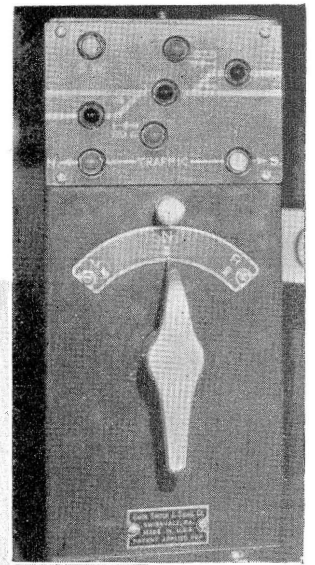
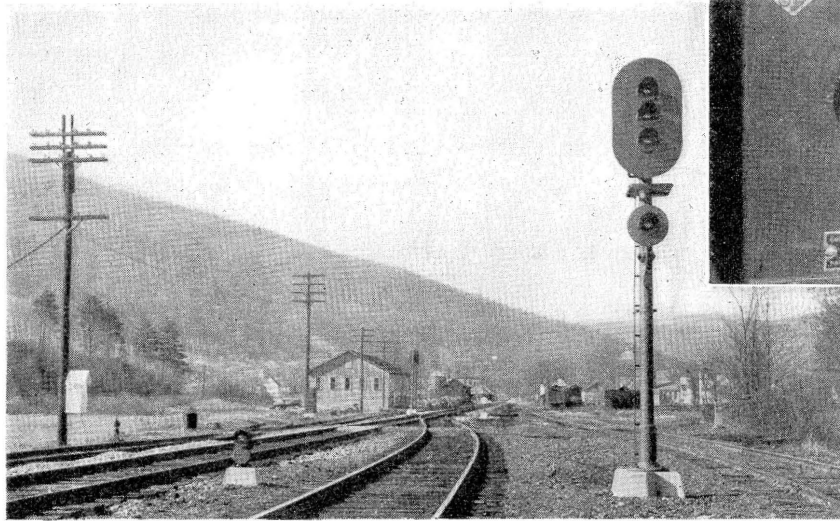


Below—View looking west at end of double track at East Branch showing signals 149.9. Right—Machine at Summitville, with one lever and illuminated track diagram, controls two power switches and two signals at the two ends of double track at Bloomingburg tunnel



C. T. C. on the New York, Ontario & Western

Installation on 8.6 miles of single track between ends of double track uses direct wire system with only four line wires. This and two other similar projects involve single track through tunnels

THE main line of the N. Y. O. & W. between Cornwall, N. Y., and Cadosia is double track, and protected by d-c. semaphore automatic block signaling, except for three short sections of single track through the Bloomingburg, the Fallsburgh and the Hawk's Mt. tunnels, which are located 35 miles, 55 miles, and 107 miles, respectively, north of Cornwall. At Bloomingburg a mechanical interlocking had

been in service at each end of the tunnel to handle the end-of-double track switches, derails, signals, etc., while at the Fallsburgh and Hawk's Mt. tunnels electro-pneumatic interlockings at the north portals controlled the switches, derails and signals at the two ends of each tunnel. These interlockings had been in service for many years, and were in need of extensive overhauling. Therefore, a decision was made to eliminate these interlockings and install remotely-controlled equipment including modern color-light signals, with either power-switch machines or spring mechanisms to operate the switches, the derails being eliminated.

During recent years heavier power permitted the operation of fewer trains. For this reason considerable study has been given to the subject of removing long sections of second

track and leaving short sections of double track which would be the equivalent of long passing sidings; power switches and signals for directing train movements by signal indication being proposed. As a part of the project of replacing the interlockings at the ends of the tunnels by remote control equipment, it was decided that a trial project of the removal of second track should be made. For this reason, second track was removed on eight miles of line between the south end of Hawk's Mt. tunnel and East Branch, the new end of double track being located at East Branch, and the new section of single track extends from that point northward through the tunnel to the south end of Cadosia yard. (See Fig. 1.) East Branch was chosen as the new end of double track because this is the logical location of the north end of a

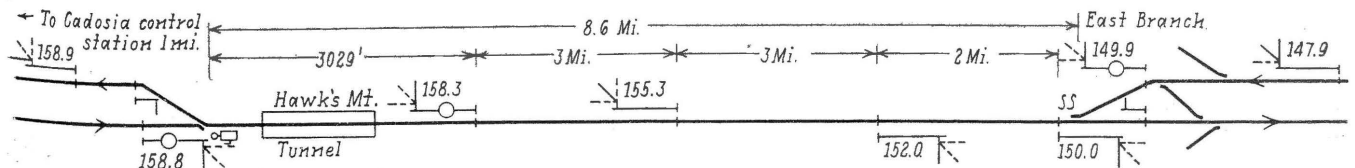
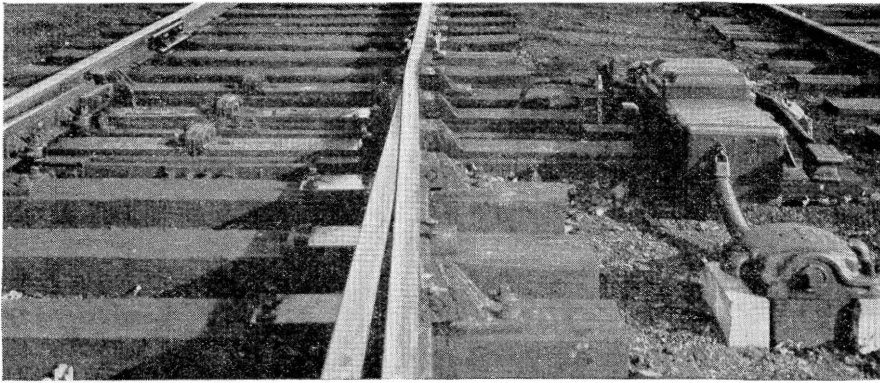


Fig. 1—Track and signal plan of the installation through Hawk's Mt. tunnel



Power switch layout—Note insulated gage plates and adjustable rail braces

double-track section in any proposed extension of a program of removing second track. As may be noted in the track diagram, the house track switches at East Branch diverge from one or the other of the two tracks of the double track, and a crossover is located between the two tracks of the double track, these arrangements being made so that the local freight train can switch the house and industry track section.

The switch at the north end of the tunnel is on ascending grade for southbound trains going from the double track to the single track. Occasions may arise in which trains may be required to stop on the switch and then take up slack before starting. In such circumstances the points of a spring switch might close between the trucks, thus resulting in a derailment when backing. A power switch was, therefore, installed at this location as well as at the four switches on the other two projects mentioned later. At East Branch a spring switch was used at the north end of double track because the tracks are practically level through this location.

Referring to Fig. 1, the southward signal 158.8 and northward signal 149.9 at the respective ends of single track, and signal 158.3 at the south end of the tunnel, direct train movements by signal indication, thus superseding train orders. These signals as well as the power switch machine at the north end of single track are controlled from the office at Cadosia, one mile north of the north end of the tunnel.

Either signal 149.9 or 158.8 when displaying a yellow or a green aspect authorizes a train to enter the single track and proceed to the right-hand track at the other end of the single track. Signal 158.3 can be controlled to display the Stop aspect when necessary to hold a train until it can be accepted in the Cadosia yard. In such cases a train is held south of the tunnel rather than stopping it in the tunnel. The signals 152.0, 155.3 and 158.3 provide automatic block signal protection so that following trains can

use the single-track section. On the average a freight train will clear the single-track section in about 17 min.

The length of single track between the ends-of-double track at the Bloomingburg tunnel is 8,325 ft., and at the Fallsburgh tunnel, 3,000 ft.; therefore, no intermediate automatic block signals are required. The field equipment at the Bloomingburg tunnel is controlled by a lever in the office at Summitville, four miles north of the tunnel, and another lever in the same office controls the field equipment at the Fallsburgh tunnel which is 14 miles north of Summitville. The equipment and control arrangement for the three projects is similar and explanation will be confined to the Bloomingburg installation.

Switch Operation

The electric switch machines are the Union Dual-Control Model M22 for operation on 20 volts d-c., and are equipped with lock rods and facing-point detectors. As shown in one of the illustrations, each switch layout includes three 1 in. by 7 in. insulated gage plates, two of which extend and are attached to the switch machine, thus eliminating lost motion. Adjustable rail braces are used on six ties including the ones with gage plates, and adjustable braces are used on both the field and gage side of the rails on the tie in approach to the switch points, thus preventing "rolling" of the stock rails.

The switch at East Branch is equipped with a U. S. & S. Co. spring switch mechanism and oil buffer, together with a Model S1 switch-and-lock mechanism including a mechanically-operated facing-point lock. As a warning to engine and train crews that trains trailing through this switch should not be backed, the location is marked by a sign showing the letters "SS" which is mounted on a short mast at the east side of the track opposite the switch.

Referring to the track plan of the Bloomingburg project in Fig. 2 for example, new Style-R2 color-light sig-

nals were installed as the home signals 7 and 8 and for corresponding approach signals 5 and 10, as well as for the new "plant departure" automatic block signals 6 and 9. Actually the signals are numbered on the mile post basis as 87.9, etc., but in order to eliminate confusion of the circuit diagrams, the single digit numbers are used in this explanation. On the sections of double track, right-hand running is in effect except for rare instances in case of major accidents. For this reason operative home signals for reverse running were not considered necessary. Therefore, the two dwarf home signals are inoperative and each consists of a color-light N2 dwarf with one indication unit permanently covered by a metal disk, and the upper unit displays a purple light permanently as a Stop aspect. Furthermore, on account of the fact that reverse running need not be provided for, no home signals immediately in approach to the facing points of the switches were needed.

A summary shows that for a northward route from the right-hand track to the single track and to the right-hand track, calls for both switches to be in the normal position and for home signal 7 to be cleared; whereas for a southward route from the right-hand track over the single track to the right-hand track, calls for both switches in the reverse position and for home signal 8 to be cleared.

In each of these three projects, one signal at each end of the two ends of single track as well as the two switch machines are all controlled by one Model B10 three-position non-interlocked desk lever. The controls as well as indications are all handled over line circuits requiring only four line wires between the office and the instrument cases. In the Hawk's Mt. tunnel project the one lever also controls northward positive signal 158.3 at the south end of the tunnel. On this installation all single track automatics are directionally controlled in such a manner that signals in a given direction can clear when opposing automatics are at Stop. All automatic signals are approach lighted. Home signals are permanently lighted on a-c. current, but approach lighted by stand-by d-c. current when power is off.

Bloomingburg Tunnel Project

In the Bloomingburg tunnel installation the desk-lever controller is located in the office at Summitville which is four miles north of the north switch at the tunnel. (See Fig. 2.) When the lever is in the center position the signals display the Stop aspect, and the switches remain in the position to which they were last

moved. When the lever is thrown to the left position, the switches are placed in the normal position and northward home signal 7 is cleared, providing the single-track section is unoccupied. When the lever is thrown to the right, the switches are both moved to the reverse position and southward home signal 8 is cleared. Should the operator elect to "try" a route but keep the signals at Stop, such route change may be made by moving the lever to the new position and then, upon switch disagreement indication, place the lever on center. Doing so merely holds the respective signal at Stop, but does not stop switch movement. The illuminated track diagram on the face of the panel above the lever has lamps which indicate: (1) the direction in which traffic between the home signals is established, (2) occupancy of each approach section to the two home signals and on the track within the home signal limits, (3) the Proceed aspect of each of the two home signals, and (4) a switch-posi-

tion common FC. (See Fig. 2.) When the lever is on center the line circuit is de-energized, when thrown to the R position B is fed on wire F, and N is fed on wire FC. Operation of the lever to the L position reverses the polarity to the line circuit. At the field location at the north switch, the line control circuit operates a 500-ohm DP14 polar relay; the position of both switches and the clearing of one or the other of the two home signals 7 or 8, depends on the closing of front neutral contacts and the position of the polar contacts in this relay. Relay TESR is the time-element stick relay in the detector and approach locking circuit; 8WPR and 7WPR are the DP17 polar switch repeater relays of the respective switches. The DP17 relay checks the position of the polar contacts with the polarity of the current being supplied to the relay before the neutral armature of the relay can pick up.

Relay 8TR and its repeater 8TPR are controlled by the track circuit 8

7WPR to check that switch 7 is in proper position, then through the common section of the circuit H and NH, then a N7H6 and 7H6 check through the 8RGP to be sure that signal 8 is indicating Stop, then through the track relay for the track section controlling "plant-departure" automatic signal 9, where the polarity is established to determine whether signal 7 displays the Clear or the Approach aspect. The controls for signal relay 8HR are a counter part of those for 7HR, the section H and NH being common to both. In the Hawk's Mt. tunnel installation, if the operator wants to hold a northward train at the south end of the tunnel, the signal 158.3 is controlled to display the Stop aspect by placing the lever on center after the train has entered the single-track section at East Branch as is indicated by the track occupancy lamp. Signal 158.3 can be again cleared by throwing the lever.

Two other polar contacts in the lever-controlled relay FR control both

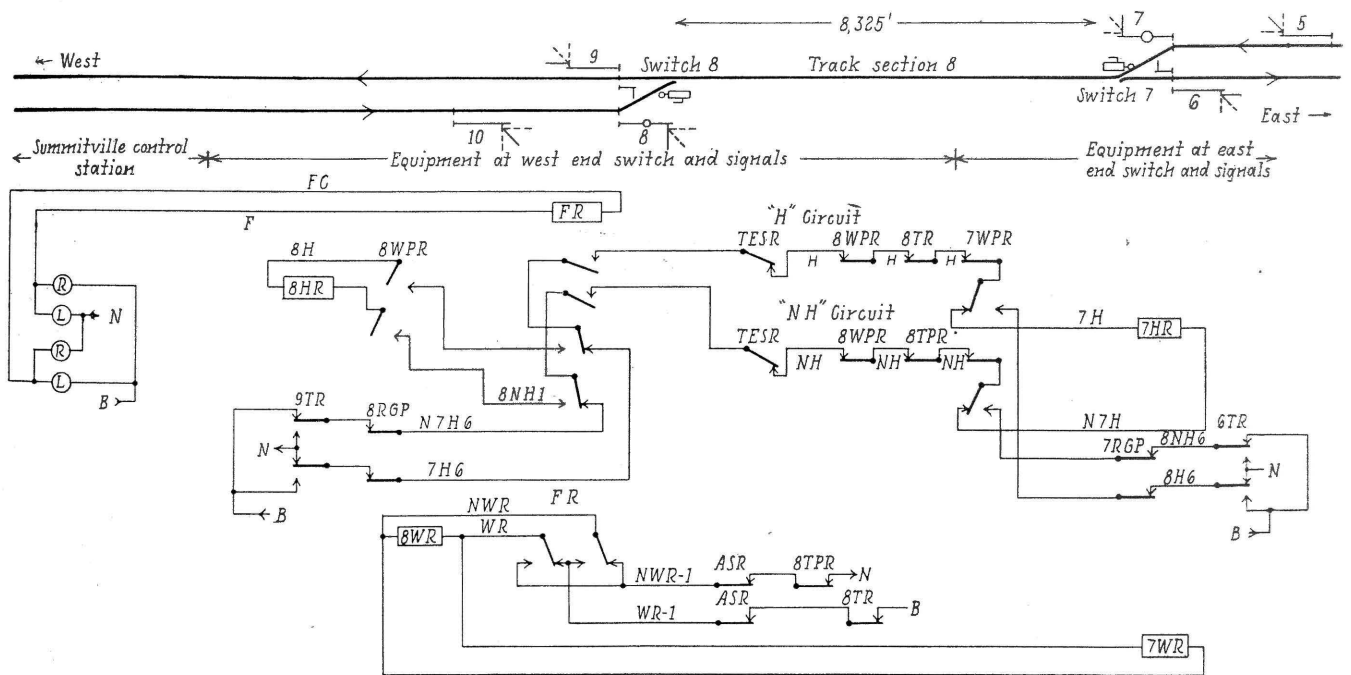


Fig. 2—Field circuits for control of two power switches and two signals from one lever

tion indication lamp to indicate that the position of the two switches is in accordance with the lever position.

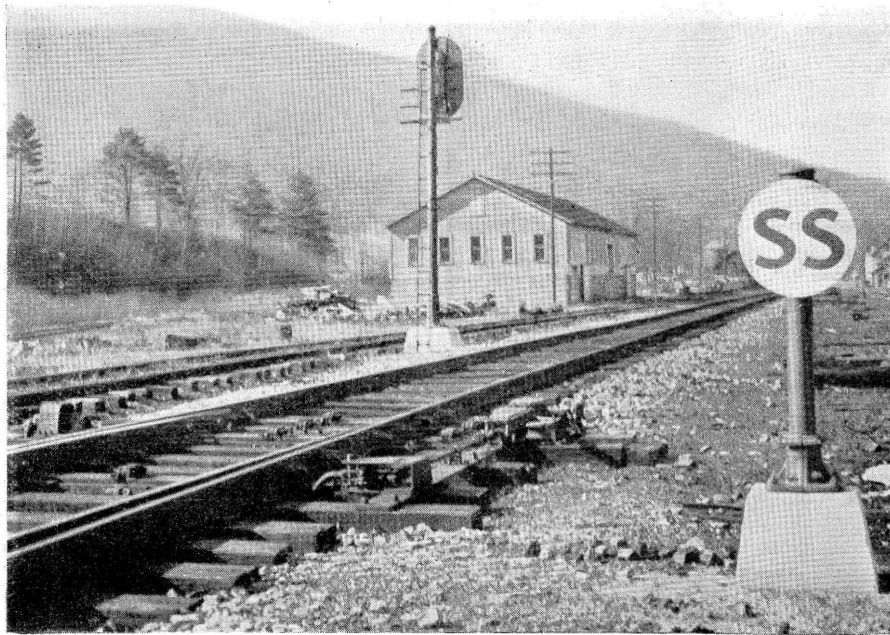
All of these controls and indications are handled over four line wires between the office at Summitville and the field location at the north switch.

Two Switches and Two Signals Controlled Over One Wire and Common

The two switches and the two home signals, 7 and 8, are controlled over one line circuit F in connection with

which includes the home signal limits. Relays 7HR and 8HR are of the retained neutral DP20 type and are the signal control relays of the respective signals. The H and NH sections of the signal controls are double-wire, double-break circuits including contacts in the FR, TESR, 8WPR, 8TR, 8TPR, and 7WPR which are common to the controls of both 7HR and 8HR. When the lever is thrown to the left to energize relay FR, closing the neutral contacts and positioning the polar contacts to that shown, the circuit 7H and N7H checks through contacts in

switches as shown in the lower portion of Fig. 2. The two switch control relays 7WR and 8WR are 1,000-ohm DP14 d-c. polar relays with contacts for handling high current. These relays are connected in parallel to two wires WR and NWR, the polarity of the feed to these wires being determined by the position of the polar contacts of relay FR. The feed to the points of the relay is checked on wires NWR1 and WR-1 through contacts in the approach stick lock relay ASR and the track relays 8TR and 8TPR for the section within the home



Spring switch layout at East Branch showing the "SS" spring switch marker

signal limits. The control for the ASR relay is of the conventional time locking type.

Two Track-Occupancy Indications Over One Wire and Common

One line wire AK brings in the energy in connection with the line common FC to control two relays including contacts in circuits to light

approach repeater 7AR is released, closing a contact which feeds WB battery through a back contact of 7AR, a back contact of 8AZR to line wire AK. At the control station this WB battery feeds through one leg of a snubbing and valve rectifier to energize relay 7AKR, through front contact of which circuits are completed to feed the lamp 7A in the track chart representing the approach section

is fed to line wire AK. The polarity of WN being reverse to that of WB previously mentioned, WN at the control station feeds through the other leg of the rectifier to energize relay 8AKR which in turn completes a circuit to feed track occupancy lamp 8A and also to ring the annunciator bell.

In case both approach sections 7AT and 8AT are occupied, the circuit for the coil of 7AZPR is closed when 8AZR picks up. When 7AZPR picks up, thus opening a back contact, the circuit for the coil of relay 8AZR is opened and it is released, which in turn causes 7AZPR to release, etc. Thus as long as both approach sections are occupied, the two relays in turn pick up and release continuously, the releasing being made slow-acting by snubbing rectifiers connected across the coils. Each relay operates about 15 times per minute. As long

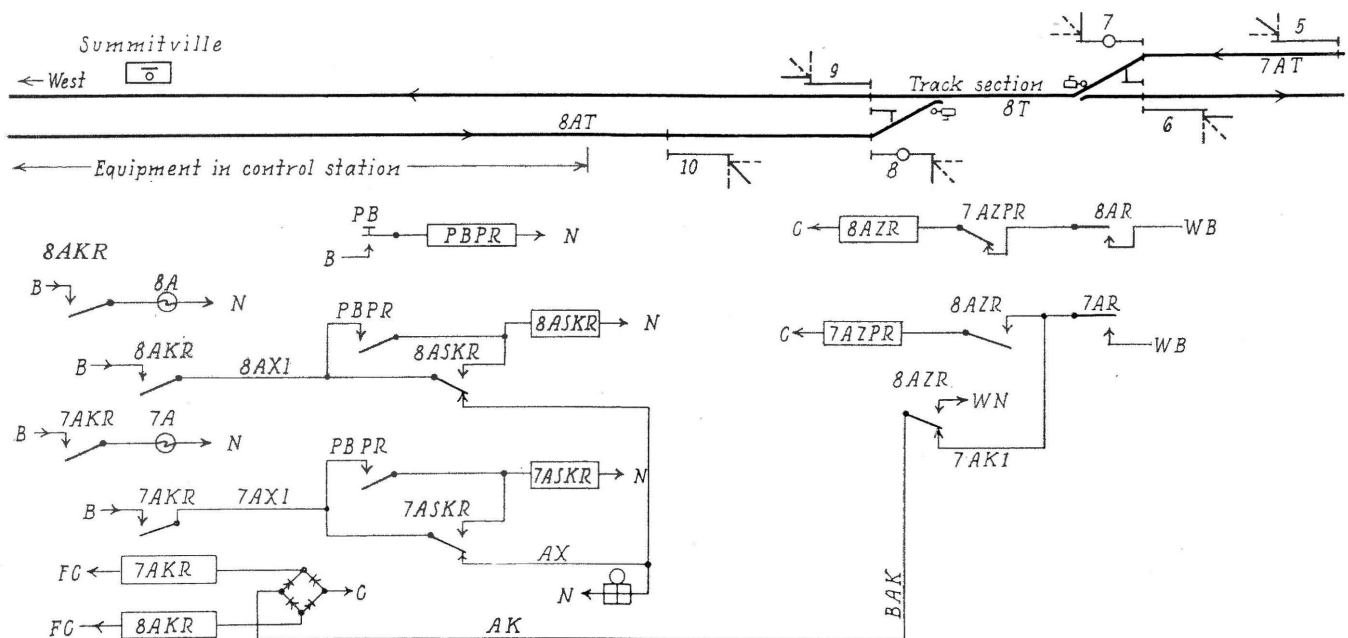


Fig. 3—Indication circuits for track occupancy of two approach sections

the two track occupancy lamps for the two approach sections 7AT and 8AT. (See Fig. 3.) The apparatus at the field station to accomplish this result includes two sets each including two 280-ohm Model L10 relays, connected as shown in Fig. 3. When approach track section 7AT is occupied the ap-

proach section 7AT and to feed the annunciator bell. If the approach section 7AT is unoccupied and approach section 8AT becomes occupied, relay 8AR is released to feed WB battery through a back contact of relay 7AZPR to energize relay 8AZR. Through a front contact of 8AZR, WN battery

as the relays are in this cycle operation, alternate pulses of WB and WN battery are being sent out on the line and, at the control station, both of the slow-release indication relays 7AKR and 8AKR remain picked up. The annunciator circuits 7AX1 and 8AX1 are fed through front contacts of these

respective relays and through back contacts of two respective stick relays ASKR to the bell. If the operator wants to stop the bell, he pushes button PB which picks up relay PBPR which energizes the respective stick relay, thus cutting out the bell. The stick operation at which time the respective AKR releases, thus automatically restoring the bell circuit for the next operation at which time the respective light becomes extinguished. The silencing of the bell for one approach

when track circuit 8T is occupied. All six indications are brought into the control station over one line wire in connection with common. Referring to Fig. 4, relays TPZR and TPZPR have the circuits for their respective coils connected through contacts of the opposite relay so that, when both are being fed, they alternately drop-away and pick up, the operation being set in motion when relay 8TPR, the repeater for the track circuit within home signals, is re-

HKR (then closed) to wire GE1, through a lever contact closed in the R position, to feed the indication lamp for signal 8. A tap off feeds one coil of a two-coil relay FKR, causing the polar contact to be positioned accordingly. Relay HKPSR is a stick relay which is picked up through a front contact of relay HKR, but sticks up through its own front contact by a circuit fed through a back contact of WKR so that it will stick up until a change is made in a line up.

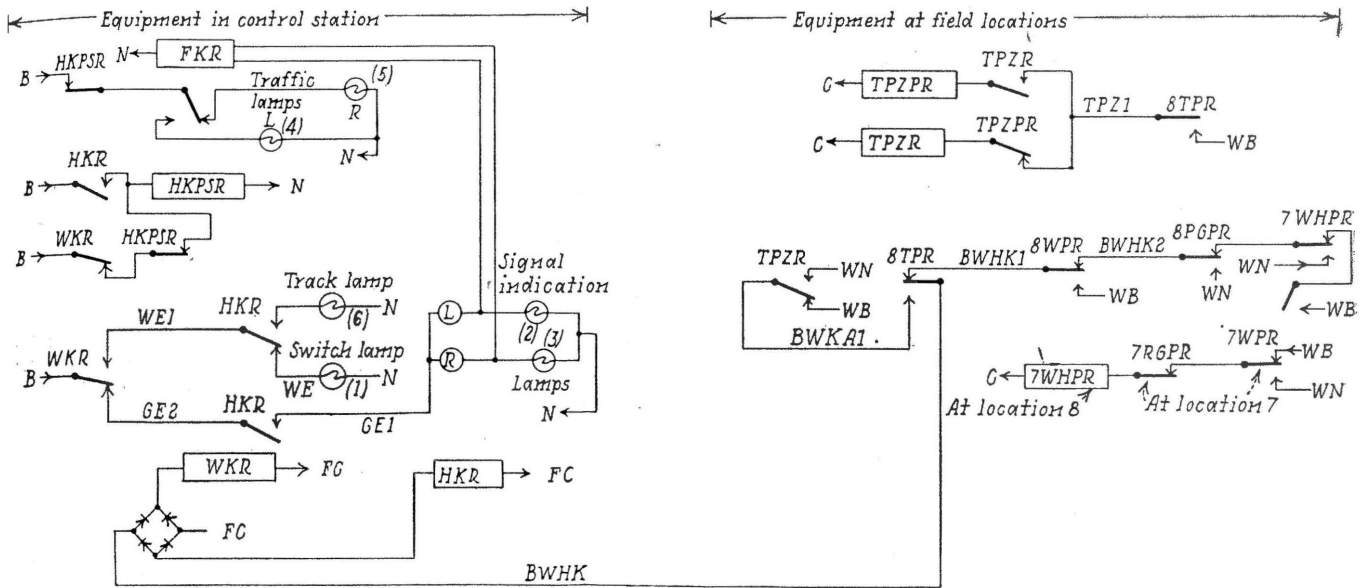


Fig. 4—Indication circuits for two switches, two signals, two traffic-direction lamps and one track occupancy

does not effect bell operation for the other approach. Indication lights are of various colors for the purpose of ready identification when seen at a distance from the controller.

Six Indications Over One Wire and Common

The switch indication lamp (1) on the track diagram is normally extinguished, but when the lever is thrown, the lamp is illuminated until the switches are operated to and are locked up in the position corresponding to that of the lever. The signal indication lamps (2) and (3) are lighted when the signal control relay for the respective signal is energized to cause the signal to display either the green or the yellow aspect. One (4) or the other (5) of the traffic-direction indicator lamps is lighted to indicate that traffic is established and the signal control relay for the signal in the corresponding direction is energized. This light continues until the traffic is changed, and is extinguished only by a change in traffic direction and appears then only when the signal clears. The track indication (6), repeats the track occupancy of the section within home signals

leased. In this circuit, the line wire from the control office BWHK connects to BWHKI through a front contact of 8TPR, thus checking that the track circuit is unoccupied, then to a finger of a contact on switch repeater relay 8WPR. If switch 8 is not to final position and locked, either normal or reverse, 8WPR would be released and wire BWHKI would get WB battery on the back contact. At the office, BW coming in to the rectifier would pick up relay WKR, thus feeding battery B over a front contact of this relay and a back contact of relay HKR to light the switch indication lamp. On the other hand, if switch-repeater relay 8WPR is energized, wire BWHKI extends to wire BWHK2 and to a finger of a contact in relay 8RGPR which is energized when the signal control relay for signal 8 and approach signal 10 are deenergized. If the signal control relays for signals 8 and 10 are picked up, then relay 8RGPR is released and wire BWHKI is connected through a back contact to battery WN, which at the control station feeds through the rectifier to pick up relay HKR. Battery B feeds through a back contact of WKR to wire GE2 through a front contact of

Battery B is fed through a front contact of HKPSR to the finger of the polar contact in FKR so that one or the other of the traffic-direction lights is illuminated, and stays lighted until the lever is operated away to the L position. A movement of the lever to the N position will not extinguish the traffic light.

Referring back to the circuits at the field location, relay 7WHPR is a polar relay which is controlled through a front contact of the 7RGPR which is up when a front neutral contact of the switch repeater relay 7WPR is closed. This normal circuit leaves circuit BWHK open at the polar contact of relay 7WHPR. If switch-repeater relay 7WPR is deenergized, the polarity of the feed to relay 7WHPR is reversed, thus closing the polar contact to feed WB battery to the line wire BWHK, which causes the switch indicator lamp on the track diagram to be lighted as explained previously. When the No. 7 signal relay is picked up, 7RGPR is released, relay 7WHPR is de-energized, thus, through a back contact feeding WN battery to line wire BWHK, which, as explained previously, picks up relay HKR, but in

(Continued on page 102)

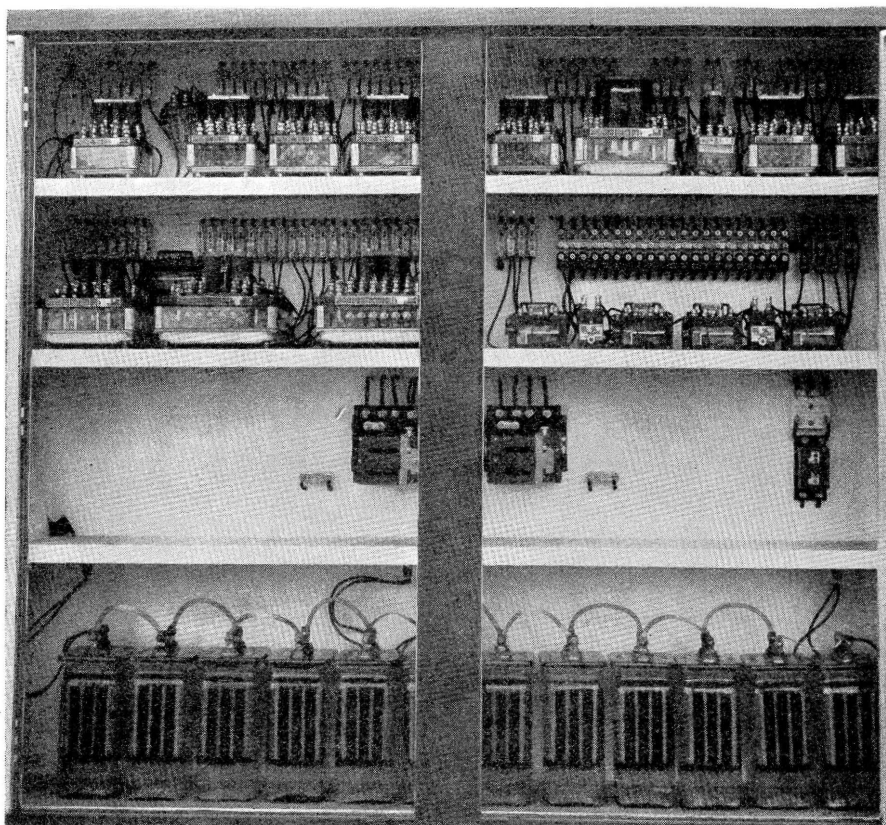
C. T. C. on the N. Y. O. & W.

(Continued from page 89)

this case the lever is in the position which causes the indication lamp for signal 7 to be lighted and picks up stick relay HKPSR, polar relay FKR and feeds the opposite traffic direction lamp, according to circuits explained previously, when discussing the indications of signal 8.

When the track section within home signal limits, 8T, is occupied, relay 8TPR is released, and, through a back contact, battery is fed to relays TPZR and TPZPR to cause them to pick up and drop-away alternately.

HKPSR was re-established. Therefore, the traffic-direction lamp, then in effect, is not extinguished, nor is it extinguished when the relays are again released, because the stick circuit is again established. A movement of the lever from either the R or the L position is required to release relay HKPSR to change the traffic-direction indications. Once traffic direction is established, the signals operate non-stick, i.e., they clear automatically for following trains depending on track occupancy, and



Interior of instrument case at field location showing L-10 type relays in second shelf from top at right

As 8TPR is released, closing another back contact, line wire BWHK is connected to BWKAI which is alternately fed WN and WB battery, which, at the control station, causes relays WKR and HKR to be picked up. Battery B is fed through front contacts of WKR and HKR in series to light the track-occupancy lamp for the section within home signal limits. The signal indication lamps cannot be lighted, because the feed to wire GE2 is broken by the back contact of relay WKR. When relay WKR is picked up, the stick feed to relay HKPSR was open, but due to the slow-acting characteristic of this relay, it does not drop because, when relay HKPR picked up, the normal feed to

the leverman does not have to move the lever to clear the signals for a following train.

Construction Features

The line control circuits are on No. 9 hard-drawn copper wire with weatherproof insulation. The insulated wires for case wiring, runs between signals, track connections and cables between line poles and cases is of Kerite manufacture. The storage batteries at the control station, at the new signals and for switch operation are the Exide Types KXHS-7 and DMGO. The plans for these installations were prepared by the Union Switch & Signal Company which also

furnished the major items of signaling equipment, such as control machines, signals, relays, rectifiers, switch machines and spring switch equipment. The field construction was handled by signal forces of the N. Y. O. & W. under the direction of H. H. Shannon, signal supervisor, and Charles Tracey, general signal inspector.

Bureau of Safety Report

(Continued from page 95)

stallations were filed, a total of 1,176 applications having been filed since this provision of the law became effective. Of these applications, 809 were acted upon during the year, 807 being approved and 2 disapproved, and 5 were canceled or action thereon postponed upon request of applicants. At the close of the year 77 applications were pending.

Monthly signal failure reports filed by the carriers during the period from July, 1938, to June, 1939, inclusive, are summarized as follows:

False restrictive failures.....	38,123
False proceed failures.....	262
Potential false proceed conditions.....	53

During the calendar year 1938, 75 passengers on trains and travelers not on trains were killed, as compared with 27 killed during the preceding year. Of these 75 fatalities, 9 resulted from collisions and 43 from derailment of trains; 17 passengers on trains and 6 travelers not on trains were killed when getting on or off cars, being struck or run over, or due to other miscellaneous causes. A total of 355 employees on duty were killed in train and train-service accidents, as compared with 516 during the preceding year. During the first 6 months of 1939, 6 passengers, 3 travelers not on trains, and 237 employees on duty were killed in railroad accidents.

Accidents were investigated by the Bureau of Safety as follows: Collisions, 42; derailments, 44; miscellaneous, 1. Of the collisions investigated, 24 occurred on lines operated by the block system, 15 occurred on lines operated by the time-table and train-order system, and 3 occurred in locations where yard and miscellaneous operating rules were in effect. Of the 44 derailments investigated, 20 involved track, 6 involved condition of switches, 7 involved defective equipment, 7 involved operating conditions or practices, and 4 involved motor vehicles at railroad and highway grade crossings.

During the calendar year 1938, there were 3,494 accidents at highway grade crossings, which resulted in the death of 1,517 persons and the injury of 4,018 persons. Automobiles were involved in 3,070 of these accidents, 1,307 persons being killed and 3,783 injured. There were 38 derailments of trains as a result of collisions between trains and automobiles, which caused the death of 43 persons and the injury of 98. Of the total casualties resulting from derailments and other train accidents at highway grade crossings, 10 persons killed and 63 persons injured were railroad passengers, employees, and persons carried under contract.