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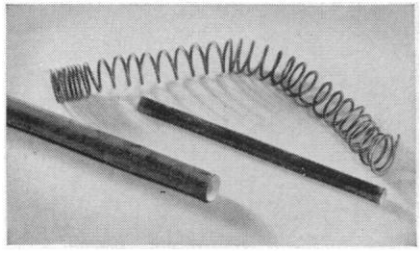
RARE EARTH RESEARCH

Recent interesting rare earth research developments

a report by LINDSAY

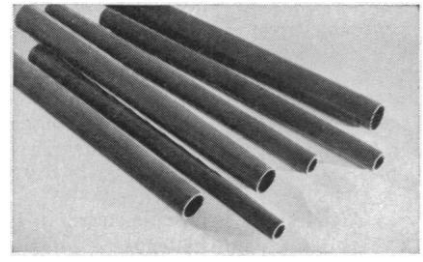
We are frequently fascinated by the imagination of researchers who are working with the rare earths. It appears that technical people, observing the many essential uses of rare earth salts in chemical and industrial processes, are looking at these fifteen unique elements as a fertile field for exploration.

During recent years, rare earths have been accepted as basic chemical tools in a wide cross section of American industry. This suggests that fruitful results may be expected from the rare earth research projects currently being carried on in industrial laboratories and pilot plant operations from coast to coast. Here, for instance, are half a dozen which may interest you.



MILES OF MISCH. This isn't a new application, but we're wondering if you know that misch metal (an alloy of the mixed rare earths) is available in wire form as well as in ingot and rod form? Cerium alloys can also be had in powder form; they are used as getters in vacuum tubes. We don't make the metal, but we can put you in touch with those who do.

FLAME SPRAYING. A new process for flame spraying various refractory oxides on metallic surfaces has been brought to near completion. Titania, zirconia and alumina can be flame sprayed, but the thing that interests us is that flame sprayed cerium oxide has some unusual properties. Rare earth oxide is a good heat radiation material, and it seems that metallic surfaces coated with rare earth oxide radiate heat much faster than do untreated surfaces.

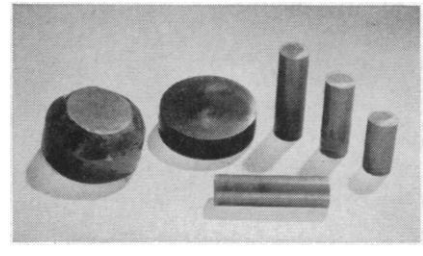


RARE EARTHS IN PLASTICS. We frankly don't know what sort of things rare earth-impregnated plastics could be used for, but a couple of people have taken enough interest in this problem to make up experimental samples. We've been doing some playing with them ourselves and have some ideas about using them. Polyethylene, for example, can be fabricated to hold up to 5 to 10 times its weight of rare earth oxide, and we've even seen some precision-bore epoxy tubing made with a rare earth oxide filler.

SEPARATION AND SAMARIUM. We are like a slaughter house in that we would like to use everything that a rare earth separation process turns out, including the squeal. With the interest that has been generated in using gadolinium as a neutron absorber (thermal cross section about 46,000 barns), we have accumulated quite a pile of samarium oxide in rather decent purity. In the process of separating gadolinium and some of the other rare earths, samarium is produced as a by-product. If you can think of a use for samarium, we have the samarium compounds.

RARE EARTH GARNETS. These are structurally somewhat similar to the garnet variety grossularite (formula $Ca_3Al_2(SiO_4)_3$). The most interesting ones are the rare earth-iron garnets such as $Y_3Fe_2(FeO_4)_3$. This mouthful of formula has been abbreviated by researchers to "YIG" for obvious reasons. Other names stem from other rare-earth symbols. These garnets, particularly those of yttrium, gadolinium, erbium, and some others have interesting ferromagnetic properties, making them useful as ferrite materials in electronic equipment. We don't make the garnets, but we do make the rare earth oxides needed to prepare them.

SINTERED SHAPES. One of our friends once wanted to know if rare earth oxides could be pressed and sintered into shaped pieces. Apparently they can, and our friend made up some experimental hot-pressed rare earth oxide and cerium oxide pieces for us.



Lindsay produces thorium and rare earth salts in purities up to 99.99% for a rather surprising variety of chemical and industrial applications. Most of these materials are available for prompt shipment in quantities from a gram to a carload.

We will be pleased to supply your research and process development people with technical data, analyses, prices and whatever may be helpful to you in exploring the possibility of the profitable application of rare earths to your own problems.

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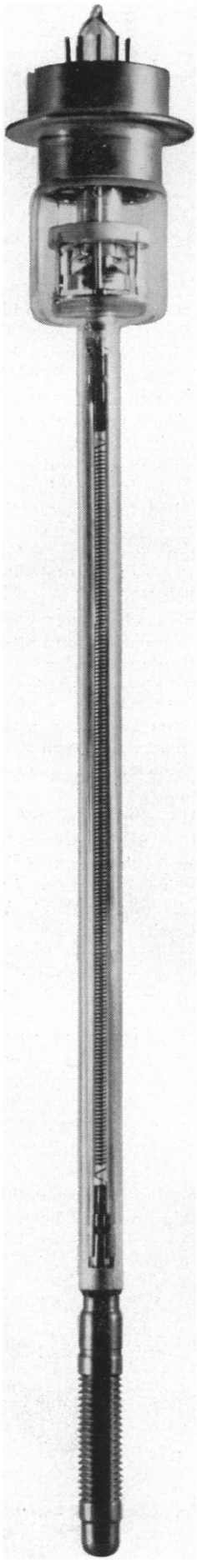


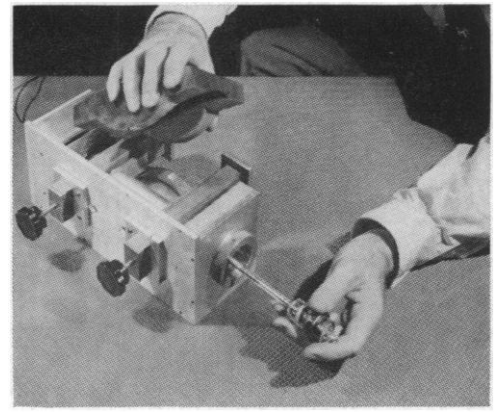
A GREAT AMPLIFIER TUBE IS PERFECTED FOR TELEPHONY

A new transcontinental microwave system capable of carrying four times as much information as any previous microwave system is under development at Bell Laboratories. A master key to this development is a new traveling-wave tube of large frequency bandwidth.

The traveling-wave amplifying principle was discovered in England by Dr. Rudolf Kompfner, who is now at Bell Laboratories; the fundamental theory was largely developed by Labs scientist Dr. John Pierce. Subsequently the tube has been utilized in various ways both here and abroad. At the Laboratories it has been perfected to meet the exacting performance standards of long distance telephony. And now for the first time a traveling-wave tube will go into large-scale production for use in our nation's telephone systems.

The new amplifier's tremendous bandwidth greatly simplifies the practical problem of operating and maintaining microwave communications. For example, in the proposed transcontinental system, as many as 16 different one-way radio channels will be used to transmit a capacity load of more than 11,000 conversations or 12 television programs and 2500 conversations. Formerly it would have been necessary to tune several amplifier tubes to match each channel. In contrast, a single traveling-wave tube can supply all the amplification needed for a channel. Tubes can be interchanged with only very minor adjustments.

The new amplifier is another example of how Bell Laboratories research creates new devices and new systems for telephony.



Left: A traveling-wave tube. *Right:* Tube being placed in position between the permanent magnets which focus the electron beam. The tube supplies uniform and distortionless amplification of FM signals over a 500 Mc band. It will be used to deliver an output of five watts.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

Technology, 19–21 June 1957. The articles primarily present recent developments in high-speed research, including heat transfer at extreme temperatures. Approximately half of the papers are devoted to problems in heat transfer, and the remainder to studies in the field of fluid mechanics.

The volume contains 439 pages. The size of type used and the excellent figures included make each paper highly readable. According to a statement in the preface, many of the papers will also be published in the technical journals of the five sponsoring societies—American Institute of Chemical Engineers, American Society of Mechanical Engineers, American Society of Refrigeration Engineers, Institute of the Aeronautical Sciences, and Society of Automotive Engineers.

The purpose of the 1957 Institute was to make available, in the West, a program devoted to advanced fundamental research in heat transfer and fluid mechanics. An inspection of the individual papers indicates that the objective has been attained. The authors of the papers were not necessarily from the West, as is evidenced by a broad geographical distribution within the United States. Several of the authors were from Canada—a fact which reflects the wide interest in the Institute meetings.

David Fultz of the University of Chicago and E. R. G. Eckert of the University of Minnesota were invited to present lectures. The titles of their lectures are listed in the table of contents, but the text material has not been included.

In addition to the five professional societies, the following universities were also cosponsors of the 1957 Institute: California Institute of Technology; Santa Clara University; Stanford University; University of California, Berkeley and Los Angeles; and the University of Southern California.

G. A. HAWKINS
Purdue University

The Exploration of the Colorado River. John Wesley Powell. University of Chicago Press, Chicago, 1957 (abridged from the first edition of 1875). xxi + 138 pp. Illus. $3.75.

John Wesley Powell (1834–1902) was the founder and first director of the Smithsonian Institution's Bureau of Ethnology, second director of the U.S. Geological Survey, and author of the classic *Report on the Lands of the Arid Regions of the United States* (1878). He was also leader of the Geographical and Geological Survey of the Rocky Mountain Region (the Powell Survey), which explored and mapped the Plateau Province in the 1870's.

Powell made his first trip into the Plateau Province in the summer of 1869, when he led the first exploration of the Colorado River, boating down the Green and Colorado from Green River, Wyoming, to the mouth of the Virgin, below Grand Canyon. He made his second journey down the river in two stages in 1871 and 1872, having spent the year 1870 obtaining support and finding accessible crossings where supplies could be cached for his second expedition.

Powell's narrative of his adventures in the canyons of the Green and Colorado, which was published in book form in 1875 as the first part of *Exploration of the Colorado River of the West and Its Tributaries,* is now reprinted, together with some of the original illustrations. The account was originally published serially in *Scribner's Monthly* (1874–75), and it is written as a report of the first trip. However, the account is actually based not only on the first trip but also on the second, and it contains, in addition, the story of Powell's 1870 trip south through Pipe Spring, Arizona, into Grand Canyon, to which in turn is tacked a description of his 1872 journey down Parúnuweap Canyon into what is now Zion National Park. Some may object to this "tampering" with the facts; those who will allow an author some license will enjoy the book for what it is, a good story of "white-water" boating in unknown waters in heavy, cumbersome craft.—R.V.O.

Miscellaneous Publications

(Inquiries concerning these publications should be addressed, not to Science, *but to the publisher or agency sponsoring the publication.)*

Records of Oceanographic Works in Japan (Special number for the Oceanographic Research Project by the Japanese National Commission for UNESCO). Compiled by the Pacific Science Liaison Committee of the Science Council of Japan. 208 pp. *Oceanographic Papers in Japan* (Annotated bibliography, 1873–1938). Koji Hidaka *et al.* 235 pp. Japanese National Commission for UNESCO, Tokyo, 1957.

Histology. H. G. Q. Rowett. Rinehart, New York, 1957. 47 pp. $0.95.

Current Medical Research. A reprint of the articles in the report of the Medical Research Council for the year 1955–56. Her Majesty's Stationery Office, London, 1957. 56 pp. 2s. 6d.

The Pseudococcidae (Hom.: Coccoidae), Described by H. C. James, from East Africa. Bulletin, Entomology, vol. 5, No. 5. G. De Lotto. 50 pp. 15s. *A Revision of the Genus Neozephyrus Sibatani and Ito (Lepidoptera: Lycaenidae).* Bulletin, Entomology, vol. 5, No. 6. T. G. Howarth. 40 pp. 15s. British Museum (Natural History), London, 1957.

The Meigs Creek No. 9 Coal Bed in Ohio. pt. III, *Further Study of the Chemical and Physical Properties and Washability Characteristics, with a Brief Review of New Methods Employed.* Bulletin No. 165. Peter O. Krumin. Ohio State University, Columbus, 1957. 373 pp. $3.

Fire Research 1956. Report of Fire Research Board and the report of the Director of Fire Research 50 pp. $0.77. *Food Investigation, 1956.* The report of the Food Investigation Board with the report of the Director of the Food Investigation Organization. 68 pp. $0.68. Department of Scientific and Industrial Research, London, 1957 (order from British Information Services, New York).

The Typical Muscid Flies of California (Diptera: Muscidae, Muscinae). Bulletin of the California Insect Survey, vol. 6, No. 1. Bruce F. Eldridge and Maurice T. James. 17 pp. $0.50. *The Conopid Flies of California (Diptera).* vol. 6, No. 2, Sidney Camras and Paul D. Hurd, Jr. 31 pp. $0.75. *The Embioptera of California.* vol. 6, No. 3. Edward S. Ross. 7 pp. $0.50. University of California Press, Berkeley, 1957.

A New Race of Wood Rat (Neotoma) from the Gulf Side of Central Baja California, Mexico. Transactions, vol. XII, No. 15. Laurence M. Huey. 2 pp. *Late Pleistocene Faunas from the Northwestern Coast of Baja California, Mexico.* vol. XII, No. 16. James W. Valentine. 20 pp. *Type Material of Eucalodium Orcutti Dall (Gastropoda: Pulmonata) from Oaxaca, Mexico.* vol. XII, No. 17. Robert J. Drake. 2 pp. San Diego Society of Natural History, San Diego, 1957.

Le Regime Alimentaire des Poissons du Lac Kivu (Congo Belge et Ruanda). Et l'exploitation des resources naturelles du lac. Exploration hydrobiologique des Lacs Kivu, Edouard et Albert (1952–1954). vol. III, pt. 2, *Resultats Scientifiques.* Jean Verbeke. Institut Royal des Sciences Naturelles de Belgique, Bruxelles, 1957. 221 pp.

Heredo - Retinopathia Congenitalis. Monohybrida Recessiva Autosomalis. A genetical-statistical study. *Hereditas, 43.* Carl Henry Alstrom and Olof Olson. Mendelian Society, 3 Adelgatan, Lund, Sweden, 1957. 178 pp.

Midwest Research Institute, 12th Annual Report of the President to the Trustees. Midwest Research Institute, Kansas City, Mo., 1957. 16 pp.

First Conference on Manufacturing Automation. Purdue University, 22–24 Oct. 1956. Automation, Cleveland, Ohio, 1956. 96 pp.

U.S. Research Reactors. Prepared by Battelle Memorial Institute for U.S. Atomic Energy Commission, Washington, 1957 (order from Office of Technical Services, U.S. Department of Commerce, Washington). 73 pp. $1.50.

Salaries and Earnings of Engineering Teachers 1956. William H. Miernyk and Morris A. Horowitz. American Society for Engineering Education, Urbana, Ill., 1957. 19 pp. $0.25.

The American Heart Association, Proceedings of the 30th Scientific Sessions. 25–28 Oct. 1957. American Heart Assoc., New York, 1957. 128 pp.

The Air Pollution Bibliography. vol. 1. Jack R. Gibson, Wave E. Culver, Mary E. Kurz. Technical Information Division, Library of Congress, Washington 25, 1957. 150 pp.