Abstracts of Technical Articles by Bell System Authors

Electron Microscopes and their Uses.[1] JOSEPH A. BECKER and ARTHUR J. AHEARN. Three and a half centuries have passed since Zacharias Janssen, a spectacles maker of Middleburg, Holland, put two lenses in a six-feet-long tube and thereby made the first known compound microscope. In the years since then, the microscope, now grown into a powerful and intricate instrument, has played an important role in the discovery of much of man's knowledge of the physical world. There is, however, much that the microscope has been unable to reveal because of its limited range of useful magnification. Today a new type of magnifying instrument, the electron microscope, is extending the range of useful magnification far beyond its old limits and promises to supplement the traditional microscope in many fields of scientific research. In this article the authors describe types of electron microscopes, tell how they function, and outline how they are being used in physics, chemistry, metallurgy and the biological sciences. A number of pictures are shown to illustrate these uses.

Recent Developments in Protective Metallic Coatings.[2] R. M. BURNS. The prevention of corrosion is accomplished by two general methods: (1) the provision of a non-corrosive environment, and (2) the interposition of a protective film to exclude the corrosive environment from the metal. As an example of the first method one may cite the de-aeration of boiler feed waters and air conditioning in which moisture is controlled and dust, sulphur gases, etc. eliminated.

Referring to the second method, corrosion protective films may be divided into two main classes: the first consisting of those films formed naturally through the production of corrosion products on the surface of the metal to give a thin protective coating; and second, comprising films of paints, varnish, ceramic products or metals which themselves develop protective films. One natural type of protective film is the chemical conversion coating produced by various treatments, such as phosphate or chromate dipping or anodic oxidation.

Zinc is the most important of metallic coatings, 45% of the metal consumed in the United States being used in this manner. Hot galvanized coatings on steel have been improved by suitable pre-treatment of the

[1] *The Scientific Monthly*, October 1941.
[2] *The Monthly Review of the American Electroplaters' Society*, September 1941.

steel surface, such as results from an alternate oxidation and reduction and by the addition of small amounts of aluminum to the zinc bath.

Electroplated zinc deposits have the advantage of being applicable in greater thicknesses than hot-dipped coatings. Electroplating methods have made considerable progress, particularly in the wire field, with the speeding up of plating rates as much as twenty-five fold.

Bright zinc coatings have been developed in response to the demand for improved appearance and this finish is gradually replacing the older dull type.

The protective value of zinc depends directly upon the thickness of the coating. Experiments have listed environments in the order of increasing attack as follows: rural, tropic marine, temperate marine, suburban, urban and highly industrial. The resistance of zinc coatings to corrosion under water depends largely upon the degree of circulation of the water and its oxygen content. When a submerged zinc-coated armored cable is lapped with jute, thereby stagnating the water, the capacity of zinc to resist corrosion is increased.

Cadmium plate has good color and is very satisfactory for indoor use. It does not possess corrosion resistance equal to zinc under conditions of outdoor exposure. Bright nickel coatings or semi-bright coatings requiring mild buffing have largely replaced the older type of nickel coatings.

A very promising process of protecting steel, known as "Corronizing" consists in the application of a layer of nickel plate followed by either zinc or tin. The duplex coating is heated to 700–1000°F. yielding alloys practically free from pores which show high resistance to the salt spray test.

Seventy per cent of the production of tin plate is used in cans. The hot-dipped process is old and well established but is being challenged by continuous rolling processes involving electroplating methods of application.

Recent progress in the protection of metals by coatings of other metals is largely in the direction of electroplating and continuous processes.

Measurements of the Delay and Direction of Arrival of Echoes from Near-By Short-Wave Transmitters.[3] C. F. EDWARDS and KARL G. JANSKY. Observations on pulses radiated by a high-power beam transmitter operating in the short-wave range show that when the receiver is located within the skip zone, echoes are observed having delays of from 1 to 50 milliseconds. These echoes are the result of scattering and three different types may be recognized, each arising from a different source.

Echoes of the multiple type were found to occur the most frequently and to have many of the characteristics of signals transmitted over long

[3] *Proc. I.R.E.*, June 1941.

distances. Components were observed from regions up to 4000 miles distant. Direction-of-arrival measurements using steerable arrays operating on the musa principle indicate that these multiple echoes are scattered from regions along the transmitted beam. Vertical angle-of-arrival measurements using a musa receiving system indicate that the surface of the earth may be the source of scattering.

Similarities between multiple echoes and southerly deviated waves from European transmitters have been found which indicate that the same phenomena may be responsible for both.

Evolution by Design.[4] REGINALD L. JONES. The evolution of the telephone plant is characterized by planning and invention. This article describes the Bell Telephone Laboratories' method of developing new and improved telephone apparatus by integrating the creative efforts of technicians in various fields of research and engineering. For telephone readers the recent development histories of telephone drop wire, relay, and station receiver are chosen to illustrate the problems encountered. Other apparatus, some of which is shown by the figures, follows a similar development pattern. New materials, improved processes of manufacture, economy in maintenance, and a better understanding of convenient use—all play continuing parts in the forward march of telephone design.

Television Transmission.[5] M. E. STRIEBY and C. L. WEIS. Experiments in the transmission of television signals over wire lines have been made from time to time as the television art has developed. The present paper discusses experiments made during the summer of 1940 with 441-line, 30-frame interlaced signals transmitted over coaxial cable and other telephone facilities. Some of the general problems of wire transmission have been included. In particular, the results of transmission studies on a system linking New York and Philadelphia are reported.

[4] *Bell Telephone Magazine*, August 1941.
[5] *Proc. I.R.E.*, July 1941.