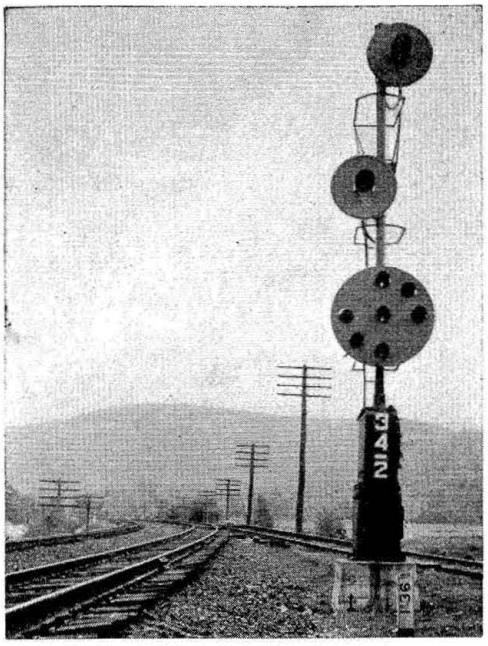


Color-light automatic signal with position-light train-order signal

# New Signaling Increases Track Capacity on the Erie

## Train Speeds increased and delays reduced on 14-mile double-track bottle neck—Position-light train-order signal is remotely controlled

THE Erie has installed searchlight-type automatic signals, using four aspects, to replace old semaphore signaling on a 14-mile section of double track between Suffern, N. Y., and Newburgh Junction, which is a part of the division from Jersey City, N. J., to Port Jervis, N. Y. Four main tracks extend eastward from Suffern to Jersey City, 31 miles, and there are four tracks westward from Newburgh Junction to Graham with three tracks 7.6 miles on to Port Jervis. One of the reasons that additional tracks have not been provided on the Suffern-Newburgh Junction section is that this part of the line follows along the Ramapo river through a mountainous territory and, as a result, the construction of additional tracks would be very expensive.

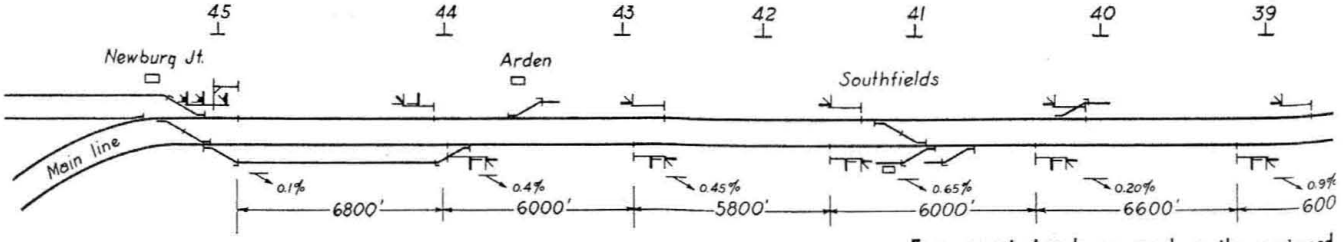
The problem of handling 18 passenger trains and 12 freight trains in each direction daily over this section of double track is complicated by the fact that some of the trains in one direction are bunched in certain periods; for example, between 6 a. m. and 8 a. m. there are six eastbound passenger trains and two scheduled freight trains. The grades in this territory are another obstacle in spacing trains. The grade descends eastward, varying from 0.04 per cent to 1.14 per cent, with an average rate of 0.32 per cent. This grade increases the stopping distance of heavy fast trains to such an extent that they could not be spaced closely with the old signaling arrangement. In view of the fact that three and four main tracks were available on the remainder of the division, this 14-mile section of double track was a "bottle neck."

In order to increase the track capacity and improve the safety of train operation on this section of double track, it was decided to replace the old semaphore signaling with new color-light signaling located on an entirely new arrangement. The old signaling was of the lower-quadrant semaphore type, installed in 1909. Each automatic block was about two miles long, with a distant signal 2,800 ft. in the approach to each home signal. With this arrangement, following trains could not be spaced closer than 2.5 miles, and, even with this minimum spacing, there was not proper stopping distance on the descending grade on the eastward track.

### Signaling on Eastward Track

The solution devised for this situation was to locate the new eastward signals to afford blocks 5,800 ft. long and to use signals with two units, displaying four aspects to indicate track occupancy three blocks in approach. These aspects are in accordance with the standard code; being red over red staggered for "stop and proceed"; yellow over red for "approach"; yellow over green for "approach medium"; and green over red for "clear." This system of automatic block signaling not only allows adequate stopping distance with minimum spacing between following trains but affords the engineman of a freight train adequate warning to control the speed of his train in conformance with the signal indications, so as to keep his train moving with safety and yet eliminate unnecessary stops.

The signaling for the westward track, which is on an ascending grade, is somewhat different. In this case the stopping distance is short, so that four-aspect signaling is not required and single-unit signals, displaying three aspects, red, yellow and green, are used.




Four-aspect signals are used on the eastward

Likewise, the layout and number of trains operated in any period permitted the use of blocks about 6,000 ft. long on this track. In order to reduce the number of stops for freight trains, those automatic signals, on the westward track which are located on an ascending grade of more than 0.3 per cent, are equipped with a 15-in. circular yellow disk known as a grade marker, which authorizes the engineman of a freight train to proceed past such a signal at slow speed, without stopping in case the signal is displaying red.

So far, the new signaling arrangement has permitted the present traffic of 60 trains daily to be handled without delays and is, therefore, highly satisfactory. However, with a view to future increased traffic, the new signals were so located as to fit in with a centralized traffic control operation, involving either-direction operation on each track. In such a proposed improvement a set of two crossovers would be located at Tuxedo midway between the two ends of the double track so as to make it possible to direct trains from one track to the other when making runaround movements.

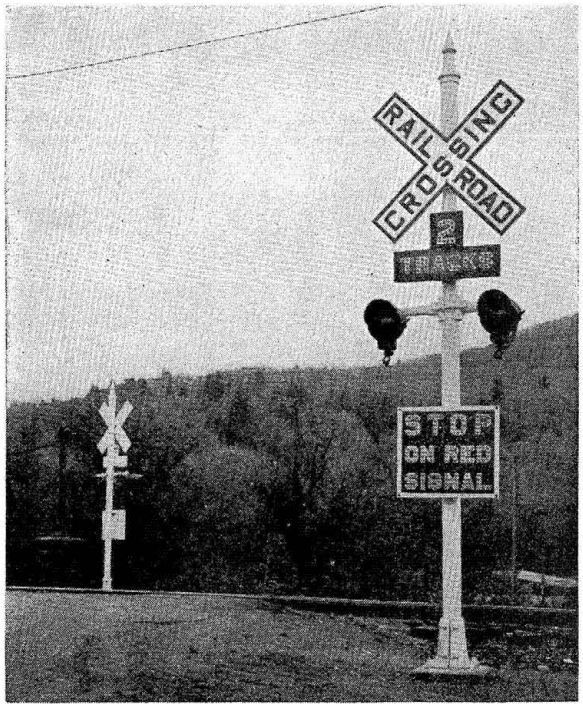
## Special Signals

This 14-mile double-track signaling installation involves 12 two-unit signals on the eastward track and 11 single-unit signals and one two-unit signal on the westward track. The automatic block signals are of the searchlight color-light type mounted on masts at the right of the track governed, excepting where signal bridges are required. The single-unit signals, as well as the bottom unit of double-unit signals, are 12 ft. 2 in. above the top of the rail, the upper unit being 6 ft. above the bottom one. This height of mounting was used to bring the signal as near as possible in line with the engineman in the cab of a locomotive and has proved to be of benefit during foggy weather.

An interesting feature of the signaling on the Erie is the use of remotely controlled three-aspect telephone train-order signals at outlying passing tracks. On such a signal, a horizontal aspect directs the train to stop on the main track and call the dispatcher; a 45-degree aspect directs the train to stop, pull into the siding and report when clear of the main track; while a vertical aspect indicates that the train is to proceed on the main track regardless of following superior trains. On previous installations, a semaphore or a color-light signal has been used to display these telephone train-order-signal aspects. However, in the new Suffern to Newburgh Junction installation a position-light signal was used for the first time for the train order signal, this position-light unit being mounted below the other signal units as shown in the illustration.

## Details of Construction

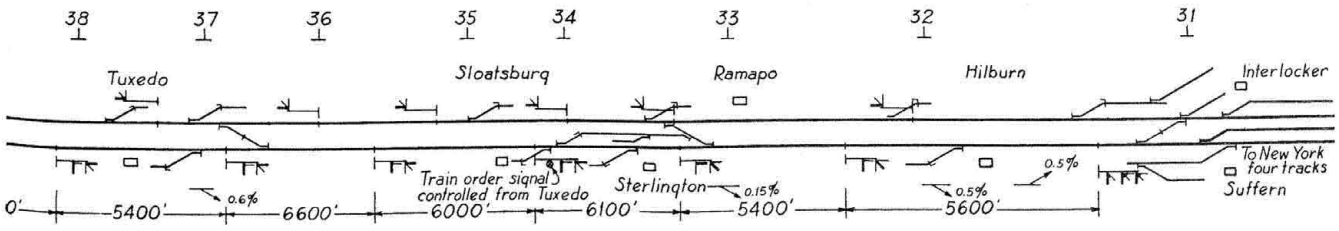
Each signal is equipped with an eight-volt lamp which has two filaments, one rated at 13 watts and the other at 3.5 watts. The lamps are normally fed at 7.2 volts in order to lengthen the life. The signal lamps are on approach control, the lamp being lighted when a train is approaching, as well as during the time the block governed by the signal is occupied. The foreman of maintainers makes a check of the traffic to determine the average number of burning hours for each signal and establishes the date of replacement of the




Highway crossing signal at Tuxedo is completely equipped

lamp so as to give about 2,000 burning hours. With this procedure, the lamps are, with rare exception, replaced before the main filament burns out, but even if the main filament does burn out the second filament gives an indication strong enough to permit the enginemen to get the indication. Another important feature of this installation is that if both filaments in the top unit of a double-unit signal burn out, a normally-energized relay in series with this filament will be released and, by means of circuits controlled by this relay, the lower unit will display red. Therefore, if the lamp burns out, there is no chance that the signal will display a less restrictive indication. For example, if the aspect were yellow over green, and the lamp in the upper unit burned out, this would leave a single green in the lower unit, except for the fact that the light-out relay operation would change the lower unit to the red aspect.

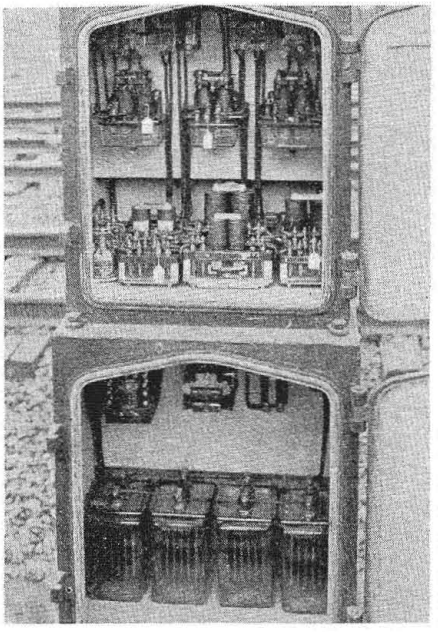
Each signal is controlled by a separate two-wire circuit, no common wire being used. The DP-21 type slow-acting polar relay with the retained neutral feature is used on the line control so as to avoid flashes of the red when changing from yellow to green or vice versa. The light-out relays are the ANL-2 type, rated at 0.18 ohms d-c. resistance, and the approach-lighting relays



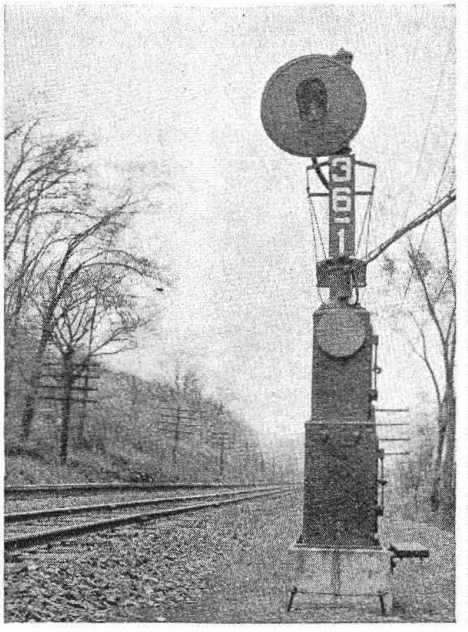

track and three-aspect on the westward

are 50-ohm Hall type, in series with the DP-21 relay or in some cases with the searchlight signal.

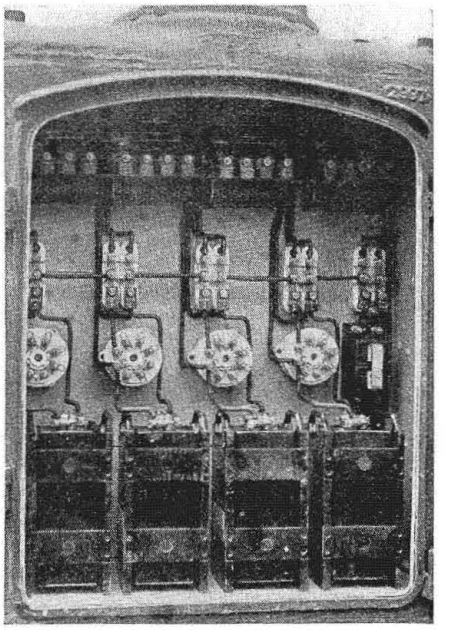
The instrument cases are wired with No. 9 single-conductor solid-copper (braid only no tape) insulated wire so that the wires stay in place and present a neat appearance as shown in the illustrations. The arresters are the Everett Raco type with a Raco high-static Type-B unit connected across each set of line arresters or track connections.



Solid wire is used in the instrument cases




Westward signal with grade marker



Track battery and rectifiers in case

### Power Supply System

The a-c. floating system of power supply is used on this installation, the line distribution being at 110 volts run on two No. 6 hard-drawn copper wires with weather-proof covering. A 110-volt line is practical in this instance because connections to existing feeds were available at several stations. In order to distinguish the 110-volt wires, they are run on amber-colored Pyrex insulators.

One advantage of using 110-volt for the distribution is that the power wires can be brought in to the instrument case, and no line transformers are required. These two 110-volt wires terminate in the case in a Raco porcelain-enclosed type of fused disconnect switch which is so constructed that when the cover is removed, the circuit is broken and the fuses, which are attached to the cover, are readily accessible. The fuses used are rated at five amperes. The transformer relays are the Type ANL-40 and the rectifiers are the RT-10 type. At each signal location a set of four cells of Exide KXHS-11 storage cells are used for the line control circuits and as a standby for the signal lamps. One Edison Type-B6H storage cell is used on each track circuit and an Everett-RV5 resistance is used in series with each track feed. The maintainer reads the voltage on each cell of storage battery each week and the gravity reading is taken every three months.

The line wire for the control circuits is No. 10 hard-drawn copper, with weather-proof covering, run on glass insulators. The cables at signal locations are made up of single-conductor No. 14 insulated wires using Raco cable straps. Parkway cable is used for underground runs, the run to the rail being single conductor No. 9 parkway made up with two wraps of steel tape but with no lead. At the rail, this cable is brought up through a Raco bootleg outlet and is connected to a 32-strand copper cable which is clamped in the top of the bootleg and extends to a ⅜-in. plug in the rail. The rail joints on this installation are bonded with stranded steel bonds with copper core, applied by welding, both the Tiger-Weld and the OBalloy types being used.

The design and construction of this automatic signaling installation was handled by the signal department forces of the Erie Railroad, the signals, relays, etc., being furnished by the Union Switch & Signal Company.

## Illinois Central Crossing Gates

*(Continued from page 343)*

interlocking, flasher and power-off relays, rectifiers and transformers. A four-conductor No. 9 parkway extends from this box to each gate pedestal, and three single-conductor No. 9 cables are run to each of the signals. Two single-conductor No. 9 parkway cables extend to each bootleg outlet at the rail. This cable is of Kerite manufacture made up with two wraps of steel but with no lead sheath.

At the rail the two parkway cables are terminated in a cast-iron bootleg outlet set on a concrete foundation. Each cable comes up through a hole in the foundation and the conductor is run around a ¾-in. threaded steel stud and held by nuts. The stud is insulated from the box and extends to the outside. Two ⅜-in. stranded Copperweld cables are bolted to each stud and extend to ⅜-in. plugs driven in the rail, one cable going to the outside and the other to the inside of the rail. The same arrangement applies for the end of the rail on the other side of the joint so that one outlet box serves for two rail-end connections. It will be noted that the bootleg is set at the end of a tie so that the space between all ties is left open to permit tamping.

These automatic gates were placed in service on May 22, and although traffic has been fairly heavy on the highway as well as the railroad, the gates have operated satisfactorily to protect the crossing. The project was planned and installed by the signal department forces of the Illinois Central, with the co-operation of the division operating officers.