

feed at 115 volts into two No. 6 insulated wires supported in cable rings hung from messenger wire, which is run overhead along the columns in the subway, west of the inbound passenger track. These same cable rings support the control wires for the signals—the number of these varying in each section. The 2,300-volt supply does not extend beyond the subway portal and the control wires between signal 070 and the portal are run in Trenchlay cable buried outside the ballast line in the subgrade. At signal locations, or where it is necessary to break the control cable for any reason, terminal boxes were used, mounted on the columns or on foundations.

Most of the signal lighting is at 115 volts, and all line relays, or the local phases of two-element track relays, were supplied directly from these low-voltage mains. Where a lower voltage is required for a track-circuit feed or for lighting the low-voltage signal lamps, an air-cooled track or lighting transformer is used.

The complication of crossovers, with their protection, involved the use of numerous relays, some of which have as many as six front and six back contacts. The relays,

together with the track transformers, track resistors and other equipment, were housed in standard instrument cases mounted on concrete foundations.

The installation of the signals in this particular section, as well as those on the other parts of this development, was handled under contract; the railroad, however, furnished competent men to supervise the work. To simplify the field work, all instrument cases were wired at the signal company's factory, the relays and other equipment being set in place and the wiring carried to the entrance terminal board. Case plans were furnished for each location, which made the work of connection extremely simple.

The placing of insulated joints, switch boxes, impedance bonds and foundations was done by the track department under signal department supervision. The running rails are 100 lb. A. R. A. section, and the track is rock ballasted throughout.

Almost seven months of operation have proved the fact that the arrangement satisfactorily meets the requirements of the transportation department.

Train Accident on the Erie Railroad

Use of call-on signal involved in rear-end collision

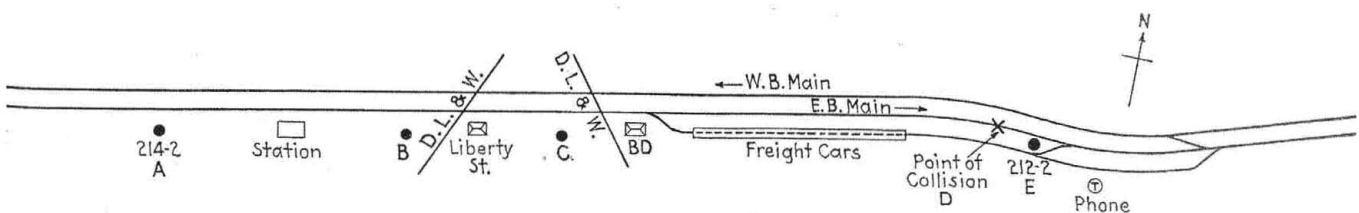
AT 7:43 p. m. on September 5, 1933, there was a rear-end collision between a passenger train and a milk train on the Erie near Binghamton, N. Y., which resulted in the death of 14 passengers, and the injury of 31 passengers and 1 employee. Investigation of this accident was made by the Bureau of Safety, I.C.C., in conjunction with representatives of the Public Service Commission of New York. A summary of the report follows:

This accident occurred on the double-track main-line over which trains are operated by time table, train orders and an automatic block-signal system, supplemented by an automatic train stop of the intermittent inductive type. The signals involved, named in order from west to east, were automatic block signal 214.2 and the interlocking home signals at Liberty street and BD towers, these signals being located 11,759, 7,980 and 5,962 ft., respectively, west of the point of accident; and automatic

positions, the night indications being red and yellow, for stop and proceed at restricted speed, respectively. These calling-on signals were installed for the purpose of advancing a train into an occupied block and for authorizing diverging movements. On account of braking distance of only 2,018 ft. between the home signals at Liberty street and BD towers, an over-lap has been provided so that automatic signal 214.2, west of Binghamton station, will not display a more favorable indication than "approach," unless the home signal at Liberty street is in the proceed position.

The automatic train stop operates in conjunction with the way-side signals, the inductors being located approximately 70 ft. in the rear of each signal.

Eastbound freight train No. 90 passed BD tower at 7:01 p. m. and pulled into the siding. Switch engine No. 78, with 30 cars, followed No. 90 from Binghamton, and after No. 90 had cleared on the siding, engine 78 pro-



Sketch of territory in which collision occurred

block signal 212.2, located 893 ft. east of the point of accident. The automatic signals are of the one-arm, three-position, upper-quadrant semaphore type, the night indications being red, yellow and green, for stop, approach and proceed, respectively. The interlocking home signals are of the two-arm semaphore type; the upper arms are of the three-position upper-quadrant, semi-automatic type, displaying the same night indications as the automatic signals, while the lower arms are non-automatic, lever controlled calling-on signals, operating in two

ceeded on the main track to the crossover east of signal 212.2. The work of setting out the 10 cars on train No. 90 for Binghamton, and in picking up the 30 cars, was in progress when passenger train No. 8 approached on the eastbound track and was stopped by the flagman of the switching crew.

Passenger train No. 8 had arrived at Binghamton at 7:03 p. m. and departed at 7:16 p. m., passed BD tower at 7:18 p. m. and was flagged shortly thereafter as just mentioned. About one minute after having been brought

to a stop, the rear end was struck by train No. 2. Train No. 2, a milk train, was stopped by signal 214.2 when No. 8 was standing at the station, and No. 2 pulled up to within a few car lengths of the rear of No. 8 and waited until that train had departed. Train No. 2 then proceeded, passed Binghamton station at 7:18 p. m., two minutes behind No. 8, received an approach indication at the home signal at Liberty street, was given the calling-on arm at BD tower, passing BD tower at 7:21 p. m., three minutes behind No. 8, and, after going about 5,338 ft. into the block, struck the rear end of No. 8 while traveling at a speed between 15 and 20 m.p.h.

Conclusions

This accident was caused primarily by the failure of Engineman King, of train No. 2, properly to obey a signal. According to Engineman King's statements, the home-signal indication at Liberty street tower changed from stop to approach before his engine reached it, and he then forestalled and proceeded toward BD tower, where the home signal was in the stop position. He received a calling-on signal indication which is defined in the book of rules as follows:

"Proceed prepared to stop short of train, obstruction, or anything that may require the speed of a train to be reduced."

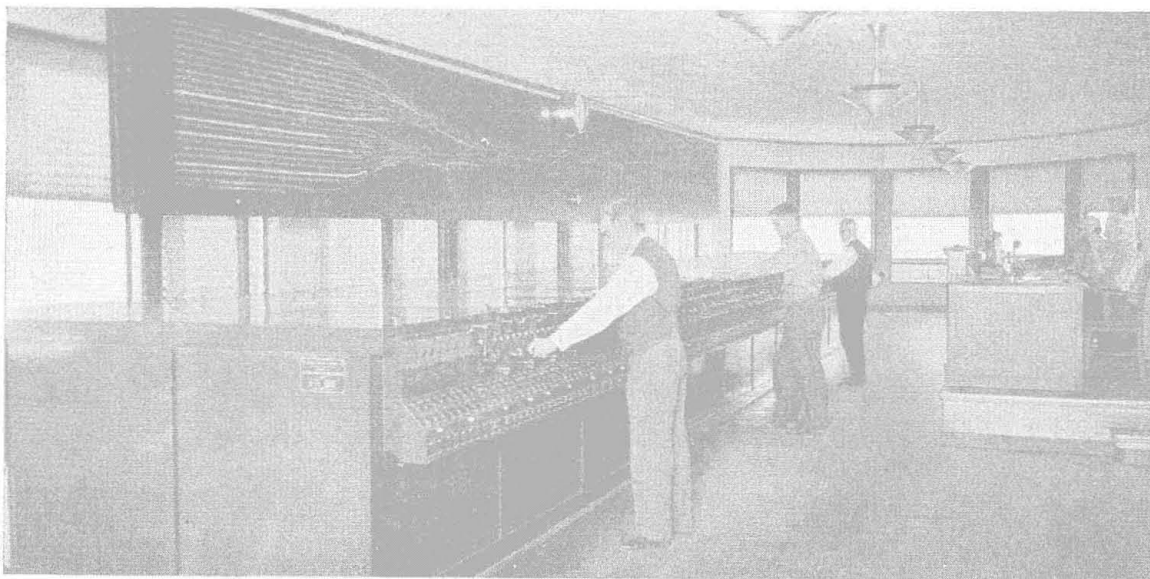
He again operated the forestalling lever, after which he entered the obstructed block, working a light throttle, and, according to his statements, he gradually opened the throttle and increased the speed of his train until he had about reached the curve west of the point of accident. He said he shut off at this point, although the fireman's statement is to the contrary, but in any event he saw signal 212.2 displaying a stop indication and assumed that this indication was displayed because train No. 8 had passed into the block governed by that signal, the thought not entering his mind that the signal might be at stop because of some other movement being made. The result was that he was proceeding with the expectation of not stopping until he reached the signal location, and it was due to this fact that when he finally saw the flagman and markers of train No. 8 between him and the signal he was going at too high speed to enable him

to stop. He knew what the indication of the calling-on signal meant, but he allowed himself to be misled by what he *assumed* was the case instead of operating his train strictly in accordance with the signal indications he had received and the rules governing the same.

Under the circumstances in this case there does not appear any reason why Signalman Mace, on duty at BD Tower, should not have displayed the calling-on signal authorizing train third No. 2 to enter an obstructed block. Not only is it necessary in many cases that trains be advanced at BD tower in order to avoid having the rear of a train block the interlocking plant at Liberty street, but it also is to be remembered that the calling-on signal was installed for the particular purpose for which it was used on this occasion; it is necessary in the operation of a railroad to keep interlocking plants clear of traffic in order that they may be free to perform their proper function, and the present case constitutes no exception to the usual practice throughout the country.

The track in the vicinity of the point of accident and the engines of the trains involved in this accident were equipped with automatic train-stop devices and investigation revealed that the automatic train-stop apparatus was in proper condition to function as intended. The engineman of train third No. 2 operated the forestalling device on his engine when approaching BD tower, where the Proceed indication of the calling-on signal was displayed for his train. Operation of this forestalling device prevented an application of the brakes by the automatic train-stop apparatus; the operation of this device also was an acknowledgment by the engineman that he recognized the fact that his train was entering an occupied or obstructed block; under the restricted-speed signal it was then incumbent upon him to control the speed of his train so as to be able to stop short of the preceding train or any other obstruction.

The record of this case does not do credit to the Erie Railroad, for there have been too many employees who failed in one way or another to perform their duties to the fullest possible extent. Such a situation is a reflection on those responsible for the proper functioning of the operating department and justifies the recommendation that greater efforts should be made in the way of instruction and supervision.



Control room of the Boston & Maine's consolidated electro-pneumatic interlocking at Boston, Mass. Train director's desk at the right