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

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 of 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...
or caution position, the lamp being
controlled through contacts on the
mechanism closed from 0 to 50 deg.
This special constant light affords in-
formation 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 ex-
tends. Regular approach control is
used for lighting the lamp when the
semaphore is at clear.

At a single signal location, such as
signal B in the diagram, special ar-
rangements 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 neces-
sary 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 oc-
cupied, 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 com-
pleted 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 con-
tact of the track relay of this track
circuit.

The four cells of the operating bat-
tery, which is used also for the feed
of the electric semaphore, has an av-
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 ele-
ments for lighting a lamp is $1.82.

The traffic on this division includes
8 passenger and 10 freight trains
daily, totaling about 18 train move-
ments daily. As this is a single-track
line, the signals operate and the elec-
tric 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 Mis-
soir division, the track curves around
hills and along streams in timbered
territory. As a result, it is very diffi-
cult for signal maintainers, section
foremen and others operating motor
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 ap-
proaching trains. On the 230 miles
of single track between Davenport
and Trenton, a total of 55 of these
curve-protection train-approach indi-
cators 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, con-
stituts of an ordinary switch indicator,
mounted on the mast of a cable post
so as to face the track, A man operat-
ing 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 ter-
ritory governed by the indicator, and
information typed on a card just be-
low 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 car-
ying the home signal control line
circuit of the block in which the indi-
cator is located extends to one contact
of the push-button. A connection ex-
tends 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.

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

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.

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.