ERIE RADIO INCREASES OPERATING EFFICIENCY

Installation on three adjacent divisions provides continuous end-to-end, train-to-wayside, train-to-train and station-to-station communication

As a means of increasing the dependability and overall efficiency of train operation and of providing additional safety, the Erie has made an extensive space radio installation on 347 mi. of main line between Marion, Ohio, and Salamanca, N. Y. As reported in *Railway Age* of July 31, page 52, the installation includes equipment in 14 wayside offices, 15 cabooses and 16 Diesel-electric locomotives. The locomotives are the double-end type, with complete radio equipment in each cab, making a total of 32 independent sets of locomotive radio apparatus now in service.

An outstanding feature of the installation is that any of the wayside offices can communicate by radio with adjacent offices in either direction, so that if sleet causes extensive damage to the pole line, communications can be handled by radio from one station to another along the entire route.

This project culminates nearly two years of extensive study and experimentation on the part of the railroad's communications and operating departments, and the Farnsworth Television & Radio Corp. Plans are now under way to extend the system west from Marion to Chicago, and east from Salamanca to Jersey City, N. J., which will complete the entire 999-mi. route between Chicago and New York.

How It Helps

The radiotelephone system is not employed for delivery of train orders, although operators along the line can instantly notify train crews of any last minute changes in orders, the exact location of a hot box, or other irregularity. This feature is especially important when weather conditions make it difficult for crews to see hand signals.

With a continuous means of communication between the conductor in the caboose and the locomotive engineer in his cab, there has been a substantial reduction in train delays and broken drawbars resulting from emergency stops in connection with hot boxes. The conductor and engineman can discuss problems and decide what action to take. The engineman can bring the train to a stop by applying the brakes from the front end and thus avoid a separation, which frequently results when the conductor, unable to contact the engineman, applies the air at the rear while the locomotive is still pulling. On July 27, at Polk, Ohio, for example, a sectionman saw a hot box on the thirty-sixth car of a train. He signalled the conductor on the caboose, who in turn notified the engineman to stop the train. This eliminated the necessity for the conductor to pull the air, and thus the possibility of the train being broken in two.

Communication between trains makes it possible for the crew of a stopped train to warn the crews of other trains in the vicinity, and also the dispatcher. For instance, also on July 27, a freight train slowed down and continued at low speed for some time. The conductor asked the engineman the reason, and the engineman replied that he was getting yellow "boards." The conductor then used the radio to find out what was ahead and received complete information, in a matter of seconds.

Train Expedited Out of Yard

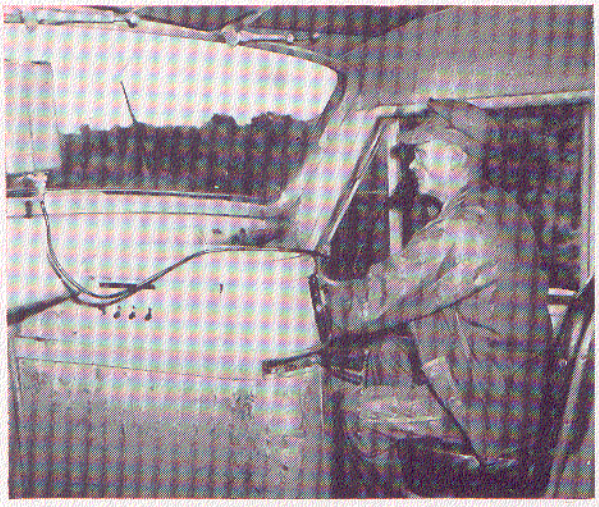
The radio is also a great help in getting trains out of yards promptly. In one case, the brakes stuck on one of the rear cars of a perishable manifest train and prevented the train from starting east out of Marion. By means of the radio, the engineman inquired of the conductor on the rear of the train what the trouble was, and the conductor told him. The conductor notified the yard office by radio, and repairmen were dispatched to the scene promptly. A few minutes later the brakes were released on the car, and the train proceeded without the delay which might have been incurred if the radio had not been in service.

In another instance, train NY-98, handling considerable perishable traffic, passed "SN" tower at Leavittsburg, Ohio, with everything in order. Approximately five minutes later, the engineman advised the operator at "SN" tower by radio that the train had struck a tractor-trailer truck which had stalled on the crossing at Larchmont avenue, North Warren, Ohio. The train was traveling at a relatively low speed because of the grade, but the truck body was tipped over on its side and was obstructing the track ahead. The operator at "SN" tower promptly telephoned the North Warren yard office to notify the track supervisor, who went at once to the scene of the accident. Using a vehicle secured from a nearby industrial plant, together with heavy chains and cables, the truck body was pulled clear of the main track in 29 min. from the time the accident occurred.

Since the train involved was on a heavy grade, it was impossible to start it without assistance. By radio communication, arrangements were made through "SN" and "WN" towers for permission to back the train to the foot of the grade. In 15 min. additional time the train was able to start without assistance and proceed eastward with a total delay of only 44 min. It was estimated that a minimum of one hour was saved to this train by use of radio.

In another instance, several cars of train NE-98,

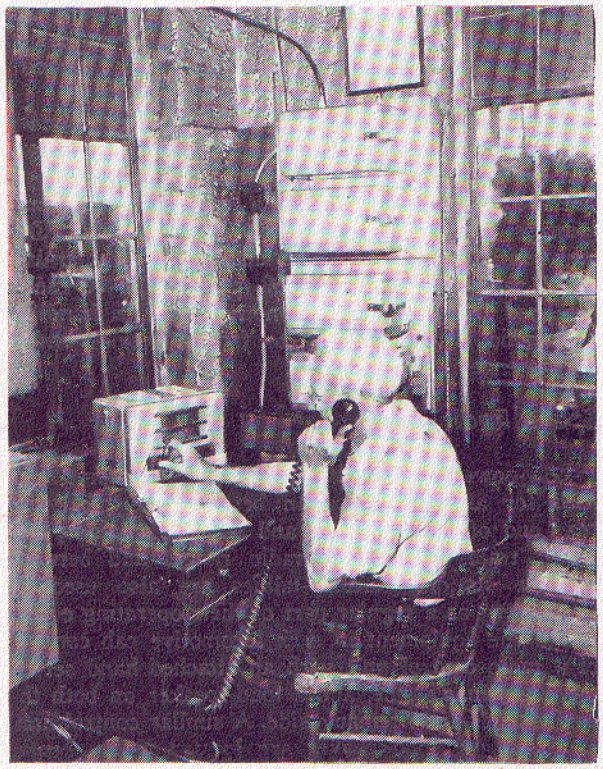
with considerable perishable traffic, were derailed two miles west of Creston, Ohio, due to a mechanical failure in a car truck. By instant communication with the operator at Creston tower, steam derricks were ordered from Marion and Kent, Ohio, within 12 min. after the accident. As regular telephone facilities were not immediately available, it was estimated that without radio approximately 45 min. would have been consumed in notifying the dispatcher and making arrangements for the derricks. Thus, a time saving of more than 30 min. was made. The speed with which the information regarding the accident was



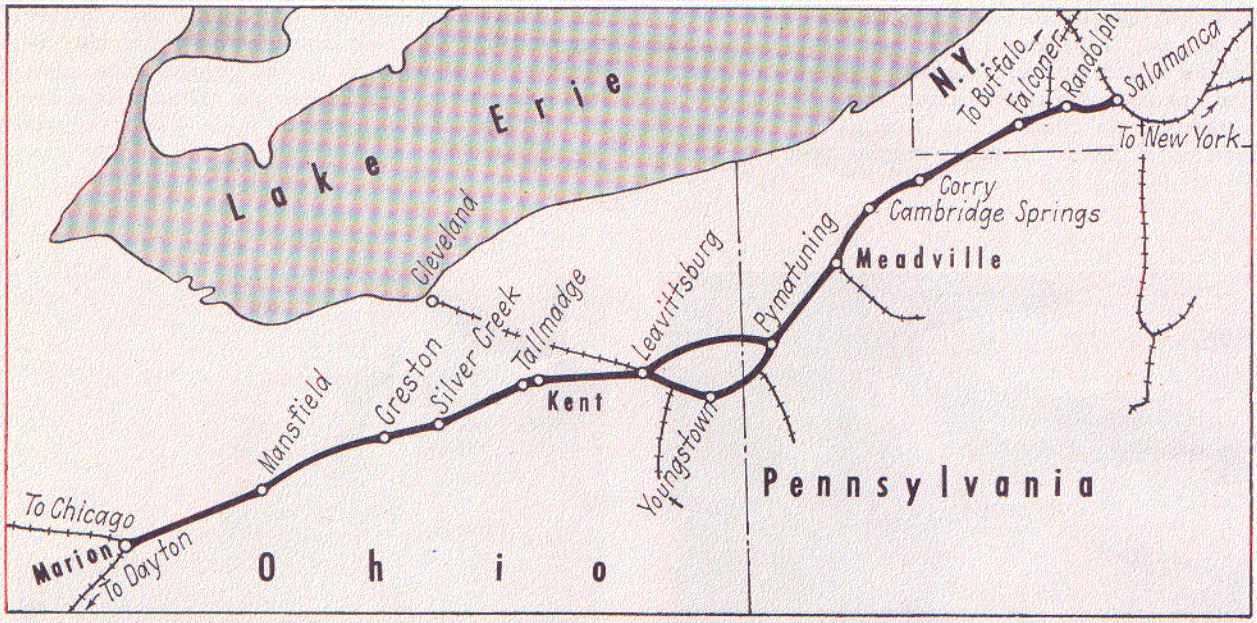
Engineman of Diesel-electric freight locomotive talking by radio to the conductor in the caboose at the rear of the train

Conductor in cupola of caboose using radio. Storage batteries for operation of the equipment are located in the battery box under the floor

Operator at a wayside office with radio control equipment talking by radio to the conductor on a train. He may also talk to adjacent radio-equipped offices



Conductor in the caboose of a freight train talking by radio to the operator at a wayside office



Map of the territory showing division points and wayside offices with radio control equipment

furnished to all interested parties not only expedited restoration of traffic over the railroad, but the direct communication maintained by radio with the scene of the accident similarly expedited the work of clearing the tracks for normal operation.

Characteristics of Territory

The installation between Marion and Salamanca involves three divisions—Kent, Mahoning and Meadville—which were selected first because they present all the complex problems encountered in freight and passenger train operations—heavy grades, curves, single and multiple track, and often unfavorable weather conditions. The Kent division extends 116 mi. east from Marion to Kent; the Mahoning division 129 mi. to Meadville; and the Meadville division 102 mi. to Salamanca. The dispatchers for these divisions are located at Marion, Youngstown, Ohio, and Salamanca, respectively.

Double track is in service for 277 mi. of the 347 mi. between Marion and Salamanca via Youngstown, and single track for the remaining 70 mi. — 28 mi. between Leavittsburg and Pymatuning, Pa., 6 mi. between Youngstown and Pymatuning; 26 mi. between Shenango, Pa., and Meadville, and 10 mi. between Waterboro, N. Y., and "RH" tower. Between Marion and Salamanca the railroad crosses five river valleys in which severe fog causes poor visibility during some seasons of the year. The maximum ascending grade in either direction in the territory is 1.1 per cent. Train movements are governed by timetable, train orders and automatic block signals or centralized traffic control.

The territory between Marion and Salamanca is part of the Erie's main freight and passenger route between the east and west, over which considerable perishable traffic is handled from Chicago for delivery to New York and the New England states. In addition, connecting freight and passenger traffic from Indianapolis, Ind., Cincinnati, Ohio, and Dayton via Marion, and from Cleveland, Ohio, via Leavittsburg to Buffalo, N. Y., via Jamestown and other points in the east is handled in the territory. Between Leavittsburg and Pymatuning, passenger trains are operated via Youngstown, but through freight trains are operated over a 28-mi. single-track cut-off, enabling them to bypass Youngstown and the extensive industrial area which surrounds that city. This cut-off is also equipped with radio.

Daily traffic in each direction between Marion and Salamanca averages one express, three passenger and 12 freight trains, with extras as required—an average of about 35 trains a day. The maximum tonnage handled ranges up to approximately 7,000 tons, with the exception of manifest freight trains, which range up to about 5,500 tons. Of the 16 radio-equipped Diesel-electric locomotives used in handling the traffic, 9 are assigned to freight service and 7 to passenger service.

Space Radio Equipment

Low-powered 15-watt space radio equipment is used for all communication between the head and rear end of trains, trains and wayside stations, different trains within the radio range, and between wayside stations. Walkie-talkies are also used by train crews as a regular part of their operating equipment. The equipment in each locomotive cab consists of a radio control unit with an attached hand set on the engineman's side, and a loud-speaker on both the engineman's and fireman's side. A similar control unit, hand set and loud-speaker are located in the center

of each caboose where they can be conveniently reached from the floor or cupola. A desk-type control unit with a built-in loud-speaker, and a separate handset are in service at each wayside control office. In either instance, the push-to-talk switch is pressed when placing a call and is released for the reply to come in over the loud-speaker. Two frequencies are utilized —160.05 m.c. for communication between the caboose and locomotives of a train or between trains, and 159.09 m.c. for communication between wayside offices and trains, as well as between offices.

Wayside Offices and Transmitters

There are fourteen 24-hour wayside offices where radio control equipment was installed, spaced approximately equal distances apart to give coverage over the entire 347-mi. route between Marion and Salamanca and the Leavittsburg-Pymatuning cut-off. Beginning at the west end they include Marion, Ohio, Mansfield, Creston, Silver Creek, Kent, Leavittsburg and Youngstown, Pymatuning, Pa., Meadville, Cambridge Springs, and Corry, and Falconer Junction (Jamestown), N. Y., Randolph and Salamanca.

The transmitters and antennas controlled by 10 of the wayside offices are located directly at those offices. On the other hand, the transmitters and antennas controlled by four of the offices are located several miles away, because of irregular terrain. For example, the transmitter for the wayside office at Mansfield is at Ontario, Ohio, 7.2 mi. distant, that for Creston at Polk, 18.1 mi.; and that for Kent at Tallmadge, Ohio, 6.0 mi. The transmitter for Corry is at Cambridge Springs, Pa., 27.4 mi. distant. To insure proper reception and transmission between trains and wayside offices along the entire route, adjacent transmitters, receivers and antennas were so located as to provide about a 5-mi. overlap in coverage.

Where radio transmitters are located a comparatively short distance from the 24-hour office, the transmitter is controlled over a separate pair of line wires. However, where the distance involved is very great, special inductive circuits are superimposed on the existing line wires, thus eliminating considerable cost in the installation of new wire. At the same time, protection is provided against failure of a transmitting station by induction on all wires, rather than on just one pair. Thus, a broken line wire or a short gap in the entire pole line due to a storm or some other reason will not affect the system.

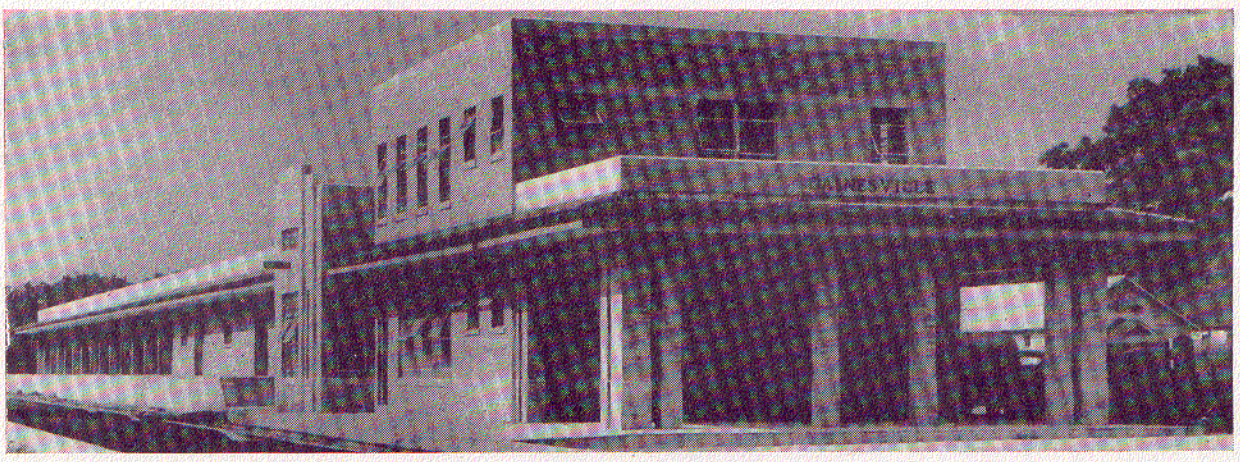
Mobile stations are normally tuned to the train-to-wayside frequency. The operator of a mobile station must depress a button on the control panel to use the end-to-end frequency for intra-train or inter-train communication. When the user of a mobile circuit is through using the end-to-end frequency, the transmitters and receivers automatically readjust themselves to the train-to-wayside frequency, thus eliminating the possibility of human error, which might result in mobile units not being on the train-to-wayside frequency when a 24-hour office calls a train within radio range of the wayside station calling.

When the train-to-way-side frequency is in use, other mobile units within range can use the end-to-end frequency for intra-train or inter-train communications, thus avoiding interference. Any station can communicate with adjacent stations in either direction, with the result that, in the event of wire-line prostration, an emergency radio relay communications network is always available along the right-of-way.

The dispatcher on any of the three divisions can, when necessary, talk to the conductor, engineman or other crew member on any train under his jurisdiction.

To do so, he calls the 24-hour operator's office nearest to the train on the dispatching telephone circuit. The operator then connects the dispatcher's circuit to the radio system and the necessary conversation may be carried on.

This project was planned and installed by Erie forces under the direction of F. H. Menagh, superintendent of communications. The radio equipment, furnished by the Farnsworth Television & Radio Corp., will be described in detail in an early issue of Railway Signaling. A description of the power supply equipment on the locomotives and cabooses will be published in a forthcoming issue of the Railway Mechanical Engineer.



New passenger and freight station of the Atlantic Coast Line at Gainesville, Fla.