

bridge runway. It is picked up from this pile by the transfer bridge bucket and deposited wherever desired in the main storage pile under the transfer bridge. The cross section of the temporary storage pile into which the unloaders can dump the coal is equal to that of any of the boats in this service, so that a boat can be unloaded into this temporary pile without any unnecessary movements of the unloader along the dock face.

When it is desired to load cars from the storage piles, the nine ton bucket operating on the transfer bridge picks up the coal from the pile and dumps it directly into the larry cars. The trestle on which the larry cars operate is continued alongside the transfer bridge runway beyond the end of the dock face in order that these cars may be loaded by the transfer bridge without unnecessary movements of the entire bridge. The trestle is equipped with two sets of crossovers so that the larry cars can be transferred from one track to another and kept in continuous operation.

Cars intended for loading at the dock are brought from Fort William around the north side of the storage ground and into the plant at the east end. A through track is provided along the face of the dock adjacent to the loading track, which provides access to a three track gravity yard located west of the face of the dock. From this yard cars can be run at will in strings of 15 or less and spotted at the loading bins by car hauls running the length of the dock adjacent to each loading track. After being loaded the cars are hauled to the east end of the dock from which they are handled by switch engines.

A large part of the preliminary work of construction was done during the season of 1911 and work was carried on through the winter of 1911-1912. The site was cleared in June, 1911, and excavations for the foundations were begun about August 1. Placing of concrete was begun about the first of October and was carried through the winter, sometimes at temperatures as low as 40 deg. below zero. All concrete work was of mass design and ample precautions were taken to prevent freezing. In order to raise the level of the ground which will be used for storage, considerable material from the hydraulic dredges in the channel leading to the dock was used for filling. The problem of getting material to the work was a very difficult one at certain stages. There was then no rail connection with the island except by car ferry, and it was necessary to transport the heavy structural members used in the unloading plant across the river on a ferry which had a capacity of only one car. During the closed season for navigation, a temporary trestle was thrown across the river between Fort William and the island, and some equipment was hauled in over this.

The construction of this plant has been handled under the direction of J. G. Sullivan, chief engineer of the western lines; Frank Lee, principal assistant engineer, and D. C. Chisholm, resident engineer at Fort William. The Wellman-Seaver-Morgan Company, Cleveland, Ohio, had the contract for the coal handling plant; Amos Harned being the contractor's superintendent on the work.

USE OF TELEPHONES ON THE PENNSYLVANIA RAILROAD.*

The first use of the telephone for despatching trains on the Pennsylvania was in 1897 on the South Fork branch, 32 miles long. At that time the number of trains was four a day, but for the last ten years the average movement is eighty trains a day, and there has been no accident due to any misunderstanding of orders. The Pennsylvania now uses 17,000 telephones; some of them owned and others leased.

In the preparation of this paper, there was secured information from 35 prominent roads (not including the Pennsyl-

*Abstract of a paper by J. C. Johnson, superintendent of telegraph of the Pennsylvania Railroad, read at the annual meeting of the Association of Railway Telegraph Superintendents at St. Louis, Mo., May 20.

vania) operating 115,000 miles of line, and the statistics obtained from these different companies is summarized. Much of the information given is of the same character as that recently published by the Interstate Commerce Commission. Other facts of interest are as follows:

Average number of train orders sent per day over each despatcher's circuit by telephone, 77.2; average on telegraph circuits, 56.6; number of cases of trouble per month per 100 instruments on telephone lines, 8; number of cases of trouble on telegraph lines, per 100 instruments, 9. Reporting as to the efficiency of lines, the average efficiency is 94.3 on telephone lines and 72.8 on telegraph lines; this being taken as evidence of the well understood fact that telephone lines are less troubled than the telegraph by bad weather. The 35 companies report about 1,000 portable telephones in use, as follows: On freight trains, 268; on wrecking and work trains, 386; on passenger trains, 150; in the hands of track foremen, 20; miscellaneous, 168. The number of telephones in boxes or booths at sidings is given as 5,255; number at automatic signals, 206.

On the Pennsylvania Mr. Johnson's inquiries show the following averages: Average cost of a way station installation, \$128; average number of train orders per despatcher's circuit, per day, on single track lines, 32. The efficiency of telephone lines is impaired by bad weather 5 per cent.; of telegraph lines by bad weather, 17 per cent. The number of portable telephones on wreck and work trains is 107; on passenger trains, 4; in the hands of track foremen, 138; miscellaneous, 47. Mr. Johnson estimates that the efficiency of wrecking trains is increased by the use of the telephone 45 per cent.; of work trains, 40 per cent.; of passenger trains, 45 per cent., and of track foremen, 45 per cent. The number of telephones in boxes or booths at sidings is 2,081; number at automatic block signals, 312, and at intermediate points along the road, not previously included, 931.

On nine out of twenty-three divisions of the Pennsylvania the telegraph is kept in service for emergency use, after the telephone is installed. There has been no reduction in the number of telegraph operators at small stations. Explaining an apparently higher cost of installations on the Pennsylvania as compared with other roads, it is stated that emergency equipment is maintained at most or all of the stations; test panels are also freely installed, so as to facilitate patching of wires when necessary. The small number of orders issued by the despatchers of the Pennsylvania is explained as probably due to the extensive use of automatic block signals. Telephones at outlying points along the road have been found of great value. A standard shelter box has been devised, the door of which, hinged at the top serves, when open, to protect the user of the telephone from rain or snow.

A special wall telephone has been developed for installation in the shelter boxes and booths which is expected to give excellent results. It is equipped with an insulated transmitter and all exposed metal parts are insulated, including the generator crank, switch hook and transmitter. The receiver has concealed binding posts. The windings of the receiver, induction coil, ringer and generator-armature and cords are given a special moisture-proof treatment. Exposed metal parts which are ordinarily nicked will be finished in a dull black.

Mr. Johnson says that on the Pennsylvania, as on other roads, an accurate estimate of the saving made by the introduction of telephones is difficult to get at, although the importance of the saving is universally recognized. The Great Northern reports that the acceleration of train movements since the use of the telephone has produced a saving of \$85,100 a year.

Mr. Johnson thinks that there has now been sufficient experience with telephone apparatus to warrant action looking to standardization of equipment. Concerning loud speaking receivers he says: "We have conducted some experiments with loud speaking receivers with a view to relieving the despatcher of the burdensome head receiver and providing him with a substitute to use during lightning storms. The snapping or crackling noises of static discharges during these storms become very

annoying with the standard head equipment, and while it may not be altogether dangerous, it is at least objectionable. It is possible that some of the despatchers have expected too much from the use of the loud speaking receiver, and have thought that it should be readily heard when they are some distance from it, instead of arranging the receiver to be heard at a distance of about 6 in. or a foot from the ear when the operator is directly in line with it. There is quite a field for development in this particular part of the apparatus, and we are confident that something will eventually be developed along this line which will be the solution."

The Pennsylvania is considering the installation of underground cables for emergency use. With such a cable looped into every station and signal station the road could cope with any adverse weather conditions. In station offices arms or brackets to hold the telephones are found of great value. The cost of maintenance of cords is reduced, the telephone is less disturbed by local noises, telephones do not get knocked off the desk, and with a head receiver the operator is free to use both hands for other work. The Pennsylvania has telephones on some of its limited trains, and also on its private cars, for use while lying at large terminal stations.

At certain points along the road five-pair emergency cables 1,000 ft long are kept ready, on special reels, to be used in making quick temporary repairs in case of damage by storms or blasting operations, etc. Mr. Johnson has in mind the construction and equipment of an emergency car equipped with a switchboard apparatus, emergency cable, selector equipment, etc., with which a temporary despatcher's office could be set up at any point.

Mr. Johnson discusses one of the principal objections to the use of the telephone, that an operator at a station does not know the location of approaching trains as he does when he has the Morse telegraph, by which he can hear what is going on among other offices while attending to his office work. With a head receiver so connected that he could move around the office, or with a loud speaking receiver, the operator could perhaps get this information from a telephone line; it is a question, however, whether operators ought to burden themselves with this information, a large portion of which is of no value to them. The constant wearing of a head receiver for eight hours is objectionable, as sometimes the pressure produces painful sensations; and it may make the ears too sensitive to weather conditions. On divisions of light traffic a signal circuit is provided so that way stations can call the despatcher by means of a buzzer, and he need not wear the receiver at all times. Some despatchers are nervous during thunder storms, but some of the oldest have found no trouble wearing the receiver through all kinds of storms. Rubber ear cushions are worn by some despatchers, but these are objectionable, as they cause excessive perspiration. The loud speaking receiver would seem to be the best remedy for troubles due to thunder storms. Many of the oldest despatchers have worn the head receivers through all kinds of storms and have never received any injury, but there is a snapping and crackling sensation which disturbs the more timid.

The benefits derived from the use of the telephone, as summarized by Mr. Johnson are set forth in about the same way as has been done by other superintendents in the past. Using the telephone a period of one or two months is sufficient to train an operator, as compared with six months to a year where the Morse telegraph is used. The saving in the time of sending and completing orders is estimated at about 40 per cent. With the telephone there is no chance that an operator will leave the train-wire open. Many operators have said that it would be a hardship to go back to the telegraph key, as has had to be done in case of trouble on the telephone selectors. Many telegraphers suffering from paralysis of the fingers or other disabilities have been enabled to maintain their positions. Delinquencies have been prevented; Mr. Johnson, however, gives only a single instance, that where a trackman discovered a

broken flange and the train endangered by the break was stopped just before going down a steep grade.

The conclusion of the paper is that as the use of the telephone is constantly being extended, it is not rash to predict that it will eventually supersede the telegraph entirely, not only for despatching, but for the transmission of messages also.

REPORT ON GOTHENBURG COLLISION.

The Interstate Commerce Commission has issued a report, by Chief Inspector Belnap, dated April 16, giving the causes of the rear collision of passenger trains on the Union Pacific at Gothenburg, Neb., March 14, in which four passengers were killed. This collision occurred at 3:37 a. m. in a severe snow storm, and the cause was the failure of the engineman of train No. 12 to see an automatic signal which indicated stop about 1,000 ft. in the rear of passenger train No. 4, which was standing at the station. The distant signal, 2,427 ft. in the rear of the stop signal, was at caution and the engineman saw it and reduced his speed to about 20 miles an hour, but smoke and snow blowing to the southward obscured the home signal and he passed it without seeing it; then, while drifting along and trying to locate his position, he suddenly saw the fusee which was being waved by the flagman of the standing train about 100 ft. in the rear of the last car. Train 4 had been there only two minutes, and no blame is attached to the men on that train. The fireman, on account of some little difficulty in keeping up steam, had seen none of the signals during the run from North Platte, about 35 miles. The engineman had a good record of 14 years' standing. He had been on duty only two hours and seventeen minutes.

This report, in explaining the spacing of the trains over the 35 miles from North Platte to Gothenburg, incidentally shows the care and precision with which flagging is carried out on the Union Pacific, and also illustrates some of the difficulties of flagging. Passenger train flagmen have been instructed—whether in print or by word of mouth does not appear—that at regular stops the flagman must immediately take his position 60 ft. from the rear of his train and be prepared to protect his train should an emergency arise. After waiting five minutes, if the train does not start, he must go back, according to rule 99. Flagman Frosch was carrying out this rule at Gothenburg. His train was behind time, and so was the following train; but the line is fully equipped with automatic block signals, and as telegraph offices were 12 miles or more apart, dependence for spacing was placed wholly on the block signals.

About one mile east of North Platte there is a long bridge, over which the road is single track. On this bridge the signals, on the night in question, were out of order, and stood in the stop position throughout the night, all trainmen being notified accordingly. But although, according to the report, the trainmen had been notified, it is also said that the conductor of No. 12 instructed his engineman to carry the flagman on the engine and proceed slowly across the bridge, not deeming it safe for the flagman to walk across ahead of the train on account of the severe storm. Train No. 4 had also complied with the rule requiring a flagman to be sent in advance when a signal on single track indicates stop; and it consumed 17 minutes in crossing the bridge; but No. 12 took only about 10 minutes, thus shortening the time interval between the two trains, which had been 16 minutes apart leaving North Platte. The time interval was further shortened, because the second train made no stops at stations.

LONGITUDINAL RAILWAY, CHILE—During 1912 there were 362 miles of railroad constructed at a cost of \$14,999,000 by the syndicate building the Longitudinal Railway connecting Santiago and Iquique under a 5 per cent. guaranty by the Chilean government. It is expected this line will be completed and open for traffic before the close of 1913.