

## Abstracts of Technical Articles by Bell System Authors

*A Modification of Hallén's Solution of the Antenna Problem.*<sup>1</sup> M. C. GRAY. An alternative formula for the input impedance of a cylindrical antenna is derived from Hallén's integral equation. It is shown that the introduction of a variable parameter  $Z(z)$  in place of Hallén's  $\Omega = \log(4l^2/a^2)$  modifies the numerical results considerably, and leads to much better agreement with experimental evidence.

*Motor Systems for Motion Picture Production.*<sup>2</sup> A. L. HOLCOMB. The various types of motor systems and speed controls used in motion picture production are reviewed, evaluated, and the basic theory of operation described.

Motor drive systems are a fairly simple but important element in the production of motion pictures, but to many people who do not have direct contact with this phase of activities, the number of systems in use and their peculiarities are very confusing. Data on most of the different types of motors and motor systems in use have been published, but in different places and at different times so that no comprehensive reference exists. This paper is not intended as information on new developments or as a technical study, but rather as a review of all the major systems with an indication of their fields of greatest usefulness and with comments on both their desirable and undesirable features.

*A Dial Switching System for Toll Calls.*<sup>3</sup> HOWARD L. HOSFORD. At Philadelphia, on the night of August 21st and the early morning hours of August 22, 1943, the cutover of the new #4 System was no mere episode; it was one of the milestones of telephone history. Intertoll dialing in itself is not new but this joint project of the Bell Telephone Company of Pennsylvania and the Long Lines Department is especially significant as it has been designed so as to extend the field of toll dialing by the operators to include the largest cities and joins together various types of dialing equipment. In its scope this project includes many points in an area reaching from Richmond, Va. to New York City and from Harrisburg, Pa. to Atlantic City, N. J.

From a traffic standpoint the #4 toll switching system actually comprises

<sup>1</sup> *Jour. Applied Physics*, January 1944.

<sup>2</sup> *Jour. S. M. P. E.*, January 1944.

<sup>3</sup> *Bell Tel. Mag.*, Winter 1943-44.

three units, the switching equipment itself which is wholly mechanical, together with the so-called #4 and #5 switchboards. The #4 board is a cordless, key-typed call distributing board which is used in conjunction with the new switching system for such calls as must be given to an operator by offices not equipped for intertoll dialing. The operators at this board function as combined inward, through and tandem operators, thus eliminating the provision of separate units to provide these particular services. In brief, there is no basic difference between the essential operation of the #5 board and the conventional through board where delayed traffic is handled; however, operators handling calls at this board must make use of the new switching system to obtain both the calling and called offices by dialing.

Prior to the cutover the first trainees were given experience by handling some 300,000 test calls of every conceivable traffic characteristic. These were routed through the new system to break in the equipment and to shake down potential troubles. Two weeks prior to cutover a dress rehearsal was held, at which time about ten per cent of the circuits were put through their paces.

To provide information of value for future installations, arrangements were made for liberal provision of registers and meters to measure any and all phases of the various steps performed by the equipment. Some of these aids are not entirely new to telephone work but their application to toll, inward and through service is a departure.

The #4 System is running satisfactorily and both the equipment and the operators who use it deliver a high grade of service. Daily some 80,000 tandem, inward and through connections formerly handled by operators are routed through the equipment.

In connection with postwar planning, studies are now being made to determine future installations in order to take advantage of the possibilities of the new system. It is confidently expected that this will provide faster service on outward, inward and through calls and that transmission will be improved. These advantages should result in overall economies in outside plant and operating.

*Theoretical Limitation to Transconductance in Certain Types of Vacuum Tubes.*<sup>4</sup> J. R. PIERCE. The thermal-velocity distribution of thermionically emitted electrons limits the low-frequency transconductance which can be attained in tubes in whose operation space charge is not important. A relation is developed by means of which this dependence may be evaluated for tubes employing electric and magnetic control. This relation is applied to deflection tubes with electric and magnetic control and to stopping-

<sup>4</sup> *Proc. I. R. E.*, December 1943.

potential tubes. Magnetic control is shown to be inferior to electric control from the point of view of band-width and gain.

*Antenna Theory and Experiment.*<sup>5</sup> S. A. SCHELKUNOFF. This paper presents: (1) a comparison between several approximate theoretical formulas for the input impedance of cylindrical antennas in the light of available experimental evidence; and (2) a discussion of the local capacitance in the vicinity of the input terminals, mathematical difficulties created by its presence, and methods of overcoming these difficulties. No exact solution of the antenna problem is available at present and so far it is impossible to set definite limits for errors which may be involved in various approximations. For this reason in appraising these approximations one is forced to rely on one's judgment and on experimental evidence. It is hoped that this paper will aid in correlating theory and experiment to the advantage of both.

<sup>5</sup> *Jour. Applied Physics*, January 1944.