Railway Signaling

Yard Entrance in Montreal *Remotely Controlled*

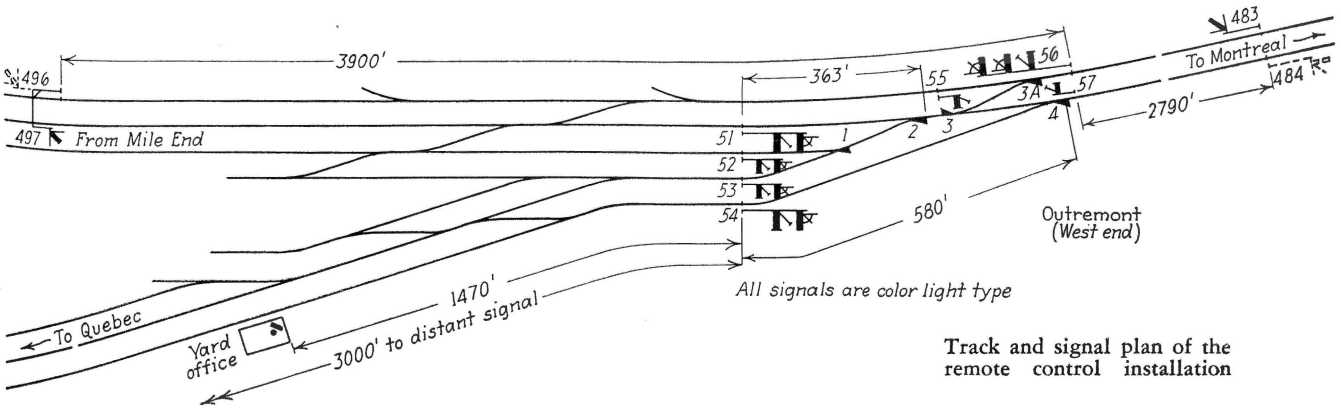
View looking toward Montreal showing signals 51, 52, 53 and 54

THE Canadian Pacific has installed power switch machines and signals at the connection between the main line and the yard at the west end of the Outremont yards in Montreal, Que., the layout being controlled by a C.T.C. type machine located on the operator's desk in the yard office 1,800 ft. distant.

The track layout at the west end of Outremont involves a junction of a double-track freight line from Mile End with the double-track through line between Quebec and Montreal, as well as the switches leading to the west end of Outremont yard. The junction and yard entrance switches were previously handled by three switchmen, one man being on duty each trick. In order to reduce these operating expenses it was decided to control the four switches by the operators in the yard office. The annual operating expense was $4,782 including wages for switchmen, coal, supplies and oil for the switch lamps. The remote control interlocking arrangement cost $21,700 with an annual charge of $300 for maintenance and operation, the annual saving in operating expense being $4,482 which is equivalent to about 20 per cent on the expenditure for the new signaling installation.

Traffic and Train Movements

Outremont is the most important freight yard of the Canadian Pacific in the vicinity of Montreal. Through freight trains of several divisions originate or terminate in this yard; likewise, there are numerous transfer movements to and from this yard daily in order to assemble or distribute cars to other yards or industries. The movement of these freight trains and transfer cuts in and out of the west end of this yard occasions considerable traffic. In addition, about one half of the passenger trains on the main line between Montreal and Quebec are now routed over this junction to the Windsor street station, representing six such movements daily. With the prospect of the addition of several trains that now run to the Place Viger station, it became necessary to provide a more efficient and safer arrangement for the opera-



Track and signal plan of the remote control installation

tion of the switches at the west end of Outremont yard.

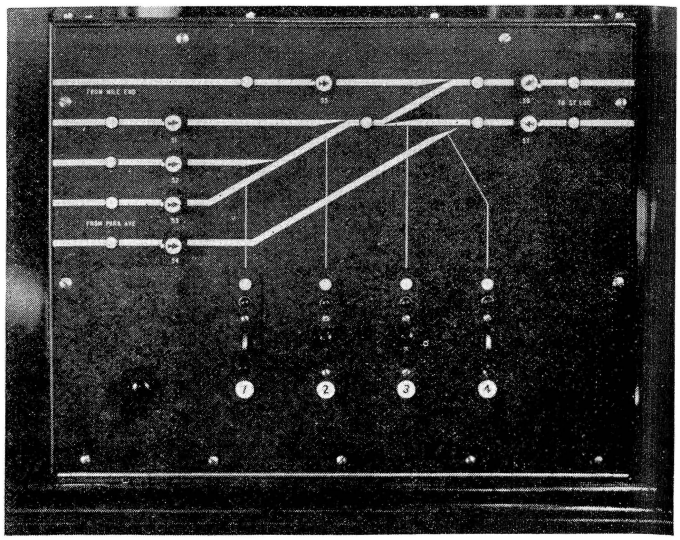
An investigation of the train movements showed that the main line routes, as well as practically all of the moves into and out of the west end yard, could be handled by installing power-switch machines for the facing-point crossover and three single switches, as indicated on the track diagram shown herewith.

Train movements on the normal right-hand running track to be routed into the yard or through onto the eastbound main track are governed by a three "arm" home signal, No. 56. The top "arm" operating to three aspects, governs over the through route to Montreal Wharf and Place Viger station; the second "arm" operating to three aspects, governs to Park Avenue station and to Quebec, while the bottom "arm" operates to two aspects to govern movements into the yard tracks and as a "call on" for main routes. Eastbound reverse movements on the normally westbound track are governed by a two-aspect dwarf signal, No. 57.

Westbound train movements on the track from the Park Avenue station are governed by a two-arm signal, No. 54, the top arm operating to three aspects. The lower "arm" of signal 54 is used for the "call on" aspect.

Westbound train movements on the right-hand track of the main track from Mile End are governed by the two-arm high signal No. 51, the aspects corresponding with those of signal No. 54.

In order to expedite the movement of westbound trains out of the yard tracks, two-arm dwarf signals, No. 52 and No. 53 were provided on these tracks, the top arm of each signal operating to three aspects, giving an engineman information to the effect that the block beyond automatic signal 484 is unoccupied so that he can proceed at maximum authorized speed, thereby getting his train clear of the switches and junction more quickly than would otherwise be possible. The lower arm of signals 52 and 53 are used for "call-on" aspect.



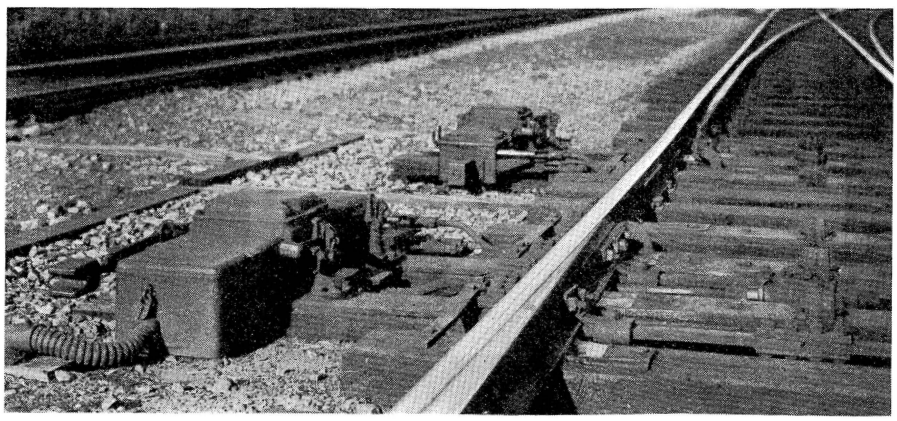
The control machine is located on the operator's desk in the yard office

All-Relay Interlocking Control

The control machine, as illustrated, has seven levers for the control of seven signals, and four levers for the control of three single switches and one crossover. The control circuits are of the direct-wire type, no code equipment being used. The track diagram is equipped with normally extinguished lamps to indicate track occupancy of the corresponding sections of the plant or approaches.

The switch levers, located at the bottom of the panel, are of the key type, being normally in the lower position, and are thrown to the upper position to reverse the corresponding switches. A small red lamp just above each switch lever is lighted when the switch is locked or when a lever is out of correspondence with the switch. The white lamp, just above the red lamp, is known as the transit light and lights when the switch is operating. As a further assistance to the operator in checking the line-up, the track diagram is equipped with movable switch points which are operated by magnets controlled by the switch-repeating relays so that the miniature point does not move until the corresponding switch has completed its operation and is locked. The signal control circuits are run through the track circuit relays, the switch repeater relays to secure SS control and through the repeater relays of opposing signals. For a signal equipped with two or more "arms" the proper aspect is secured for each route by selecting the controls through the switch repeater relays.

Stick control is used for all signals. An operative distant signal is provided for each main-line approach to the plant, the distant signal being cleared automatically when the corresponding home signal is cleared. Thus it may be seen that, in so far as the control of the field functions is concerned, this interlocking is practically the same in effect as that of a centralized traffic control installation, the important difference being that the comparatively small area of the plant imposed no serious limitation to the number of wires used for control or indication circuits. However, by means of a split battery arrangement for the feed of the control circuits it was possible to design the circuits so as to economize on the wire requirements and yet secure reliability of operation equal to that of modern requirements for signaling practice.



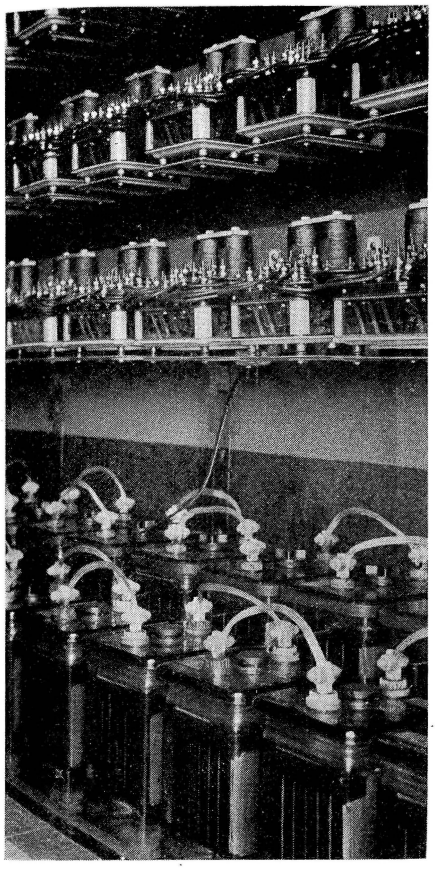
The dual-control switch machines are equipped with point detectors

Modern Equipment Used

The six switch machines on this plant are the Style M-22, equipped with dual-selectors, permitting hand operation if necessary. As shown in one of the illustrations, each switch layout is equipped with three insulated gage plates 1 in. thick and 6½ in. wide. Two plates extend and are

attached to the switch machine so as to eliminate lost motion. Enclosed type switch adjusters are used and the head rods are of the C.P. standard type. Each machine is equipped with a point detector. Ramapo Ajax adjustable rail braces are used on three ties including the one ahead of the points.

The signals on this installation are all of the Union searchlight type.



Interior of sheet-metal house

The lamps in each signal are rated at 11 volt.

The wiring from the control station to the plant layout is in an underground cable made up with lead sheath, jute, steel tape, etc., having 30 No. 14 and 3 No. 8 conductors and a twisted pair of No. 14 for a telephone circuit. The main wire runs on the plant area are single conductor insulated wires and cables run in creosoted wood trunking supported on concrete foundations.

At a central location on the plant a sheet-metal house 5 ft. by 7 ft. is used for housing the instruments and battery. The wires for all incoming circuits are terminated on porcelain-based terminals mounted on a board at the lower section of the left wall. The relays and other instruments are mounted on boards attached to a rack set out from the wall about 8 in. to allow space for running wires behind the boards. The track and control relays are all DN-11 wall-mounted spring-suspension type, and the thermal time-element relays are the type TB.

The power apparatus is arranged on a panel on the end wall. Type ANL-40 transformer relays are used to secure proper low voltages for the signal lamps and to transfer this load to the storage battery should the a-c. supply fail.

A set of 16 Exide EMGO-9 storage cells is used for the operation of the power switch machines and this battery is charged by an RT-81 rectifier. Two sets of five cells, each of KXHS-13 battery, arranged for a split battery feed for control circuits, is charged by two separate RT-21 rectifiers. Fixed Raco sealed resistance units are used to adjust the voltage for the feeds to different control circuits. Each track circuit on this plant is fed by one cell of KXHS-7 type battery.

This interlocking was planned and installed by the signal department forces of the Canadian Pacific, the principal items of material being furnished by the Union Switch & Signal Company.

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Accident on the Missouri Pacific

At Lone Tree, Mo., on the Missouri Pacific, on January 4, a passenger train struck the rear of a freight train which was pulling into a siding. This accident resulted in the death of the conductor of the freight train and injury of five persons on the passenger train. An abstract of the report of the Bureau of Safety investigation of this accident is as follows:

The accident occurred on a single-track line over which trains are operated by time table and train orders, no block-signal system being in use. The southbound extra freight train, including 56 cars and 2 cabooses, passed Harrisonville, 6.64 miles north of Lone Tree, at 6:44 p.m., 1 minute ahead of the schedule of the following passenger train. The freight was stopped at the north switch of the Lone Tree siding at 6:54 p.m. and had just started to enter the siding when its rear was struck by the passenger train. The passenger train passed Harrisonville at 6:50 p.m., running 5 minutes late.

From the report, it seems that the engineman of the freight train was anxious to get as far as Lone Tree before taking siding for the following train, so that a meet could be arranged with another passenger train without introducing serious delays. The fireman, the head brakeman and the rear flagman were all of the opinion that there would not be time to make Lone Tree ahead of the passenger train. The flagman called the conductor's attention to the situation at the two stations in approach to Lone Tree, but the conductor replied, "No, let him go," and the conductor also directed the flagman not to throw off a fusee because he did not want to cause the passenger train to be stopped.

While the freight train was approaching Lone Tree, the flagman could see the headlight of the following train, and as soon as his train slowed down, he got off and ran back to flag. However, he got back only about five car lengths. The passenger train was running about 55 m.p.h., and when the engineman saw the fusee and flagman's lantern, he applied the brakes in emergency and was able to reduce the speed to about 35 m.p.h. when the rear of the freight was encountered.

The rules require that, unless otherwise provided, an inferior train must clear the time of a superior train in the same direction not less than five minutes, but must be clear at the time a first-class train in the same direction is due to leave the next station in the rear where time is shown, and, failing to clear the main track by the time required by rule, must be protected as required by Rule 99.

There are 8 passenger trains operated daily over this part of the railroad, and the total traffic for the 30 days preceding the date of this accident averaged nearly 20 trains per day. Traffic of this density, together with the conditions brought out by this investigation, call for serious consideration as to the need for the block-signal system for the purpose of preventing future accidents of the character here involved.

Conclusion and Recommendation

This accident was caused by the operation of an extra train on the time of a following superior train without authority and without adequate flag protection. It is recommended that this carrier give consideration to the need for the additional protection on this line which would be afforded by adoption of the block system.

Editor's Note: The installation of automatic signals on the territory involved in this accident had been proposed and authorized for the 1936 program, prior to the collision. Work of installing signals is scheduled to start during April. The report of this accident by investigating officers of the railroad states, under the conclusion, that "direct cause was the failure of the flagman to function as per mandatory requirements of Rule 99; indirect cause was the failure of the flagman to appreciate the obligation and responsibility placed on him by Rule 951."