

versations at a time over long distances can be replaced by a printed microwave tube that has many of the properties of a coaxial cable.

New and important as it is, printed circuitry is an old art, borrowing techniques used for centuries in the manufacture of china and for decades in the engraving industry.

The most popularly used method of etching printed circuits uses essentially the same process that makes the metal images for the pictures and cartoons that appear in newspapers and magazines. The image of the circuit is printed photographically onto the surface of a metallic coated sheet of plastic. The areas where the printed wires are desired are protected by an anti-corrosive chemical. The plate is then immersed in a solution that eats away the unprotected metal, leaving the desired pattern. It has been estimated that about 75% of the printed circuits used today are produced in this way.

Most of the rest of the circuits are manufactured in very much the same way as china is decorated. Machines print or silk-screen the wiring pattern on a ceramic surface with metallic paint. The slab is then baked to fuse the paint to the surface.

In the third common method, a heat press stamps out the circuit on a plastic card coated with an adhesive-backed sheet of copper. The excess metal is then stripped off.

Printed wiring is primarily a production tool, Gustav Shapiro, chief of the engineering electronics section of the National Bureau of Standards, said. Nothing can be done with printed circuits that cannot be done with ordinary wiring, but the technique lends itself ideally to automation, the coming trend in industry.

Automation, or automatic assembly, has been described as the second industrial revolution, and printed circuits are destined to play an important part in it.

Science News Letter, March 3, 1956

THE ART OF "Speakmanship" HOW TO TALK YET MAKE GOOD SENSE

Today more than ever, the difference between solid success and frustrating failure often hinges solely on one's ability to express oneself effectively—both in private and in public. As it happens, the laws of successful voice communication are no longer a mystery—in fact are quite simple and, with the new techniques, can nowadays be mastered readily by the person of average intelligence willing to expend a little effort.

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Books of the Week

For the editorial information of our readers, books received for review since last week's issue are listed. For convenient purchase of any U. S. book in print, send a remittance to cover retail price (postage will be paid) to Book Department, Science Service, 1719 N Street, N.W., Washington 6, D. C. Request free publications direct from publisher, not from Science Service.

CANCER OF THE LUNG: Pathology, Diagnosis and Treatment—Milton B. Rosenblatt and James R. Lisa—*Oxford University Press*, 330 p., illus., \$15.00. Correlation between clinical and pathological findings has been stressed throughout to provide a more basic understanding to the problem of early diagnosis.

ENJOYING MODERN SCIENCE—Victor C. Smith and W. E. Jones—*Lippincott*, 2nd ed., 466 p., illus., \$3.32. Science in readable form for the eighth grader.

EXPLORING MODERN SCIENCE—Victor C. Smith and W. E. Jones—*Lippincott*, 2nd ed., 353 p., illus., \$3.12. The seventh grade textbook in the Science for Modern Living series.

GUIDE TO INSTRUMENTATION LITERATURE—W. G. Brombacher, Julian F. Smith and Lyman M. Van der Pyl—*Govt. Printing Office*, National Bureau of Standards Circular 567, 156 p., paper, \$1.00. To assist research investigators, instruments users and others interested in utilizing the extensive and scattered literature on instrumentation.

LOST COST HI-FI—Donald Carl Hoefler—*Arco*, 132 p., illus., \$2.00. Containing hundreds of hints for budget high fidelity.

MODERN SURVEYING: For Civil Engineers—Harold Frank Birchall—*Philosophical Library*, 2nd ed., 528 p., illus., \$15.00. Dealing with the subject of surveying in a practical manner to aid the engineer working in the field or on a definite project. Including photographic and aerial surveying.

NINETEENTH SEMI-ANNUAL REPORT OF THE ATOMIC ENERGY COMMISSION—Lewis L. Strauss, Chairman—*Govt. Printing Office*, 200 p., illus., paper, 60 cents. Reporting the activities of the past six months, with a special section on the International Conference on the Peaceful Uses of Atomic Energy. (See SNL, Feb. 11, p. 95.)

101 ATOMIC TERMS: And What They Mean—*Esso Research and Engineering Co.*, 20 p., illus., paper, free upon request direct to publisher, 15 W. 51st St., New York 19, N. Y. A popular-type glossary defining terms used by atomic scientists, many of which are peculiar to atomic energy.

THE POWER TO GO—Merrill Denison—*Doubleday*, 324 p., illus., \$5.00. The story of the automotive industry in America.

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY: Volume 14, General Aspects of the Use of Radioactive Isotopes: Dosimetry—*United Nations (Columbia University Press)*, 305 p., illus., \$6.50. Describing production, handling and distribution of radioisotopes, as well as techniques that have been developed for the measurement of detailed properties of the various radioisotopes, including monitoring in industrial situations.

ROCKS AND MINERALS—Richard M. Pearl—*Barnes & Noble*, 275 p., illus., \$1.95. Explaining how rocks and minerals are classified, how they can be recognized and identified, and how they should be collected and displayed. Including some color plates to aid identification.

SCIENCE ACROSS THE LAND—Victor C. Smith and Barbara Henderson—*Lippincott*, revised ed., 223 p., illus., \$2.24. Giving suggestions for experiments for the fourth grader to do to help explain the new things he is learning about science.

SCIENCE ALONG THE WAY—Victor C. Smith and Katherine Clarke—*Lippincott*, revised ed., 128 p., illus., \$1.72. Introducing the first grader to science.

SCIENCE AROUND THE CLOCK—Victor C. Smith and Katherine Clarke—*Lippincott*, revised ed., 160 p., illus., \$2.00. A textbook for the third grade student.

SCIENCE BENEATH THE SKIES—Victor C. Smith and Barbara Henderson—*Lippincott*, revised ed., 352 p., illus., \$2.48. Included in this textbook for the sixth grade students is a section on science fairs.

SCIENCE THROUGH THE SEASONS—Victor C. Smith and Barbara Henderson—*Lippincott*, revised ed., 352 p., illus., \$2.36. For the fifth grader.

SCIENCE UNDER THE SUN—Victor C. Smith and Katherine Clarke—*Lippincott*, revised ed., 160 p., illus., \$1.88. Science for the second grader.

SOURCES OF INFORMATION AND UNUSUAL SERVICES—Raphael Alexander, Ed.—*Informational Directory Co.*, 4th ed., 64 p., paper, \$2.00. A guide to information, pamphlets and services available from organizations and agencies in the United States. The fourth edition contains 170 new entries.

TERRACOTTA FIGURINES FROM KOURION IN CYPRUS—John Howard Young and Suzanne Halstead Young—*University Museum, Museum Monographs*, 260 p., illus., paper, \$5.50. A study of the mass of figurines uncovered by the excavations at Kourion, on the island of Cyprus, undertaken by the University Museum of Philadelphia between the years 1934 and 1948.

THROUGH THE MATHESCOPE—C. Stanley Ogilvy—*Oxford University Press*, 162 p., illus., \$4.00. In other sciences, such as astronomy, scientists have instruments like the telescope to aid them in their study. Although the mathescope is not a physical instrument, it should help to "view" this introduction to some of the more interesting elements of mathematics "through the mathescope," a term invented by Watson Davis, director of SCIENCE SERVICE.

USING MODERN SCIENCE—Victor C. Smith and W. E. Jones—*Lippincott*, 2nd ed., 654 p., illus., \$3.96. A general science textbook for ninth grade students.

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