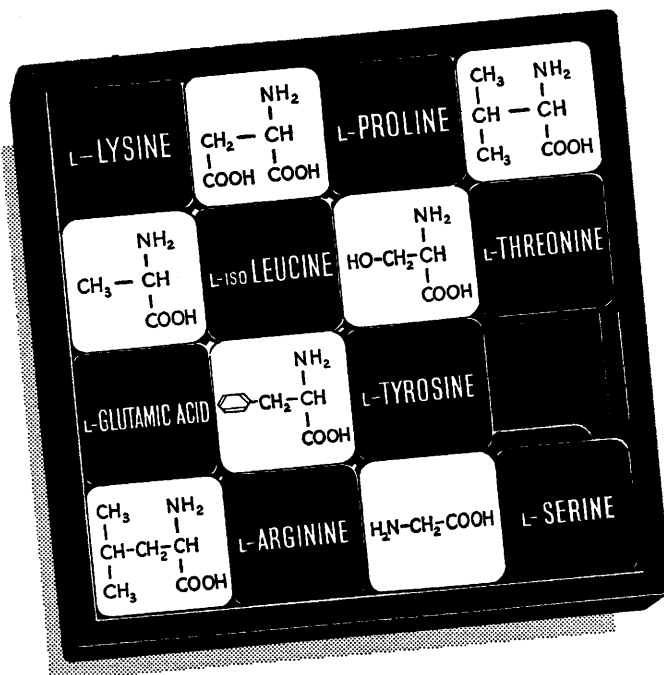
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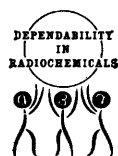
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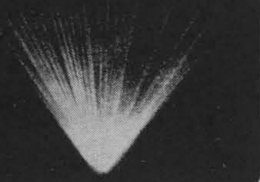


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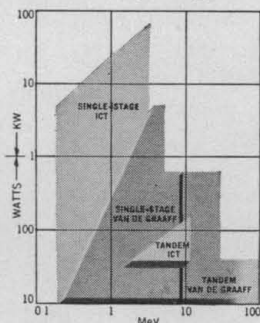
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CHARGED PARTICLES



Development of higher energy Van de Graaff particle accelerators which retain high beam precision, stability, and homogeneity, remains a continuing contribution by HVEC to "energy-oriented" research.

To provide even greater freedom of experimentation, HVEC is also anticipating the need for the higher beam intensities required in power-oriented research projects. Invented by Dr. R. J. Van de Graaff, the new Insulating Core Transformer (ICT) accelerator now provides high beam currents with all the desirable beam char-



THE ICT CONCEPT: new high-current machines emerging from HVEC research

acteristics of Van de Graaff machines. As the graph shows, the high power levels available from the ICT accelerator now make possible a new realm of precision experimentation.

The Insulating Core Transformer

The ICT is essentially a three-phase power transformer with multiple secondaries, each of which is insulated from the other. Rectified current from the secondaries is series-connected to achieve total voltage. In the ICT, electrostatic and electromagnetic fields exist in the same space, as contrasted to the conditions in a conventional transformer. The result is a highly efficient dc power source capable of stable operation at elevated potentials and power levels.

A number of ICT accelerators and power generation systems are now available.

Single-Stage ICT Accelerators

Two types of single stage ICT accelerators have been developed for research use. The first incorporates an ICT power source coupled to the acceleration assembly through a coaxial cable.

	PROTON ENERGY (KeV)	CURRENT (MAX.) (Analyzed)	TANK HEIGHT Feet	TANK HEIGHT Meters	TANK DIAMETER Feet	TANK DIAMETER Meters
ICT 300	300	15 mA	4'4"	1.32	4	1.2
ICT 500	500	10 mA	5'3"	1.60	4	1.2

The second system utilizes a rigid transmission line to transmit electrical power to the accelerator terminal.

4 MeV ICT	ENERGY (MeV)	CURRENT	DIMENSIONS Length Feet	DIMENSIONS Length Meters
Positive Ions	1.5-4	3 mA	26'6"	8.08
Electron Conversion	1.5-3	10 mA	26'6"	8.08
3 MeV ICT Electrons	1.5-3	20 mA	29'	8.84

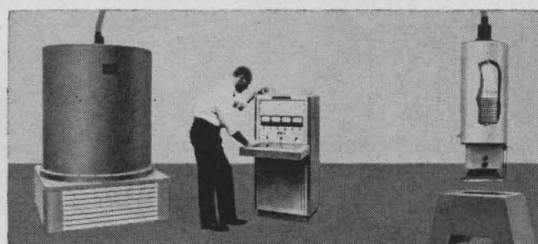
8 MeV ICT Tandem Accelerator

The 8 MeV ICT Tandem provides proton energies continuously variable from 3 to 8 MeV at a maximum guaranteed beam current of $2\mu\text{A}$. The ICT power source is capable of providing 12 mA at 4 mv which, in combination

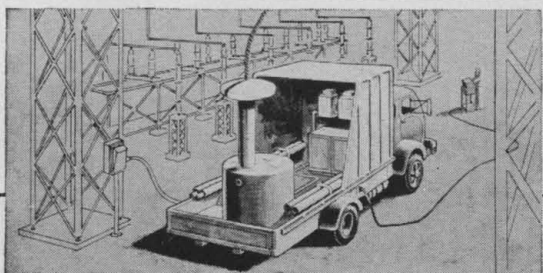
with newly developed components emerging from HVEC, will enable the accelerator to keep pace with future research requirements. The 8 MeV Tandem is convertible to single-stage ion or electron operation.

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Developed primarily as high-current sources of electrons for industrial processing applications, these systems allow extreme flexibility of operation. Two models are available: 300 kv at 30 mA maximum beam current and 500 kv at 20 mA maximum beam current.



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Robert H. Goddard

The United States Government this fall issued an airmail stamp commemorating the pioneer rocket research of Robert H. Goddard. Pictured on the stamp are Dr. Goddard, an Atlas rocket, and a launching tower at Cape Kennedy. In a year or so the McGraw-Hill Company will publish *The Papers of Robert H. Goddard*. It seems an appropriate time to relate a bit of history involving Dr. Goddard and the A.A.A.S.

Early in 1924 the Association's Committee on Grants approved a grant to Dr. Goddard for the full requested amount of \$190. (The Association at that time made small research grants, and still does, but now the money is all handled by affiliated academies of science and is chiefly used to assist students in their research projects.)

In accepting the grant, Dr. Goddard wrote: "This assistance comes at a time which makes it particularly valuable, inasmuch as some of the facilities which we now have will be available for but a limited time."

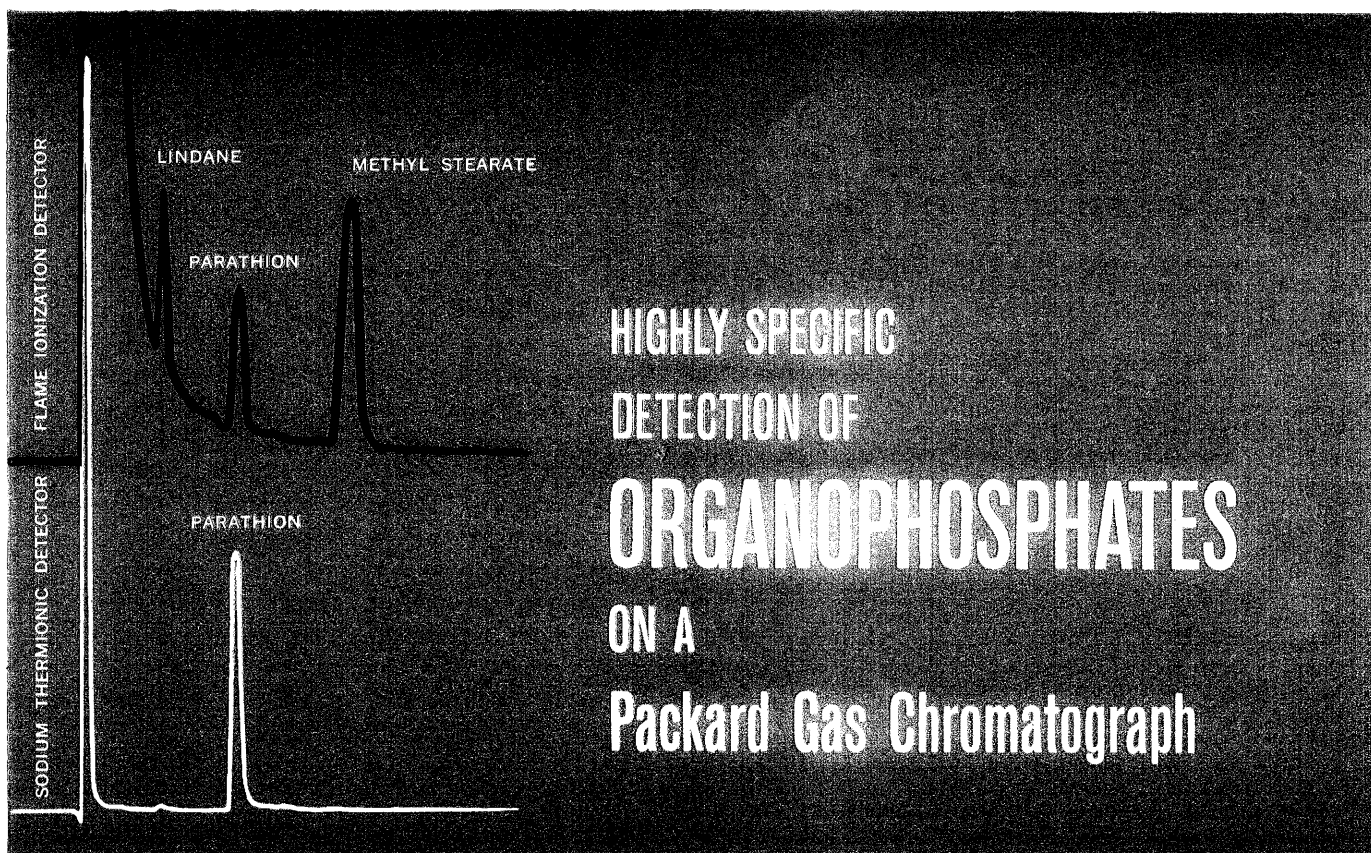
On the day before Christmas of 1924, Dr. Goddard submitted a progress report which read in part:

"The work for which assistance has been necessary is the construction and test of a small rocket model, made with the intention of demonstrating the feasibility of using liquid propellants. This work, which has been supported during the past year by the Smithsonian Institution, the A.A.A.S., and Clark University, involves but two main classes of expenditure: the salary of a skilled instrument maker, and liquid oxygen. I have an arrangement with a large oxygen concern by which liquid oxygen can be obtained at practically no expense for a very limited time. I have therefore kept the grant from the A.A.A.S. intact in order that it might be used when the funds now available from the other sources (most of which must be used within a year from the time the appropriation is made) have been used. It is not possible at the present time to predict for which of the above two expenditures the A.A.A.S. grant can be used to best advantage.

"During the past year an engine to be used in connection with the rocket has been designed, tested, and perfected. A feeding device to be used with this engine has also been developed, although considerable time was consumed because of the small scale upon which the work is being carried out. A final, complete model is now being constructed, with the weight reduced to the smallest possible amount.

"I trust that this report of progress will be satisfactory to the Committee on Grants, and wish to take this opportunity of thanking the Association for assisting in this work. I hope that the forthcoming results will justify their confidence."

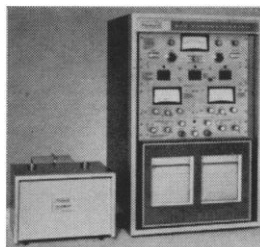
The results amply justified that confidence. We can all be proud of the fact that the Association was able to help Dr. Goddard in the lean years of his pioneer work.—DAEL WOLFLE



Phosphorous-containing compounds are one of the most recent groups to yield to a Packard Gas Chromatograph. The chromatogram which is shown above was made on a Packard Model 7611 dual system (dual column oven, dual detectors, dual electronics and dual recorders) and represents an important achievement in simultaneous determination of compounds of widely separated concentration.

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*L. Giuffrida, J.A.O.A.C., 47, No. 2, 293 (1964)

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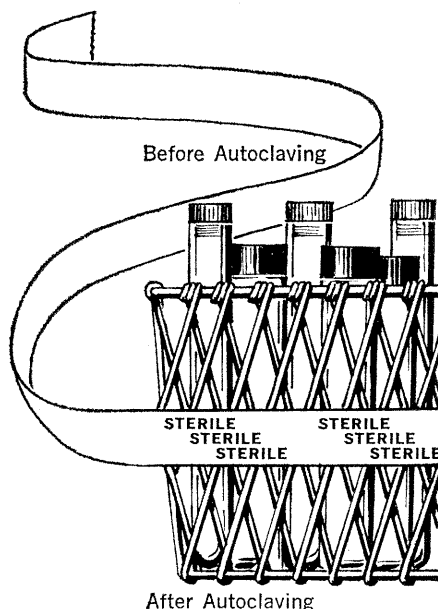
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symp., Miami, Fla. (H. D. Hulme, Westinghouse R&D Center, Bldg. 601-1346, Churchill Boro, Pittsburgh, Pa.)

12-15. **Crustacea**, symp., Cochin, India. (Marine Biological Assoc. of India, Marine Fisheries P.O., Mandapam Camp, S. India)

14. **American Genetic Assoc.**, Washington, D.C. (W. R. Singleton, Biology Bldg., Univ. of Virginia, Charlottesville)

18-20. **Solar Radiation Simulation**, intern. conf., Los Angeles, Calif. (H. F. Sander, Inst. of Environmental Science, 34 S. Main St., Mount Prospect, Ill.)

19. **American Inst. of Mining, Metallurgical, and Petroleum Engineers**, Metallurgical Soc., 7th mechanical working conf., Pittsburgh, Pa. (R. W. Shearman, Secretary, Metallurgical Soc. of AIME, 345 E. 47 St., New York 10017)

19. **Cor Pulmonale**, New York Heart Assoc., New York, N.Y. (NYHA, 10 Columbus Circle, New York 10019)

19-20. **Die Design and Press Tooling Conf.**, American Soc. of Tool and Manufacturing Engineers, Hartford, Conn. (M. Zapico, Asst. Conf. Director, ASTME, 10700 Puritan Ave., Detroit 38, Mich.)

20-22. **Instrumentation**, College Station, Tex. (P. T. Eubank, Chemical Engineering Dept., Texas A&M Univ., College Station)

20-23. **National Soc. of Professional Engineers**, New Orleans, La. (P. H. Robbins, 2029 K St., NW, Washington, D.C.)

22. **Bibliographical Soc. of America**, New York, N.Y. (Mrs. H. C. Ralph, P.O. Box 397, Grand Central Station, New York 10017)

22-1. **Earthquake Engineering**, 3rd world conf., Auckland and Wellington, New Zealand. (Administrative Secretary, Third World Conf. on Earthquake Engineering, P.O. Box 5180, Wellington)

22-23. **Blood**, annual symp., Detroit, Mich. (W. H. Seegers, Dept. of Physiology and Pharmacology, Wayne State Univ. College of Medicine, Detroit)

22-23. **Hydrocarbon Analysis**, symp., American Soc. for Testing and Materials, Houston, Tex. (ASTM, 1916 Race St., Philadelphia 3, Pa.)

25-26. **Fundamental Phenomena in the Material Sciences**, 3rd annual symp., Boston, Mass. (D. B. Fay, Ilikon Corp., Natick Industrial Centre, Natick, Mass.)

25-26. **Viruses of Laboratory Rodents**, symp., Atlanta, Ga. (R. Holdenried, Natl. Cancer Inst., NIH, Bethesda, Md. 20014)

25-27. **American Inst. of Aeronautics and Astronautics**, New York, N.Y. (J. Bidwell, AIAA, 1290 Avenue of the Americas, New York 10019)

25-28. **American Meteorological Soc.**, annual, New York, N.Y. (K. Spengler, AMS, 45 Beacon St., Boston 8, Mass.)

25-28. **American Society of Heating, Refrigerating and Air-Conditioning Engineers**, Chicago, Ill. (R. C. Cross, 345 E. 47 St., New York 10017)

25-28. **Modern Methods of Analytical Chemistry**, 18th annual intern. symp., Baton Rouge, La. (P. W. West, Dept. of Chemistry, Louisiana State Univ., Baton Rouge)

25-28. **Cardiovascular Diseases**, 2nd natl. conf., Washington, D.C. (C. H. Maxwell, 9650 Wisconsin Ave., NW, Washington, D.C. 20014)

25-29. **American Mathematical Soc.**, Denver, Colo. (G. L. Walker, AMS, 190 Hope St., Providence, R.I.)