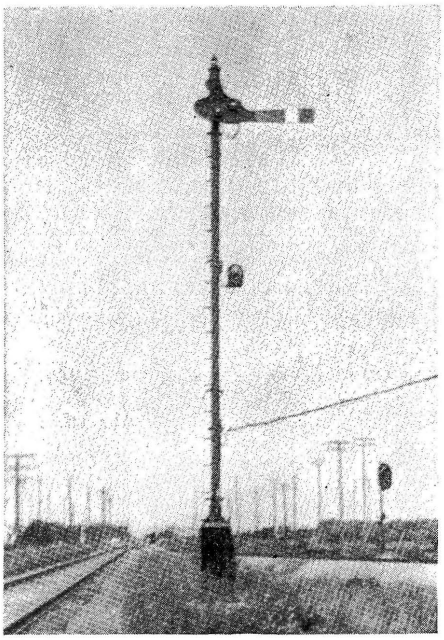
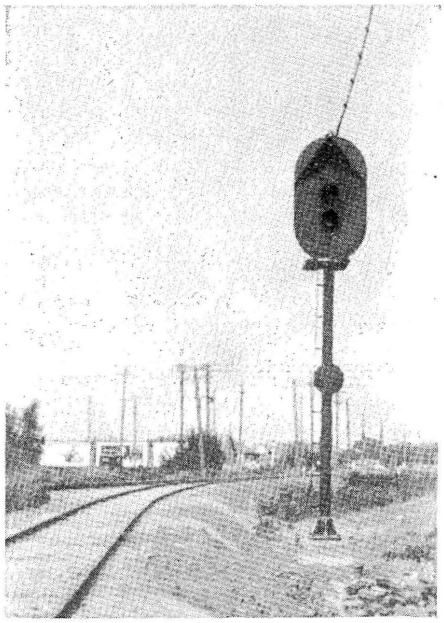


Home signal on the Canadian Pacific

Switch Indicators



Westward home signal on the Midland

Serve as Interlocking Control Devices

Co-ordinated track facilities are ingeniously signaled, using switch indicators, with push-button control, in dual role—Desired train operation is attained at exceptionally low cost.

SIGNAL protection, in which switch indicators are used as interlocking control devices, as well as for the conventional purpose of train-approach indication, has been installed by the Midland Railway Company of Manitoba, in a very economical and effective solution of a train-operation problem that was encountered at Winnipeg, Man., Canada.

At the location in question, the Midland paralleled the Canadian Pacific for several thousand feet, crossing several streets and the Assiniboine river, as shown in the sketch. Until last year each railroad operated a separate drawbridge over the river, and Portage avenue was crossed at grade by both roads. In recent years the Municipality objected to these grade crossings at Portage avenue, and several plans for their elimination were proposed and discussed before the present solution was agreed upon by all parties.

An old contract between the Midland and the Municipality placed upon the Midland the obligation to participate in the expense of grade separation at Portage avenue. The expense that would have been occasioned by the separation of the Midland grade from the Portage avenue grade was such as to necessitate searching for a more economical solution of the problem. With the co-operation of the Canadian Pacific, the Municipality, and the Dominion's Board of Railway Commissioners, the following plan was chosen.

It was decided to run the Midland trains over the Canadian Pacific track for a distance of approximately 4,000 ft., and to abandon the Midland drawbridge and track between the points now occupied by signals 3 and 4. Thus, with only one railroad track to contend with, the cost of grade separation at Portage avenue was brought within the realm of possibility. Because of the co-operation of the two railroads in co-ordinating their facilities, the Dominion and the City agreed to bear the entire expense of the Portage avenue grade separation project.

Another factor that made this plan attractive was the elimination of the Midland's drawbridge over the Assiniboine. This was timber trestle 1,070 ft. long, with a 246-ft. timber draw span. The bridge was old and the cost of maintaining it was approaching a point where the need for a new bridge was clearly indicated. By operating jointly with the Canadian Pacific over the Assinibone, it was possible to effect an appreciable saving in bridge maintenance alone, and the need for a new bridge was permanently eliminated. The bridge was sold to a Winnipeg lumber company, by whom it was removed at no cost to the railroad.

In making the two track connections, the Canadian Pacific constructed two 120-ft. turnouts. The Midland moved 520 ft. of track in order to make the Academy avenue connection, and constructed 544 ft. of track with a No. 11 turnout in order to make the connection north of Portage avenue.

This preview of the events leading up to the co-ordination of facilities discloses the nature of the signaling problem that was involved. As train movements over the Midland at this point are chiefly those occasioned by switching, it was not considered necessary to provide an elaborate interlocking system that would permit non-stop moves through the junction switches. Automatic interlocking, with power-operated switches, was not justifiable. Since traffic and operating conditions were such that it was not considered objectionable to stop all Midland trains upon entering and

again upon leaving the Canadian Pacific track, the Midland adopted the simple but effective expedient of equipping the hand-throw junction switches with switch indicators and using these indicators as interlocking devices for the four home signals, as well as for the commonly accepted purpose of indicating the approach of trains. This is believed to be the first installation in which switch indicators are used in this dual capacity.

It will be seen that this signaling arrangement is about as inexpensive a system as could possibly be conceived consistent with the particular conditions that prevailed here. Under this plan, Canadian Pacific trains move over the joint track under full signal protection, without stopping at either junction. Midland trains, on the other hand, before entering the joint track, are required to stop at the junction home signal and wait for a trainman first to operate a push-button, then to observe the position of a switch indicator, and then to open the switch. If, then, all conditions are proper for the movement of the Midland train over the joint track, the Midland home signal, either 3 or 4, as the case may be, will display a yellow aspect indicating "proceed with caution." When signal 3 or 4 clears, the other three home signals are automatically interlocked in the stop position and remain in that position until the Midland train has moved into the clear at the other end of the joint track, or until the signal system has otherwise been restored to its normal condition. Positive block protection is thus provided in both directions, for both following and opposing train movements, as only one train at any one time can enter this joint block on a proceed signal indication.

Street-Car Crossing Interlocking is Involved

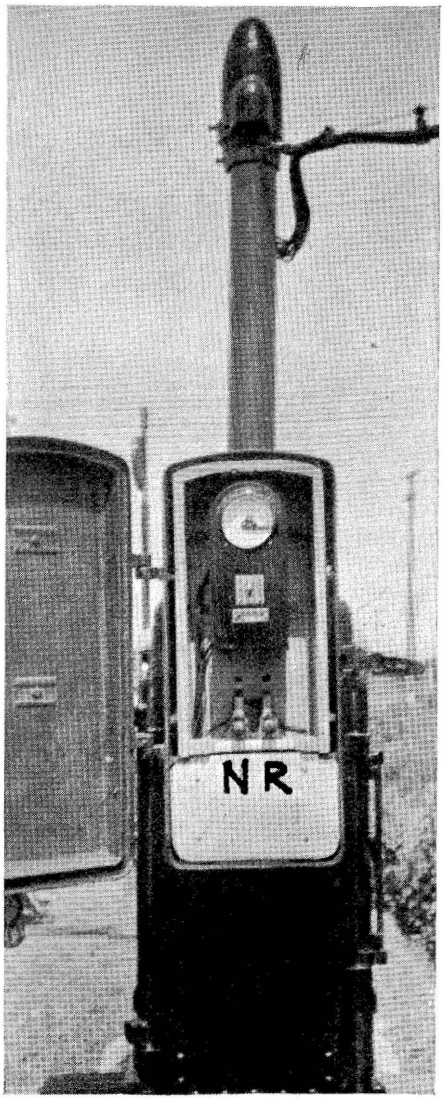
From a design standpoint, the signaling system was slightly complicated by the presence of an automatic interlocking system controlled by trolley contactors at Academy avenue, where the double-track Winnipeg Electric Street Railway crosses the Canadian Pacific at grade, and formerly crossed the Midland at grade as well. Here, as the sketch shows, the Winnipeg Electric has, in each track, a derail which, together with a two-position, color-light signal, governs street-car movements across the Canadian Pacific.

Before a street-car motorman can proceed across the Canadian Pacific, he must first receive a clear signal, which authorizes him, not to cross the Canadian Pacific track, but only to pass the trolley contactor. When the trolley contactor has been passed, the derail closes, and the street-car can then proceed, on derail indication, across the Canadian Pacific track. After crossing the Canadian Pacific track, the street-car motorman must secure another clear indication at the second signal shown, the latter indication being his assurance that the derail has returned to its normal derailing position behind him.

Canadian Pacific train movements over the electric line are controlled through interlocking relay 1R—2R and, therefore, the interlocking is cleared for the electric line as soon as the rear end of a Canadian Pacific train clears the crossing. This arrangement was desired here in order to expedite traffic on the electric line.

Practically no significant changes were made in the street-railway crossing interlocking, which had been installed many years before by the Winnipeg Electric. However, the presence of the d-c. propulsion line made it imperative to use alternating current in the railroad track circuits. Some of these a-c. track circuits were, of course, in service in connection with the Winnipeg Electric interlocking. It will be noted that single-rail a-c. track circuits are used between Academy avenue and Portage avenue. This was necessitated by the fact that the Winnipeg Electric uses one rail of the Canadian Pacific track to tie its Academy avenue and Portage avenue street railways together.

Indicator and push-button control station in case

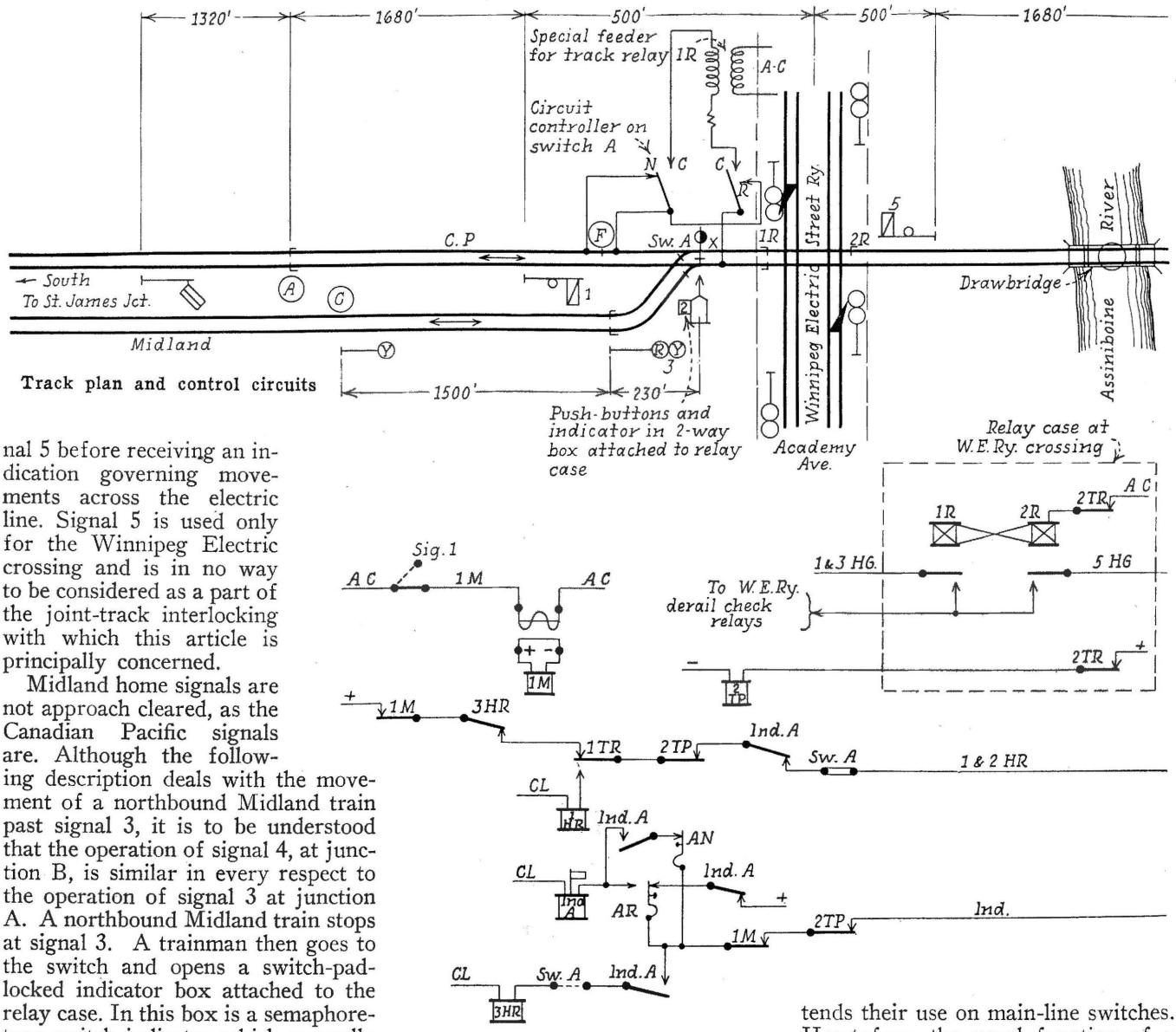


The new interlocking uses as much as possible of the Winnipeg Electric interlocking equipment, the more important connections with the old system being shown in the accompanying schematic wiring plan. The Winnipeg Electric interlocking utilized color-light signals on the Midland and semaphore signals on the Canadian Pacific. Its control track circuits extended from A to B on the Canadian Pacific, and approximately from C to D on the old Midland line. Much of this equipment was retained in the present system, but a study of the layout plan will show that several changes were necessitated in track circuits, signal locations, etc.

Because the joint track is signaled as a positive block for train movements in either direction, the Canadian Pacific home signals, 1 and 2, are fitted with a lunar-white marker, below the semaphore arm, which requires Canadian Pacific trainmen to secure orders from the dispatcher before proceeding past either of these signals when the indication is "stop." In the absence of communication facilities, Canadian Pacific trains would be required to flag through the block. Midland home signals 3 and 4 are fitted with a special stop-signal marker which, in effect, places Midland trains on practically the same basis as Canadian Pacific trains in the event that proceed signals are not displayed. Color-light approach signals are located 1,500 ft. in the rear of home signals 3 and 4. These approach signals display a continuous yellow aspect indicating "approach next signal prepared to stop." The fixed semaphore distant signals on the Canadian Pacific were in service in the Winnipeg Electric interlocking and were retained unchanged.

Signal Operation

Normally, all signals indicate "stop." Canadian Pacific home signal 1 or 2 automatically indicates "proceed" when a train enters the approach section, starting at A for signal 1, and at E for signal 2. Signal 1 is also controlled by the Winnipeg Electric interlocking at Academy avenue, but southbound trains proceed to sig-



Track plan and control circuits

nal 5 before receiving an indication governing movements across the electric line. Signal 5 is used only for the Winnipeg Electric crossing and is in no way to be considered as a part of the joint-track interlocking with which this article is principally concerned.

Midland home signals are not approach cleared, as the Canadian Pacific signals are. Although the following description deals with the movement of a northbound Midland train past signal 3, it is to be understood that the operation of signal 4, at junction B, is similar in every respect to the operation of signal 3 at junction A. A northbound Midland train stops at signal 3. A trainman then goes to the switch and opens a switch-padlocked indicator box attached to the relay case. In this box is a semaphore-type switch indicator which normally indicates "stop," and below it are two push buttons, one marked N and the other R. The trainman presses push button R, holding it closed for a few seconds. Thereupon, if no train is on the joint track, or on the approach section of Canadian Pacific home signal 1 or 2, the switch-indicator semaphore indicates "clear." This is the trainman's authority to open the junction switch. If, when the trainman has fully reversed the junction switch, all conditions are as they should be, signal 3 will display a yellow aspect indicating "proceed." Signal 3 is also controlled by the Winnipeg Electric interlocking at Academy avenue, and this, of course, must be taken into consideration by the trainman if signal 3 does not clear after he reverses the junction switch.

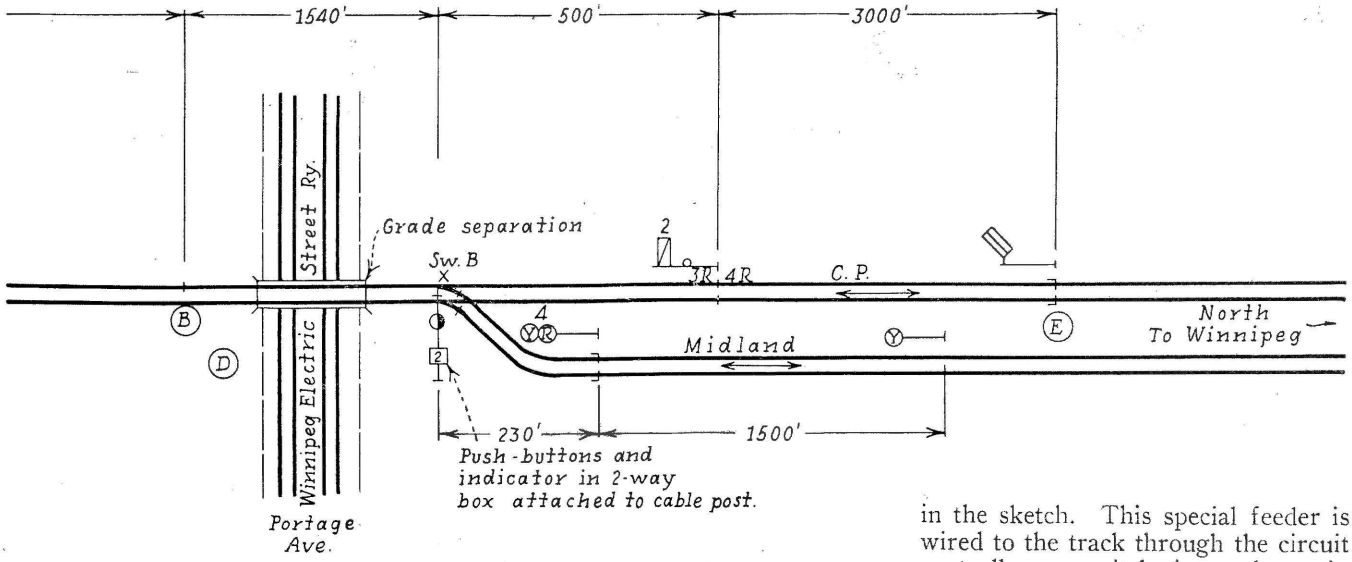
As the accompanying written circuit plan shows, a switch indicator cannot display a clear indication unless the trainman operates push button R, and then the indicator can clear only if signals 1 and 2 are at stop, no train is on the joint track, and the switch indicator at the other junction has not been cleared for an opposing move by a Midland train. This provides ample protection against all possible conflicting moves.

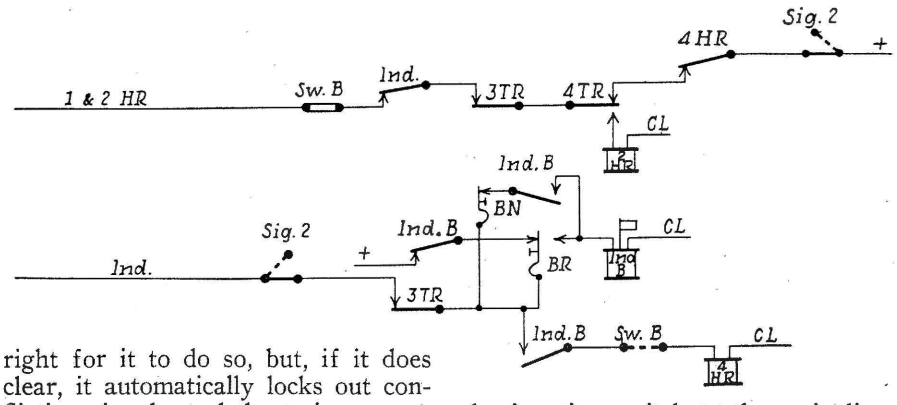
Either of the R push buttons can be operated by a trainman at any time, regardless of the presence of trains on any of the tracks, and without in any way interfering with the movement of Canadian Pacific trains that may already have received clear signals. The N push buttons, AN at Academy avenue, BN at Portage avenue, are provided for the purpose of re-setting the system in its normal condition when one of the R push buttons has been operated but the contemplated train movement not made.

Hazardous Condition is Eliminated

It will be seen that this novel function of a switch indicator completely eliminates a hazard that ordinarily attends their use on main-line switches. Heretofore, the usual function of a switch indicator has been only to indicate to the trainman, before he opens the switch, whether or not a train is approaching on the main track. Suppose that a trainman, operating a conventional switch indicator of this type, receives an indication that the main track is clear and that, therefore, it is safe for him to open the switch. If, now, the trainman should wait even 60 seconds while unlocking the padlock before he opens the switch, it is entirely possible that a train could have approached during this 60-second interval, and that the trainman, not having looked at the indicator a second time, might open the switch in the face of a fast-approaching train.

This danger, ordinarily inherent in the use of switch indicators by reason of the time interval between the observation of the switch indicator and the actual opening of the switch, is eliminated in the Winnipeg signaling. Here, as in a conventional switch-indicator installation, the indicator will not clear unless conditions are





right for it to do so, but, if it does clear, it automatically locks out conflicting signals, and the trainman can take as much time as required, after observing the indicator aspect, before opening the switch, without running the risk described above.

Parenthetically, it is interesting here to know that the Great Northern has used a similar arrangement at other locations on its railroad. However, at these locations, which comprise branch line junctions with a main track, a wayside signal replaces the switch indicator used in the Winnipeg installation. This has the advantage that the engineman receives exactly the same indication that the trainman receives before opening the switch. The trainman first operates a push button at or near the junction switch. If no trains are approaching, the wayside junction signal then displays an aspect indicating to both the engineman and the trainman that it is safe for the trainman to open the junction switch. When the trainman operates the push button, all conflicting signals are locked out, and no danger whatever attends the opening of the junction switch to the main line.

Track circuit 1 embodies a feature which is of interest, despite the fact that it is necessitated by the special conditions peculiar to this installation. Track relays 1R and 2R are of the combination interlocking type. This means that when a southbound Midland train enters track circuit 1, track relay 1R cannot drop all the way to its back contacts. If a northbound Canadian Pacific train should enter track circuit 1 while a southbound Midland train is passing through switch A, the Canadian Pacific train would, in the absence of special provision to the contrary, hold 1R "on the hook." Since 1R must be all the way down on its back contacts before signal 1 can clear, this means that, under these circumstances, the Canadian Pacific train would not receive a clear signal even after the Midland train cleared the fouling point.

To circumvent this possibility, an additional insulated joint was installed at F, and the special feeder was connected to the track circuit, as shown in the sketch. This special feeder is wired to the track through the circuit controller on switch A, as shown in the sketch, where N designates a switch-box contact that is closed only in the normal position, C designates contacts that are closed only when the switch is in the center position, and R designates a contact that is closed when the switch is fully reversed. With this arrangement, when a trainman restores the switch to its normal position after the Midland train has cleared the fouling point, the special feeder momentarily energizes 1R as the switch passes through the center position. Then, when the switch has been closed in its normal position, the Canadian Pacific train shunts 1R and the relay drops to its back contacts, thus enabling signal 1 to clear.

It is important that the Midland trainman does not operate the junction switch until the southbound Midland train has cleared the fouling point, as otherwise track relay 1R remains shunted by the Midland train even when the special feeder is connected to the track, and thus the purpose of the special feeder is defeated. Therefore, especial care is taken to observe the operating rule requiring trainmen to wait until the train has cleared the fouling point before closing the main-line switch.

General Railway Signal Company Type-K neutral relays are used, energized by direct current taken from Type-BQ rectifiers floating on a 110-volt a-c. line. The switch indicators are the G.R.S. Type-9A. Push-button switches were furnished by the Western Railroad Supply Company. Raco lightning arresters and Copperweld ground rods complete the list of the major new equipment required.

All of the signal work was done by the Midland. The plant is maintained by the Canadian Pacific signal forces. The installation was completed in July, 1936, and, in its first year of operation, has proved to be entirely satisfactory from every standpoint.