Another matter; I early learned the value of the *Railway Age* (that wasn't its name in those days), subscribed for it, and not only read it, but studied it faithfully. I used to get a lot of intellectual enjoyment out of the studies in train operation, train order problems, and reports on wrecks. Later on the information so gained stood me in good stead. From the reports on wrecks, I learned many things which should not be done. I could not recommend anything more highly to the embryo signal engineer today than to study the *Railway Age*. It broadens your outlook.

How many of the signal men of today realize the significance of the fact that there were railroads long before there were signals and that most of the traffic and operating problems were worked out as to fundamentals before signals were thought of. It is perfectly true that a modern high speed railroad could not be operating without signals (automatic train control may or may not be included broadly in the term), but the fact remains that signals were not introduced into railroad operation until they were sorely needed. And train control as such is being introduced today by main strength. It is a serious commentary on the education of our signal officers that legislation is necessary to stimulate growth. Lest they feel that they alone have been selected as a target, what shall we say of our executive and mechanical officers who waited until compelled by outside regulatory authority before introducing the automatic coupler and automatic brakes, except sporadically?

A certain Mr. Bennett has presented to the A.I.E.E. a paper entitled "Education for the Functional Division of Engineering" which was published in the November, 1923, issue of the "Journal" of the Institute. In this paper Mr. Bennett brings out the fact that the narrowness so often observed in the so-called specialist is not due to too great specialization, but to too much in the wrong direction and not enough in the right. Roughly what he recommends is that men be not trained to be electrical, mechanical, mining, chemical or other so-called engineers; but rather to be research, sales, supervising, managing, construction or maintenance engineers. The same idea applies to railroading. What we want on a railroad is men who have specialized in railroading.

As it seems to me, to borrow from the sayings of Fido, the bird dog, the signal officer who is going to make a hit in the future and who is going to see a field of railroading outside the signal department opening up before him is the one who gets behind the new idea and pushes. But first let him beware that he has mastered his subject. That isn't so simple as it sounds. When I retired from between the two streaks of rust more or less gracefully it was necessary for a good signal officer to know only the elements of electrical engineering, architecture, concrete construction, civil engineering, blacksmithing, carpentry, pipe fitting, telegraph line work, track laying and maintenance, drafting, office management and gasoline engineering, train operation and enough law to draw up and pass on contracts. That was all he had to know and understand outside his own specialty of circuits, dog charts, mechanisms and terminology. Nowadays he has to add at least radio engineering, advanced electrical engineering with special reference to transients, finance, accountancy and traffic. That will about bring him up to date. What the future may require I will not attempt to predict.

So it seems to me that if the signal officer will master these subjects and add to them a little salesmanship and a lot of respect for the other fellow's job and opinions, the wall won't be able to stand for long. For look you! What operating officer is there, be he ever so experienced, or what executive, who would dare proceed in the future without consulting with his signal officers and treating them as one of the family, provided the signal officers have been faithful to their trust? Who else on the modern railroad must of necessity be so well equipped to handle new traffic and operating problems as they arise than the conscientious signal engineer? More power to him, may his tribe increase! May he step up and over the wall!

Train Operation by Signal Indication*

By M. A. Baird

Signal Engineer, Erie Railroad, New York

THE Erie was one of the first roads to make use of a signal on double track with the current of traffic that could be used in place of the written train-order. In 1909 in connection with the proposed automatic signaling of a double track division 139.7 miles in length, with 16 eastbound and 15 westbound, 85-car passing sidings, it was thought that a considerable saving could be effected and the operation facilitated by the use of a signal which would direct trains to: (1) Stop and hold main track; (2) Take siding; (3) Proceed on main track regardless of following superior trains.

The automatic signals were to be of the one-arm, three-position, upper quadrant type, located on the mast with, and 12 ft. below the automatic signal. This new signal is termed "telephone train order signal." It is located generally at the entrance end of passing sidings although it can be used quite advantageously at other locations. It is controlled by a polarized line circuit from the nearest day and night telegraph office, and the train dispatcher directs the operation by instructions to the office controlling the signal. The circuit arrangement is such that the telephone train order signal (lower arm) requires the automatic signal (upper arm) to display its most restrictive indication whenever the train order signal is at either the 45-deg. or stop position. This arrangement, of course, provides a distant indication approaching each train order signal.

The rules governing the movement of trains by signal indications given by the telephone train order signals are:

(a) Arm horizontal—Red light at night.
Indication: Stop on main track and consult dispatcher on telephone.

(b) Arm inclined 45 deg. above horizontal—Yellow light at night.
Indication: Take siding and consult dispatcher on telephone when clear of main track. Passenger trains will report before pulling into siding.

(c) 1. Arm inclined 90 deg. above horizontal—Green light at night.
Indication: Proceed regardless of following superior trains until otherwise directed by dispatcher.

2. Trains are forbidden to accept this indication if there is any known cause that will prevent them from making their usual running time. In such an event, they will consult immediately with the dis-

*Paper presented at the March meeting of Signal Section, A. R. A.

patcher by telephone. When a train accepts the "proceed" indication and for any cause is unable to make its usual running time, it must protect itself against following preferred trains according to Rule 99, Operating Department.

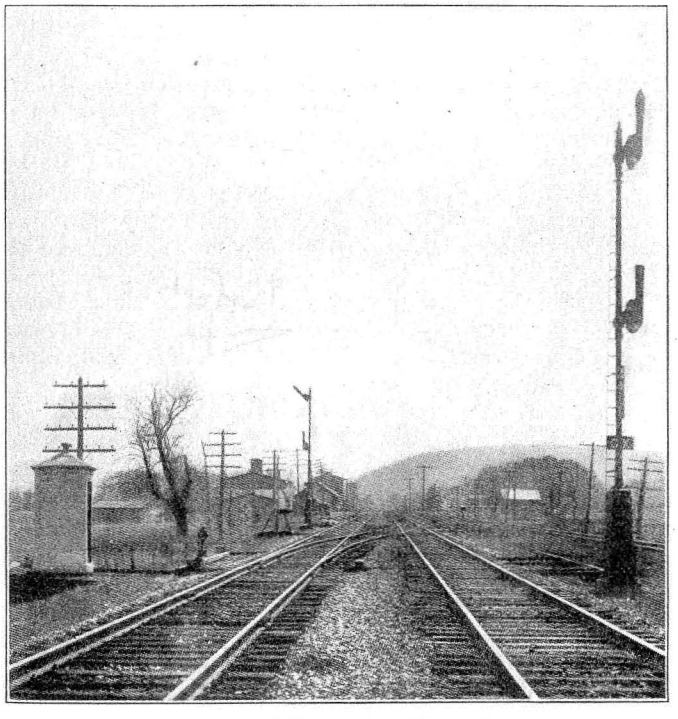
(d) 1. It is forbidden to use a crossover at any point where a telephone train order signal is located without permission from the dispatcher.

2. When trains approach interlocking points with insufficient time to clear the schedule of a superior train at next passing point, the whistle must be sounded for a siding and if "proceed" signals are displayed, trains will proceed in accordance with paragraph "c."

The use of the above described signal eliminated the necessity for the use of the following train order forms: Form *B*-Directing a train to pass or run ahead of another train; Form *D-E*-Time orders; Form *G*-Extra trains; Form *J*-Holding order. This new system proved conclusively that it did facilitate the handling of trains over the division and in consequence thereof effected a saving. During the next seven years the Erie installed 1,367.8 track miles of automatic block signals and the telephone train order signal was used wherever possible.

Train Orders Eliminated in Dense Traffic Zone

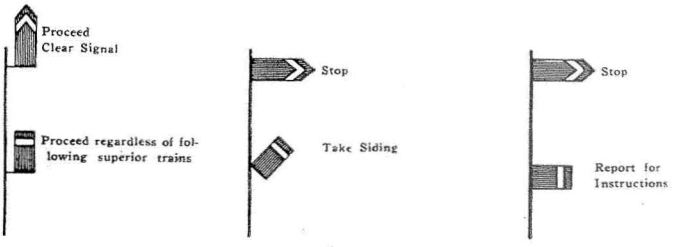
In the Erie's densest commuter traffic zone there are four tracks, one part of which (Jersey City to Croxton, 2.2 road miles, 8.8 track miles) is equipped with automatic block signals for normal direction and reverse traffic operation on all four tracks. Traffic locking between towers at each end of this piece of track control the direction of traffic. Normally two tracks are operated eastward and two tracks are operated westward. During the morning rush period three tracks are operated eastward and during the evening rush period three tracks



Installation of Signals Governing Train Movements on Double Track

are operated westward with the fourth track also used westward for a few trains. Trains are scheduled to operate over a certain track, although in emergency, trains may be routed over any track and are governed by signal indications only.

These four tracks serve two tracks from Croxton to *HX* bridge, a distance of three miles. The two tracks connect to four tracks again at *HX* bridge and were formerly signaled for traffic in one direction only. This resulted in delays to six eastbound and five westbound trains daily during the rush hours. In order to eliminate this delay, special orders were used, and a train master and an assistant chief dispatcher were placed at each end of this three-mile section of double track for three hours daily in order to handle properly the operation of these eleven trains against the current of traffic.



Signal Indications for Directing Train Movements in Use on the Erie

Both tracks were then signaled for traffic in either direction with traffic locking between towers located at each end of the three-mile section. This arrangement eliminated the delays and the necessity for orders, released the two men, and allowed of a much better spacing of trains. For example, from 8:03 a. m. to 8:23 a. m. there are 11 eastbound trains over this piece of track. They are now handled 6 on one track and 5 on the other track by signal indications only. A similar condition prevails westbound during the evening rush period, 11 trains being handled in 26 min., which are now routed 6 to one track and 5 to the other track, allowing of a 3 min. spacing between trains.

On three sections of single track equipped with automatic signals with traffic locking between towers located at each end, trains are governed entirely by signal indications. These three sections are 9.2 miles, 5 miles and 3.4 miles in length.

I. C. C. Report on Key System Accident

THE Interstate Commerce Commission has issued a report, accompanied by a diagram and other illustrations, on the investigation by the Bureau of Safety of the rear collision of westbound passenger trains on the line of the Key System Transit Company, at Oakland, Cal., on December 4, when eight passengers and two employees (off duty) were killed and 36 passengers and 2 employees were injured. Train No. 15 of the San Francisco-Sacramento Railroad, consisting of a single electric car, No. 1014, moving at about twenty miles an hour, ran into the rear of train No. 729 of the Key System, consisting of four cars, which had been stopped because of delayed trains ahead; and the rear car of the standing train was crushed for a length of 18 ft.

This line, double track, is equipped with automatic block signals, 420 ft. apart, and each signal has, connected with the semaphore arm, an automatic stop, arranged to apply the brakes of passing trains by striking a trip on the top of the car.

The signals and the automatic stop worked properly, but the braking distance, which is calculated for a speed of 36 miles an hour was insufficient, train No. 15 having been run at excessive speed.

The report gives the cause as the failure of Motorman Brubaker to observe the rules and obey the block signal indications; and it is stated that the trains "were permitted" to be operated thus. "The Key System Transit