ditorial Pommen

Railroad Applications of Electronics

NEARLY 70 years ago, while working on an incandescent lamp, Thomas A. Edison made a discovery and made a brief notation about it in his notebook. What Edison noted at that time, and what Fleming and DeForest later put into practice, is the fact that when a filament in a lamp is heated, it not only sends out light but it also emits electrons. If a metal plate is sealed into the bulb, current can be made to flow across the space between the plate and the filament along an invisible electronic path. DeForest's contribution is the grid, placed between the filament and the plate, which acts as a valve or throttle to control the flow of the plate current. By this means, a very small amount of energy, such as an incoming radio energy, when impressed on the grid, can be made to reproduce itself at a very much greater level.

The most widely used and known devices of this character are the so-called "tubes" used in ordinary radio receiving sets. As a matter of fact, until this war started, almost all of the devices of this nature were commonly referred to as "tubes" or "radio tubes," but these terms have since been supplanted by the more accurate descriptive term of "electronics." Electronics of various designs can be used for various purposes: to amplify; to rectify a-c. to d-c.; to generate high frequencies; to transform electric light into electric current; or to transform electric current into light.

Owing to the extensive developments, during the war, in radio, walky-talky, telephones, etc., the general public has been captivated by the idea that electronics represent some sort of new-found Aladdin's lamp. It may be well at this time, therefore, to review briefly, the studies, developments and applications of electronics which have been made by the railroads, dating back as far as 28 years ago.

In 1916, soon after electronic devices were developed for use in radio, the engineers of one signaling manufacturer visualized the possibility of using electronic devices as amplifiers in continuously-controlled train control and cab signaling. In fact this was the first commercial application of electronics outside the radio field. This early cab signaling and train control required four electronic devices on each set of locomotive equipment, which number was later reduced, by continuous study and development, to one electronic unit.

In the early days, the filaments were so fragile that they were good for only a few locomotive road trips, but continued development has produced electronic units which are now good for a year or more. Tests, made each time a locomotive is brought in for boiler washing, show-whether the electronic device is good for a further period. As a result, the failure of an electronic filament in service is comparatively rare today. The development of this unit to withstand service on locomotives, contributed to a large extent to the possibility of producing electronic equipment for commercial services other than radio.

Electronic devices have also been used as amplifiers in equipment for detecting grounds, as described on page 597 of *Railway Signaling* for December, 1934, and in schemes intended to improve track circuit shunting, as discussed on page 71 of the February, 1934, issue.

An important application of electronics is in carrier current systems, by means of which one line wire circuit can handle as many different circuits as desired, up to a limit imposed by the separation of frequency bands. One application of carrier current is for telegraph and telephone communication circuits, in the utilization of which the railroads have been active for several years; for example, 13,914 circuit miles of carrier communication facilities were installed on the railroads of the United States and Canada during 1943.

Another important application of electronics in carrier systems is in coded C.T.C. line circuits, by means of which two or more territories can be controlled over one pair of wires. The first installation of this character was placed in service in June, 1942, between Redding, Cal., and Dunsmuir, on the Southern Pacific, as described in the March, 1943, issue of Railway Signaling. Up to the present date, 27 C.T.C. sections controlled by carrier current coded C.T.C. have been completed or are under construction. This development has made it practical to handle the very large C.T.C. installations which have been giving such a good account of themselves during this period of unprecedented railroad traffic. The Union Pacific installation between Las Vegas and Yermo is of the type referred to and is described in the September, 1943, issue of Railway Signaling.

Another application of electronics in railroading is in so-called public address systems which use loudspeakers at various locations in stations, freight yards, produce yards and other places, an example of which was explained in an article concerning loud-speakers in a yard on the Illinois Central in the February, 1944, issue of *Railway Signaling*.

Still another application of electronics is in communication systems in freight classification yards for telephone conversation between the humpmaster and the enginemen of hump locomotives. Such communication facilities are now in service in eleven freight classification yards. A further adaptation of this same form of communication is for telephone conversation between the enginemen and the conductor of freight trains, as well as between trains, or between trains and wayside stations. Articles describing the use of electronic devices in this form of communication were published in *Railway Signaling* for July, 1940; December, 1943; and March, 1944.

This discussion up to this point has dealt primarily with the use of electronics in apparatus and systems which have been widely adopted and have been in extensive use in regular railroad service for a number of years. A further fact is that, in the period since January 1, 1920, at least nine different railroads have co-operated with various manufacturers in making 20 different extensive tests of radio for train communication. Further developments and tests in this field comprise one of the activities of the Radio Technical Planning Board, a national body of which the Association of American Railroads is a sponsoring member, and is represented on the Board by representatives appointed by the Telegraph and Telephone Section, the Signal Section and the Electrical Sections of the A.A.R.

It is obvious from what has been said here that for 28 years the railroads and the manufacturers have been actively engaged in developing uses for electronics and installing apparatus including such devices. Developments of this nature are continuing and naturally they may be expected to be accelerated in the postwar period because of the greater availability of manpower and materials which will exist at that time. Electronics has its limitations, however, and damage can be done—in fact has been done—by statements made without a complete knowledge

of the history of electronics on the railroads, and of the requirements of train operation, signaling and communications on railroads.

Centennial of Telegraph

On May 24, the telegraph industry, including the railroads, will pay tribute to the memory of Samuel Finley Breese Morse, the inventor of the Morse telegraph, in a centennial celebration of the sending of the first telegram. The first message "What God hath wrought," was flashed over the first telegraph line from the chamber of the United States Supreme Court, then the capitol in Washington, to the Baltimore & Ohio Railroad station in Baltimore, Md., on May 24, 1844. On May 24, 1944, this scene will be reenacted in Washington and Baltimore, and a Joint Congressional Committee will unveil a monument commemorating the sending of this first message by Samuel Morse.

The first telegraph line circuit was constructed on the right-of-way of the Baltimore & Ohio between Washington and Baltimore. Throughout the 100 years of development and expansion of telegraph and other forms of communication, the railroads have played an important part, and on May 24, 1944, the Association of American Railroads will join with the Western Union Telegraph Company, the International Telephone & Telegraph Corporation, the R.C.A. Communications, Inc., and the American Telephone & Telegraph Company to observe the centennial of the sending of the first telegraph message and to pay tribute to Morse and the men who assisted him.

Striking pictorial study of Southern Pacific cab-in-front freight locomotive framed between two automatic signals on the famous Shasta Route linking San Francisco and Portland. The backdrop is beauteous Mt. Shasta. The picture was made in C.T.C. territory near Dunsmuir, California.

