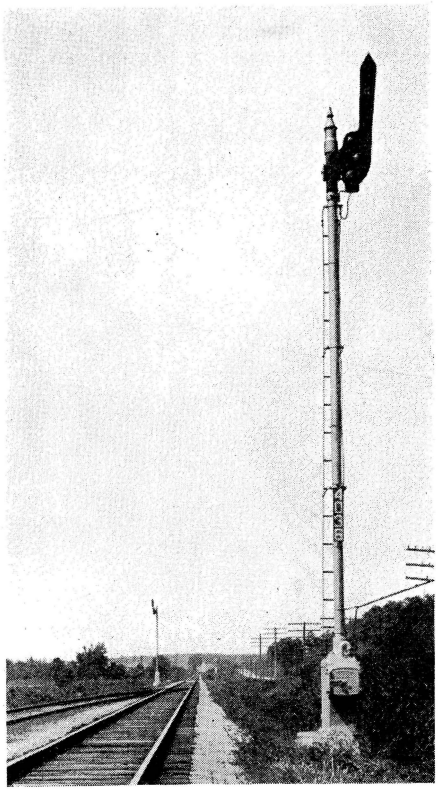
Electric Lights for Semaphores and Train Approach Indicators on the Rock Island



The primary batteries, for operation of signals and lamps, are housed in concrete wells

Approach control circuits control 3.5-volt, 0.3-amp. lamp fed from four-cell section of primary operating battery—Indicators controlled by signal line circuits

DURING the past 10 years, the Chicago, Rock Island & Pacific has replaced oil semaphore lamps with electric lamps on practically all of the 1500 miles of automatic block semaphore signaling on the railroad. The improved night aspect of the signals, and the reduction in maintenance and operating costs effected by the electric lamps, are some of the advantages as compared with oil lamps.

The type of construction of the electric lamps and control circuits as used on the Missouri division are typical, and the explanation following applies to this territory. The eastern sub-division of the Missouri division, extending from Davenport, Iowa, to Trenton, Mo., 230 miles, is practically all single-track. This territory was equipped with automatic block signaling in 1910, using three-position, upper-quadrant signals operated by Style-S mechanisms. The signals and relays are of the direct-current type operated by primary battery.

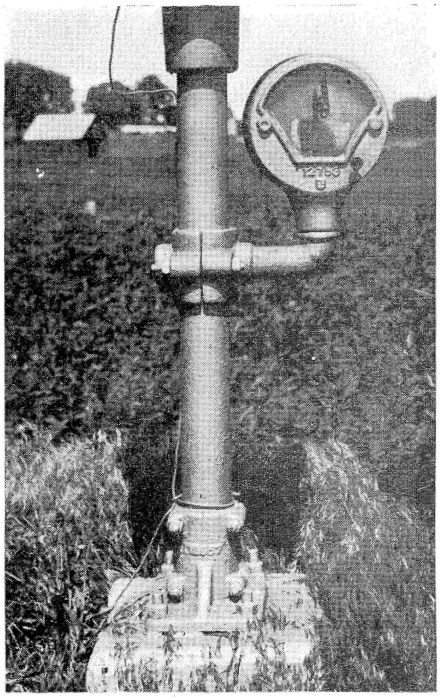
As originally installed, the 500-ohm, hold-clear coil was fed by the entire operating battery, consisting of 16 cells of 500-a.h. primary in series. Later, as a means of saving battery, the circuit was arranged through contacts on the controller of the mechanism, so that as the signal arrived at the clear position, the feed for the hold-clear coil was connected to only 8 cells of the total 16 cells. Shortly thereafter, 4 cells were added to the normally open set, making a total of 20 cells per signal. When this scheme was first tested, it was thought that there might be some loss in the efficiency of the battery because of these eight cells being exhausted earlier than the remaining cells. However, it was found by experience that these eight cells could be exhausted and then renewed without any noticeable effect in the operation or the life of the battery as a whole. Under this arrangement, of course, the current discharge through the eight cells was only about half what it was before, due to the reduced voltage, and furthermore, the remaining cells had no discharge, normally. Thus the life of the battery was materially increased. On the average, the 8 cells used to feed the hold-clear had an average life of 870 days, as compared with 380 days when the entire battery was used by the hold-clear as well as operation of the signal, and the 12 cells used only for clearing the signal had an average life of 1,200 days, as compared with 380 days when the entire battery was used for the hold-clear as well as operation of the signal.

During the change-over from oil lamps to electric lamps, various types of lamps and arrangements of battery supply were tested. The final conclusion was that a 3.5-volt, 0.3-amp, lamp was needed to give a satisfactory light. As it was not considered economical to feed such a lamp continuously from a primary battery, it was decided that approach control of the lamps was necessary so that the lamps would be illuminated only when a train was approaching, thus conserving the battery.

In view of the fact that the battery saving scheme for the hold-clear position of the slot coil, using eight cells only, had given no trouble in so far as the operation was concerned, it was decided that it would be entirely practicable to use four of the remaining cells of the operating battery to feed the electric semaphore lamp, using approach control.

Approach Control Circuits

The overlap system is used for the control of the automatic block signals. Therefore, at a double location the circuit of the feed for the lamp in signal A on one side of the track is made through a contact on signal B on the other side of the track made from 0 to 5 deg., signal B always being held in the stop position when a train is approaching signal A. For the leaving signal at a siding layout, the signal is lighted all of the time when the signal is in either the stop



This indicator provides information concerning the approach of trains

or caution position, the lamp being controlled through contacts on the mechanism closed from 0 to 50 deg. This special constant light affords information to train crews on the siding or to the operator, as to the approach of trains in the two blocks through which the control of the signal extends. Regular approach control is used for lighting the lamp when the semaphore is at clear.

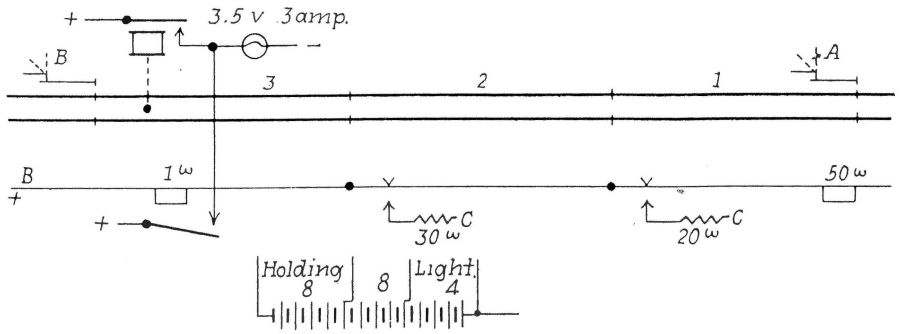


Fig. 1—Circuits for control of approach lighting

At a single signal location, such as signal B in the diagram, special arrangements had to be made to effect approach control of the electric lamp. At each signal there is a set of 6 cells of 500-a.h. primary battery, contingent on the length of the circuit, to feed the line control circuit of the signal in the rear, such as signal A, a 50-ohm d-c. polar line relay being used. Where line control was necessary for the approach lighting, a 1-ohm ANL relay, located at signal B, was connected in series with the line circuit for signal A. When the block from signal B to signal A is not occupied, the line relay at signal B is energized, drawing about 0.050 amp., which is not enough current to pick up the 1-ohm ANL relay. However, when either of the track circuits 1 or 2 in the block A to B are occupied, the ANL relay at B is de-energized, and as any of the track relays drop, a resistance unit is connected from a back contact of the relay through to common, the value varies due to the length of the line circuit. This results in a circuit from + battery at B through the ANL relay which draws enough current, about 0.110 amp., to energize the ANL relay. The circuit to feed the lamp on signal B is completed through a front contact of the ANL relay, thus lighting the lamp. For the third track circuit, the lamp is lighted directly through a back contact of the track relay of this track circuit.

The four cells of the operating battery, which is used also for the feed of the electric semaphore, has an average life of 750 days, whereas the eight cells, which are used only when the signal is being cleared, have an average life of 1,200 days. In other words, figuring the price of a 500-a.h. primary battery renewal as $1.17, the average annual cost of battery elements for lighting a lamp is $1.82.

The traffic on this division includes 8 passenger and 10 freight trains daily, totaling about 18 train movements daily. As this is a single-track line, the signals operate and the electric lamps are lighted for a train movement in each direction. Each signal operates an average of 1,000 times per month (0 deg. to 90 deg.).

Train Approach Indicators

At numerous places on the Missouri division, the track curves around hills and along streams in timbered territory. As a result, it is very difficult for signal maintainers, section foremen and others operating motor cars to see or hear approaching trains far enough to operate their cars safely. On the semaphore automatic block territory, the signals provide information as to approaching trains, but beyond the point where signals can be seen, the men are under a serious handicap to know whether a train is approaching.

Realizing the hazard and the delay in operating motor cars, the Rock Island started in 1925 to provide train-approach indicators at certain places along the line where bluffs, hills, or timber along curved sections of the line cut off the view of approaching trains. On the 230 miles of single track between Davenport and Trenton, a total of 55 of these curve-protection train-approach indicators have been installed, and 22 have been provided on the color-light signal territory between Trenton and Kansas City.

As shown in one of the illustrations, the train-approach indicator, as used on semaphore signal territory, consists of an ordinary switch indicator, mounted on the mast of a cable post so as to face the track, A man operating a motor car, who wishes to check up on approaching trains, stops at the location and pushes the button at the lower left of the face of the indicator case. If the indicator blade at once moves from zero to the clear position, no trains are approaching in the territory governed by the indicator, and information typed on a card just below the blade explains how far the indicator controls. If the blade does not move to the clear position when the button is pushed, this indicates that a train is coming and the motor car operator acts accordingly.

The circuits for the operation of an indicator are shown in Fig. 2. A connection from the line wire carrying the home signal control line circuit of the block in which the indicator is located extends to one contact of the push-button. A connection extends from the other push-button contact to the common line wire. Connections from the normally-open points of the contacts of the push-button extend to the coils of a 50-ohm polar relay. Ordinarily, a Type 9-C is used for the indicator control.

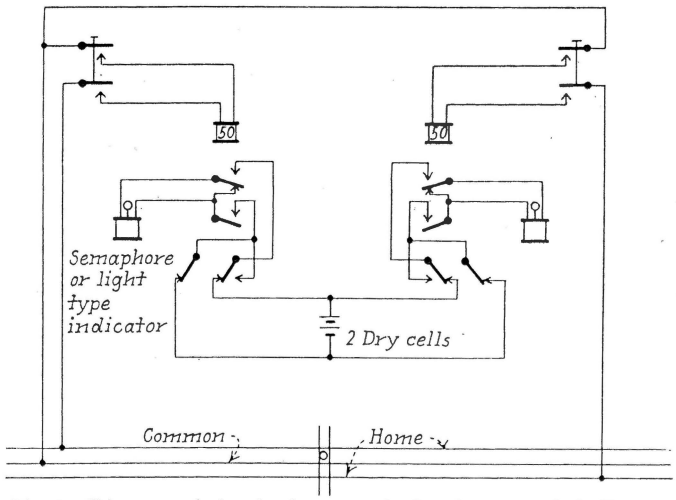


Fig. 2—Diagram of circuits for control of train-approach indicator

The signal line control circuits are polarized, and by following the indi-

cator control circuit in Fig. 1, it will be seen that the home signal line control must not only be energized, but it must be polarized to result in the 90-deg. position of the signal before the contacts in the indicator control

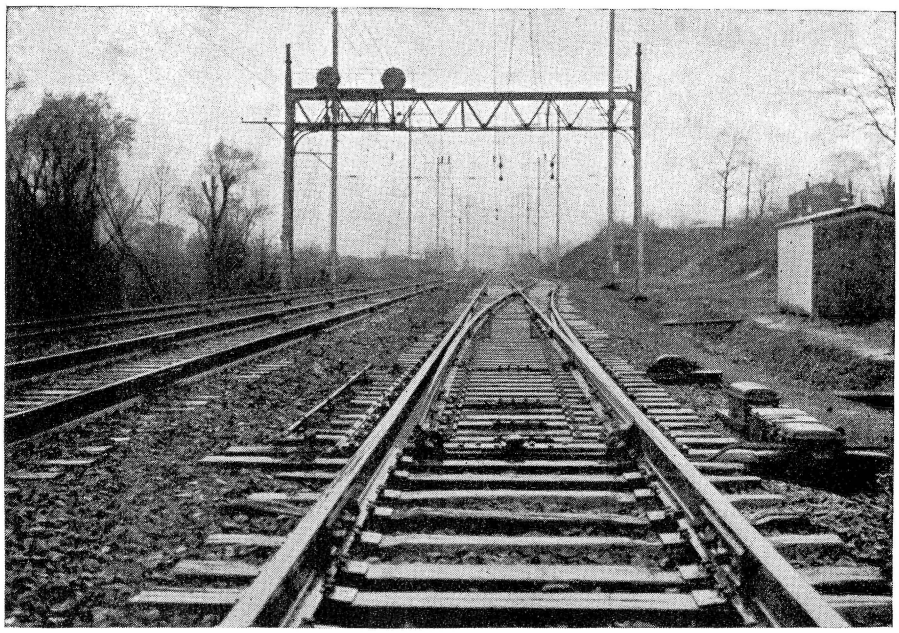
Lamp-type train-approach indicator on color-light signal territory

relay are closed so as to complete the circuit to clear the train-approach indicator. In other words, the signal for the block must be clear and the next signal in advance must be at 45 or 90 deg., thus indicating that the two blocks are not occupied by a train.

The use of a circuit for a normally-energized switch indicator was not practicable on account of the current required to feed it from primary battery. Likewise, it was found that it was not possible to pick up the indicator directly by a push-button because three extra cells had to be added to the line battery. Therefore, the problem was solved by using a normally de-energized 50-ohm relay, which could be energized from the existing line battery. A set of two dry cells was provided to pick up the indicator, such a set of battery usually giving a life of at least 18 months in this service.

On Light Signal Territory

On the color-light signal territory west of Trenton, the a-c. floating system of power supply is used so that a-c. power can be used as necessary to operate the train-approach indicators. For this territory, each train approach indicator consists of a 10-watt, 110-volt electric lamp in a metal body with a 3-in. clear glass lens. The lens is directed straight across the track so that the light can be seen readily from a passing motor car, but cannot be seen by the enginemen of approaching trains. The lamp is controlled through the contacts of a Type 9-C d-c. relay, which is connected in series with the signal line control circuit. A total of 22 of this type of train-approach indicators are in service on the color-light signal territory west of Trenton.



Remote control location on the Pennsylvania near Baltimore, Md.

Instructions for Crossing Protection in New York

THE railroads operating in the state of New York have co-operated in an attempt to reduce unnecessary traffic delays at railroad-highway grade crossings, where highway traffic is very dense, by the issuance of special instructions to train crews. These rules apply only in the state of New York.

The instructions issued by the New York Central read as follows:

"When switching, or when a train or cars are left standing on the approach track circuit of a highway flashing-light signal, causing the continuous operation of the signal, a member of the crew must, when practicable, be stationed at the crossing to facilitate highway traffic, advising such traffic when it is safe to cross."

The Lackawanna has the following rule:

"When crossing watchman is not on duty and trains stop on a main track within the above described approach sections, without blocking the crossing, or when cars are being switched over the crossing, a member of the train crew, equipped with proper signaling appliances, shall proceed immediately to the crossing for the purpose of expediting the movement of vehicles and pedestrians over the crossing."

The Ontario & Western rule reads:

"At crossings where automatic crossing warning signals are maintained and no watchman is on duty; when a train stops or is switching, or cars are left standing on the crossing signal circuit, causing the crossing signals to operate unnecessarily when actual train movement over the crossing is not involved, a member of train crew or watchman should be stationed at the crossing to direct and avoid delay to highway traffic."

The Reading has the following rule:

"Should a train or cars remain on the bonded section of track causing continuous indication of visual train-approaching signals; where practicable, a trainman or watchman must be stationed on the crossings and arrange for pedestrians or vehicles to pass over the crossing."

The use of rules such as these should eliminate a lot of the criticism emanating from the general public regarding grade crossing protection, which results in extended delay to highway traffic.