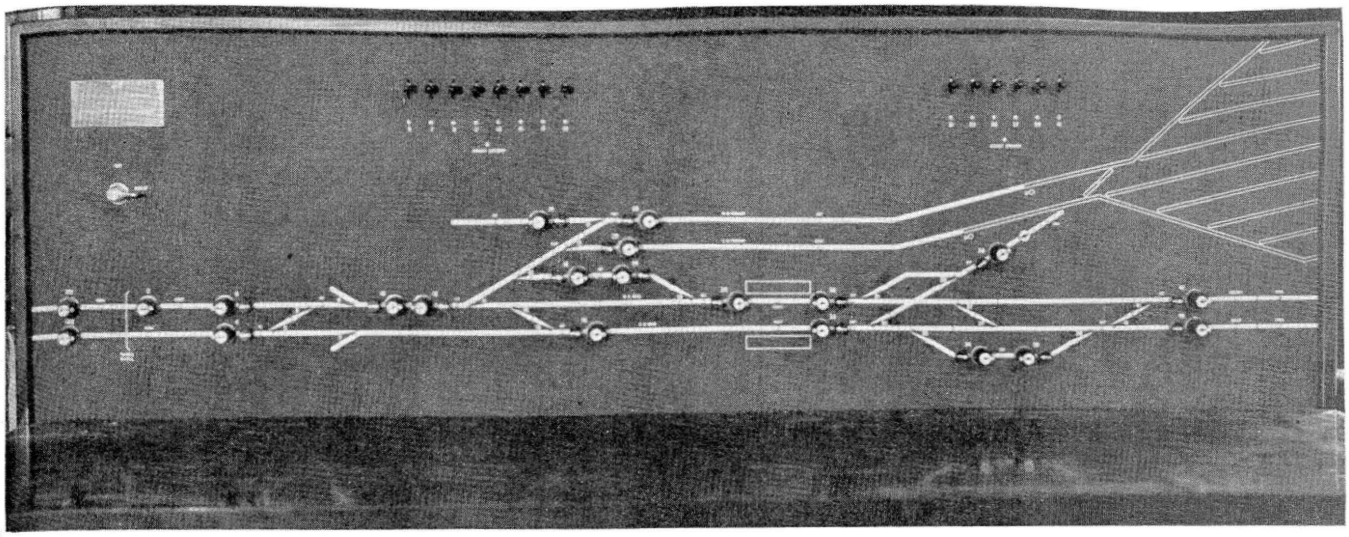


The new NX interlocking control machine is located in the operator's office in the Windsor station

New Interlockings at Windsor, Ont.,

On the Michigan Central

Lever-control plants, with mechanical locking, replaced by modern NX entrance-exit and miniature-lever all-relay plants

At Windsor, Ont., at the east end of the double-track tunnels under the Detroit River, the Michigan Central Lines in Canada has extensive facilities including three main-line crossovers, turnouts from the double-track main line to the freight yards, and special sidings to facilitate changing from steam to electric locomotives.

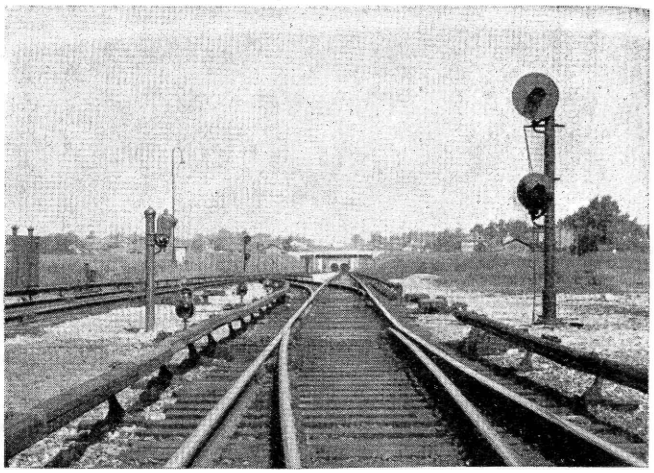
The Michigan Central operates 25 passenger trains and approximately 43 freight trains daily through Windsor. Also, 6 passenger trains of the Canadian Pacific are operated daily on the Michigan Central between Windsor and Detroit. The line of the Canadian Pacific from Toronto, Ont., comes in at the northeast portion of the Windsor layout and connects with the track along the north side of the west end of the Electric Yard. When using the main line tracks for station stops at Windsor, these Canadian Pacific passenger trains are routed through the lead between the yard and the main line east of signals 30 and 32. When the main tracks at the station are occupied, the Canadian Pacific trains use the two freight tracks north of the north platform, and in such instances these trains are routed to and from the main line at the turnouts and crossovers west of the platform.

In order to permit a track crew to work on one track or the other inside the tunnels, the track layout at Windsor and the signaling were designed to permit trains to be operated in either direction on either track through the tunnels, traffic-locking for the control of the signals being provided as will be explained later.

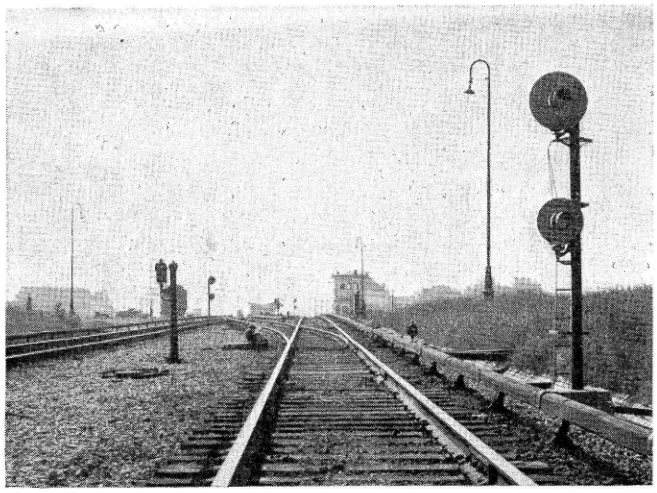
Another important phase of the operations at Windsor is the necessity for changing locomotives. Electric locomotives are used on the 2.7-mile territory through the tunnels between Windsor and Detroit, and steam locomotives are used on the territory east of Windsor. The locomotives for passenger trains are changed while the trains are standing at the station platforms. The siding and switches west of the platforms are used for changing locomotives on westbound trains, and the special locomotive siding east of signal 30 is used when changing locomotives on eastward trains. Numerous extra lineups of the interlocking are required to get the locomotive on and off these sidings, and off and on the passenger trains. Eastbound freight trains are pulled from Detroit by electric locomotives, and then routed over crossover No. 5 and turnout switch 11 to the freight track and then into the Electric Yard. From this yard, steam locomotives pull the trains through Tower 3 interlocking to the freight classification yard or out onto the main line eastward. Likewise, westbound freight trains are pulled into the Electric Yard by steam locomotives, and then electric locomotives pull the trains through Windsor and to Detroit. An additional handicap in the operations is that all passenger trains stop at Windsor while customs and immigration inspections are made. The duration of the inspections on a certain train cannot be determined in advance, and if the delay is too long, other trains may have to be run around. Therefore, crossover arrangements are provided to permit such moves.

At the time the tunnels were completed in 1907, two General Railway Signal Company lever-control electric interlockings were installed at Windsor to handle the switches and signals. Tower 1, which handled the area from the east end of the tunnel to Windsor station, had 33 working levers to control 5 switches, 5 crossovers, 1 derail, and 20 signals, and 2 check lock levers.

Starting near the west end of the Windsor layout the tracks descend toward the tunnels on a 1.5 per cent grade. In view of the fact that some car might get away and drift back toward the tunnels, a Wharton type derail was installed on the eastward track just east of the eastward home signal. To provide derail protection for the westward track a switch, which was removed during recent track changes, was set normally for the turnout. Tower 2, which controlled the area east of the station including the leads to the yard, had 38 working levers to control 14 switches, 2 crossovers and 22 signals. A mechanical interlocking, Tower 3, was installed at the east end of the Electric Yard to control the switches and signals at that layout.



View looking west with signal 9 at the right and signal 12 at the left



View looking east with signal 4 at the right and signal 6 at the left

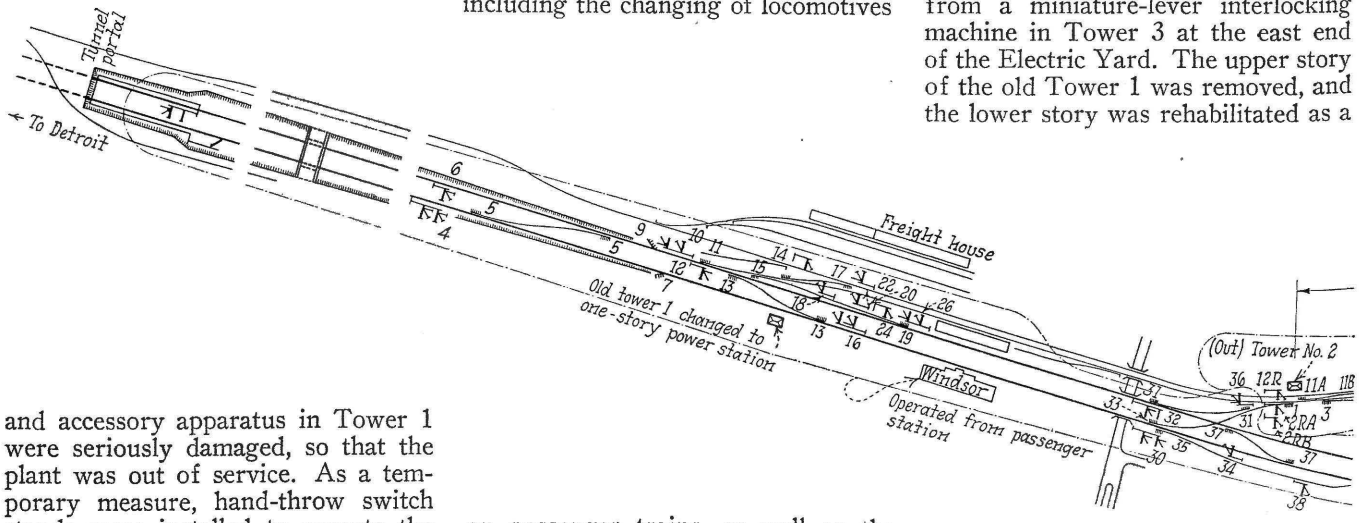
In August, 1939, the 600-volt d-c. traction circuit was accidentally connected to some of the interlocking circuits, and the control machine, wiring and accessory apparatus in Tower 1 were seriously damaged, so that the plant was out of service. As a temporary measure, hand-throw switch stands were installed to operate the switches, and the signals for directing routes were controlled by circuits properly selected through switch circuit controllers, signal-repeater relays and a set of knife-switch levers mounted on a panel in the switch-tender's house. Not only because of the damage done by the fire at the interlocking Tower 1, but also due to the fact that the old plants needed extensive replacements, a decision was made to reconstruct the interlockings throughout Windsor, and provide modern types of control machines.

An Analysis of Operations

An analysis of the operations showed that the handling of trains through the passenger station area, including the changing of locomotives on passenger trains, as well as the routing of freight trains off or onto the main line, all fell in one operating category, and, therefore, might better be controlled by one man rather than in part by each of two men. On the other hand, the routing of freight trains into and out of the west end of the Electric Yard had to be coordinated with the operation of the east end of this yard which was handled by the interlocking Tower 3. The logical solution, therefore, was to provide an entirely different arrangement of interlocking control limits, and to use modern interlocking control machines and systems of circuits.

New Interlocking Limits

A new NX interlocking machine, in the office of the station at Windsor, now controls the switches, derails and signals formerly included in the Tower 1 interlocking, and also the main line crossovers, locomotive interchange track switches, and turnouts leading to the yard, which were formerly included in Tower 2 interlocking. The remaining switches and signals at the west end of the Electric Yard, which were formerly in Tower 2 interlocking, are now controlled from a miniature-lever interlocking machine in Tower 3 at the east end of the Electric Yard. The upper story of the old Tower 1 was removed, and the lower story was rehabilitated as a



Track and signal plan of the entire

one-story building for housing switching apparatus for the electric traction system. The old Tower 2 was removed.

When changing over to the new interlockings, several minor changes were made in the track layout, the accompanying plan showing the new layout as now in service. As a part of the improvements, the Wharton type derail on the eastward track, used for tunnel protection, was replaced with a Hayes type derail, and a similar derail was installed on the westward track. The two new Hayes derails are operated by switch machines as a part of the interlocking.

New Signals Installed

The old interlocking signals of the semaphore type were replaced with searchlight type signals with quick-detachable plug-in type connections. The masts for the old high signals were badly rusted where they were clamped in cast-iron bases. The deteriorated sections were cut off, and the masts were set down in concrete foundations which were poured in place. Thus the new high signals are all on masts much lower than the old ones, but an important point is that the signals are now at the proper height to be approximately in line with an engineman in the cab of a locomotive. At locations where adequate clearance was available, the dwarf signals were mounted on masts high enough to bring the center of the lens 6 ft. above the level of the top of the rail.

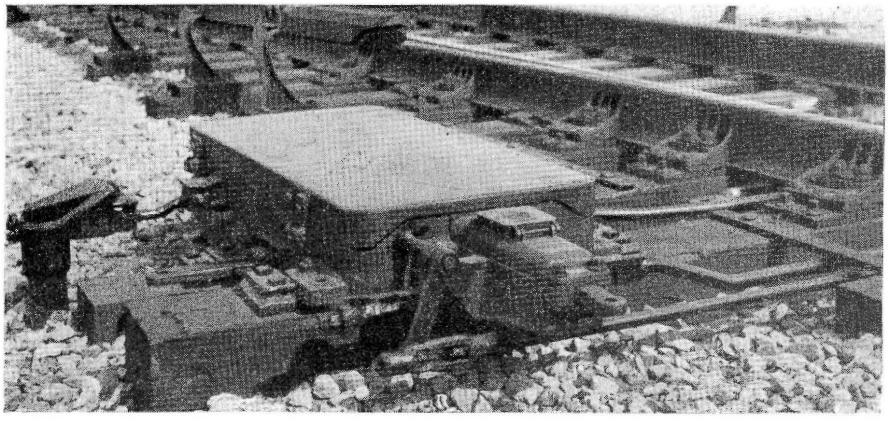
Signaling Arrangements

The signaling arrangement for the new plant was designed with two purposes in mind; (a) provide for all the special train movements and the changing of locomotives, as well as for run-around moves; and (b) when a high "arm" aspect could not be given, provide other proceed aspects which would authorize train movements at the highest possible speeds which were consistent with safety in consideration of the occupancy of track sections ahead. In other words, not require a train to move at caution-slow-speed through an extended distance when actual conditions were safe for medium speed or better.

Whereas some of the high home signals on the old plants had three arms, the maximum on the new signals is two "arms." Each high home signal for right-hand running, such as signals 4, 26, 30 and 42, has two operative "arms," the top "arm" governing straight through moves on straight track, and the lower "arm" governs diverging moves. The lower "arms" operate to three aspects so that a green aspect can be displayed if the two "blocks" ahead are unoccupied, thus giving enginemen additional information as compared with a two-aspect "arm." These lower arms can also be used to display a "call-on" aspect, which in all instances is yellow-under-red. This aspect is also displayed when signals govern into non-track-circuited territory.

Three-position signals are used for the back-up dwarfs, such as signals 6 and 12, which govern reverse running moves on a route over a crossover to the other main track for right-hand running into automatic block territory beyond the plant. The use of the green aspect on such a signal, permits trains to pick up speed and get under way rather than operating at slow speed for longer distances. The same statement regarding the use of three aspects applies to signal 36, governing movements from the yard to the main line, and also dwarf signal 22, which governs movements from the westward freight track which also is used frequently by Canadian Pacific trains when making the station stop.

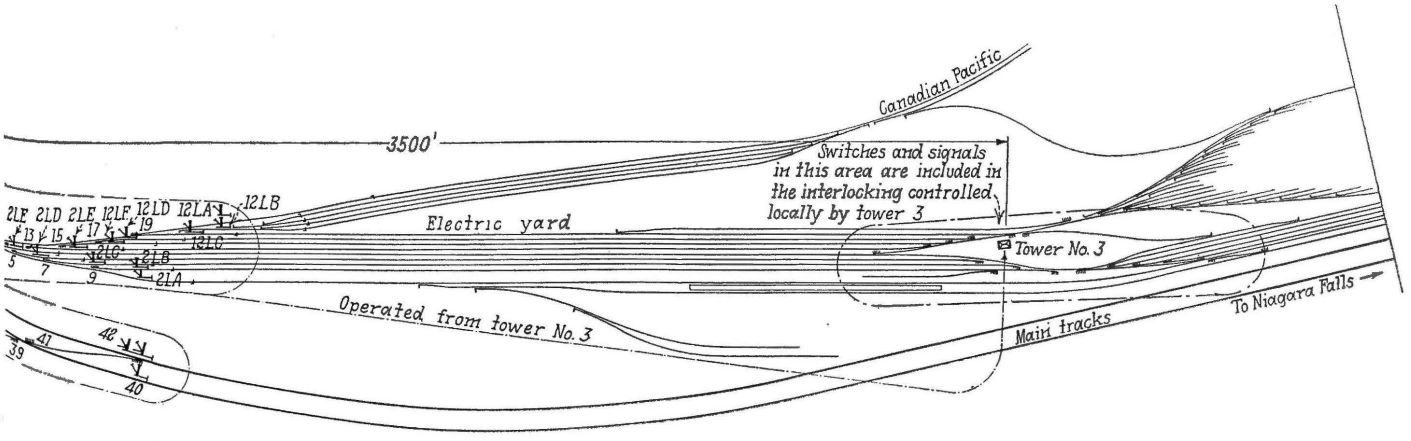
Signal 32, which governs reverse running moves from the normal westward main track into the yard or over the crossover to the eastward main track, has a fixed top "arm" and a three-position lower "arm." Dwarfs displaying only two aspects, red or yellow, are used to govern short routes confined to interlocking limits or up to other interlocking signals, such as leading out of a locomotive parking siding or out of a yard track.



Model-4 electric switch machine after being rebuilt

The New Windsor Control Machine

The new Windsor interlocking is of the NX type. The control machine in the Windsor station has 19 en-



interlocking layout at Windsor

trance knobs and 19 exit buttons to control 6 single switches, 6 crossovers, 2 tunnel protection derails and 19 signals. The basic principles of the NX system of circuits for the control of interlockings were explained in an article on page 220 of *Railway Signaling* for April, 1939, and will, therefore, not be given here.

The panel of the control machine is 18 in. high and 60 in. long. For the area within home signal limits and the approach sections on the main lines, each track is represented on the diagram by white lines 3/16 in. wide, which stand out in contrast with the dull black finish of the panel. Small lamps mounted in the lines representing the track are normally extinguished, but are lighted to show white when each corresponding track circuit is occupied by a train, thus outlining the route being used.

The switches and crossovers are represented by small, movable sections of the track which are called route indicators. The movable sections are operated by magnets mounted behind the control panel, and are actuated to positions which outline the route as soon as the towerman pushes the exit button. An indication as to whether each switch is locked is given by a small lamp with a red lens mounted behind the track lines adjacent to each route indicator. Each such lamp is lighted to show red when electric locking, including the equivalent of mechanical locking, has taken effect at the corresponding switch, and the switch is, therefore, not free to move. Thus these lamps are known as "lock lights."

Entrance Knobs and Exit Buttons

In the line representing the track, at the location corresponding to each interlocking signal, there is an entrance knob. As a means of effecting different controls, each knob can be pushed, can be turned, or can be pulled, and in each instance a different set of contacts is operated. The knob is so constructed that it cannot be pressed while in a turned position; therefore, only one type of control can be initiated. When pushed, the knob returns to the normal position by spring action, as soon as the towerman removes his finger. When the knob is turned to initiate a control, it must be turned back to normal in order to cancel the initiation. When a knob is pushed to initiate a control, it may be pulled to cancel that initiation.

Each of these knobs is ¾ in. in diameter, and stands out 1 in. from the face of the panel. To facilitate identification, the number of the signal is etched in white, adjacent to each knob. The knob is hollow and surrounds a separately-supported round disk of Lucite, which fits in the face of the knob. A white glass arrow in the face of the knob points in the direction in which the corresponding signal controls, and maintains this position. A small round white marker, on the outer rim of the knob, indicates the position of the knob, this marker normally being in line with the track and at the base of the arrow in the face of the knob.

An exit button is mounted in the line representing the track at each point where a train leaves the section of track over which a signal governs. Each exit button is 9/16 in. in diameter, and normally stands out from the panel 5/16 in. A white arrow on the face of each exit button points in the direction a train would be going when leaving the end of a route controlled by the respective button. These exit buttons are operated by pushing, and do not turn; they return to normal position by spring action as soon as the towerman removes his finger.

To Line Up a Route

In normal operation, when a route is to be lined up, the towerman pushes the entrance knob corresponding with the signal for the track on which the train is to enter the plant. This action causes a red light to flash behind the arrow in the face of the knob, as an indication that the lining up of a route has been initiated.

The next action is to push the exit button corresponding to the end of the route, following which the route indicators immediately line up to correspond with the route desired. The red lock lights under the route indicators are lighted at the same time and indicate, in conjunction with the continuous white line, the route which has been called for. After the various switch machines have responded to the route called for and the signal clears, the flashing light in the entrance knob changes to a steady burning green or red indication. The green indication shows that the signal has cleared. The red indication is used with signals which govern beyond interlocking limits to show that a route has been lined up, but that the signal has not cleared because of track occupancy. When the train ahead moves out of the block, the signal clears and the indication changes from red to green.

If the towerman initiates by pushing or turning the entrance knob and the route desired is not available, the pushing of the exit button has no effect, and the lamp in the entrance knob continues to flash. In this case the operator may cancel the initiated condition as described above, or may wait for the route desired to be available and again press the exit button. The non-availability of a route is indicated to the operator by following the desired route across the panel and noting whether the red lock light is lighted under any of the route indicators which must be operated in order to secure the desired route. As the train travels over the route, the signals go to Stop and remain at Stop until the towerman again sets up the route (stick signal). This is known as "automatic route restoration."

When lining up a route including several intermediate signals, the push operation of the entrance knob and the exit button at the end of the complete route causes the switches to operate and all of the several intermediate signals, as well as the one at the entrance, to clear. This control feature is known as end-to-end control, and eliminates the necessity of operating entrance knobs and exit buttons for each of the intermediate sections.

When a "closing-in" move is to be made, as, for example, to move a locomotive back onto a train that is standing within the interlocking limits, a "call-on" signal aspect, consisting of red over yellow, is used on a two-arm signal; or a single yellow may be displayed on a dwarf signal. In order to prevent the operator from inadvertently allowing such a move, he is required to use a distinctive type of manipulation by which he *rotates* the entrance knob so that the white dot or marker on the knob turns downward through 90 degrees. He then presses the exit button as before.

A flashing red indication is displayed in the entrance knob until the route is lined up. When the signal clears, the indication changes to a flashing green. In this case the signal will not go back to stop when the train accepts it. The flashing green serves to remind the operator that he must rotate the entrance knob back to normal as soon as the train has passed the signal.

Special Control of Derails

The two derails, 7 and 9, on the two main tracks are set normally to derail cars so they cannot drift down into the tunnels. When establishing a route including one of these derails, the derail is controlled to clear the track the same as a switch is controlled in the NX system. After a train uses a route and passes beyond the home signal limits, the switches remain as they were until another route is established. This sort of operation is not correct for these

derails because they should be returned to the derailing position in order to provide the protection for which they were installed. For this reason, the controls are so arranged that when the rear of a train clears the track circuit including a derail, that derail automatically returns to the derailing position without any action on the part of the operator.

Traffic-Direction Through Tunnels

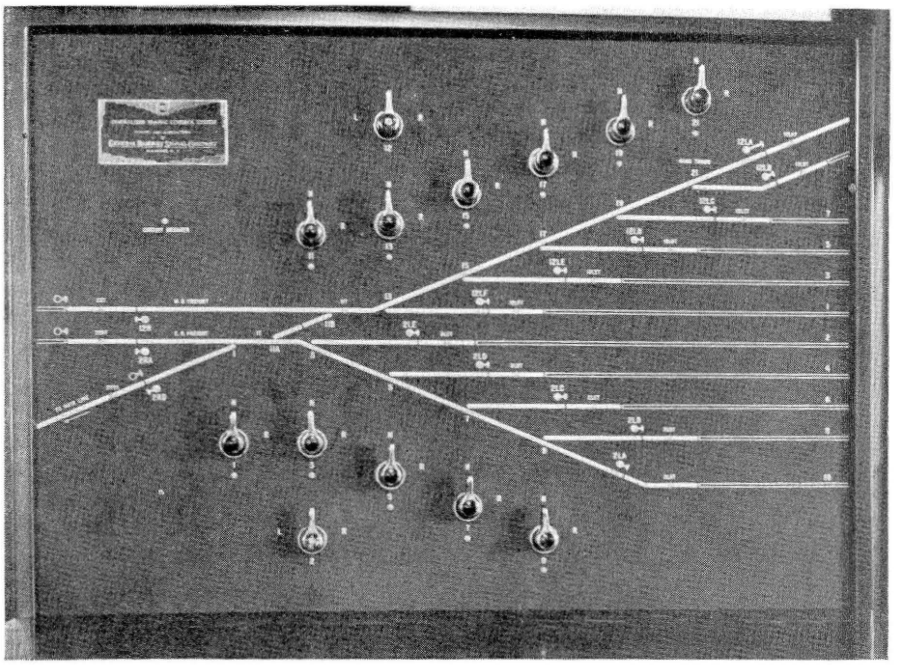
The two knobs at the left, on the lines representing the tracks through the tunnels, are for the control of traffic-direction locking for the control of signals to direct train movements by signal indication in either direction on each track between the Windsor interlocking and the 15th St. interlocking in Detroit. Normally the traffic-direction locking is set up for right-hand running. If no train is within the traffic locking section or approaching it, the direction of traffic may be reversed on either track by cooperative action on the part of the two operators at either end of the tunnels. When necessary for track forces to work on one of the tracks in the tunnels, trains can be run in either direction on the other track by using the traffic-locking system.

Test Keys for Control of Switches

Arranged in rows in the upper section of this panel are small levers of the key switch type, which are used for test operation of the corresponding track switches. Associated with each test key is a corresponding light, which is lighted white whenever the respective switch is either in transit or is out of correspondence with the switch position called for by the route control set up by the NX system or by the test keys. During normal operation of the plant by the NX control system, the test keys are kept in the normal center position at right angles to the face of the panel. When the test key is moved to its downward position, the corresponding switch will operate to its normal position, and when the test key is moved to its upward position, the switch will operate to its reverse position. This method of individual control of switches was provided for use when a maintainer is testing or adjusting a switch.

The movement of a test key is ineffective to operate its corresponding switch when a route including that switch is established by the entrance-exit control system. Therefore, before using the test key, any existing route controls including the switch must be cancelled. Conversely, if the test key has been left in either the normal or the reverse position, no route can be set up by NX operation, which calls for the corresponding switch to change its position. A route can be set up, however, by NX operation over the switch in the position in which it is held by the test key.

An innovation in the construction of this control machine is the use of Lucite rod to conduct the proper color of illumination to the face of the machine for switch and entrance button indications. Rods of this material may be bent as required to reach the desired position and still the rods will conduct light from one end to the other. Color of the light displayed can be changed by extinguishing one lamp and lighting another of a different color.



The lever type interlocking machine for controlling the switches and signals at the west end of the Electric Yard

New Control Machine at Tower 3

The 14 signals, 10 single switches and 1 crossover at the west end of the Electric Yard are controlled by a miniature-lever interlocking machine on the operator's desk in Tower 3, which is located about 2,800 ft. to the east of this track layout. The face of the panel is 18 in. high and 26 in. wide. The main track sections are represented by white lines ⅛ in. wide in the panel. Each section has a translucent round spot which is illuminated when the corresponding track circuit is occupied. Cars are left standing for extended periods on the yard tracks, and, therefore, track-occupancy indications would be of no use. In order that the operator may know when a train is ready to pull out of a yard track, a track circuit 100 ft. long was installed in the approach to each signal governing a move out of a yard track. Occupancy of each of these sections are indicated on the diagram by a small white illuminated spot in the track line.

The crossover and the 10 single switches are each controlled by a two-position lever, these levers being arranged in two diagonal rows, one row above and one below the track diagram so that each lever is adjacent to that portion of the diagram which represents the corresponding switch. Switch 21 leads to a yard track which is used primarily for storing cars, and, therefore, the installation of a power switch machine was not justified. This switch is operated by a hand-throw stand but a lever No. 21 is provided and must be operated to line up the signal selections for a move over this switch when it is reversed by hand throw. A telephone is provided at this switch so that trainmen can inform the operator when they want to use this switch.

Switch 1 is normally lined for through moves on the straight track of the eastward freight track. The crossover between the two freight main tracks is normally open. The switches leading from the two ladder tracks to the various yard tracks are normally lined for through moves on the ladder tracks. With this setup, no yard track switch has to be moved to line up for a Canadian Pacific passenger train when moving over the north ladder track.

The switch levers stand normally in the vertical position, thus controlling the corresponding switches to their

normal position. When a switch is to be operated to permit a train movement into or out of a yard track, the corresponding lever is thrown 90 deg. to the right. A white lamp below each switch lever is illuminated when the lever is thrown and continues to stay lighted until the switch moves to the corresponding position and is locked, then the indication lamp is extinguished. This indication is known as the out-of-correspondence lamp, and, in case the switch does not follow the lever control, the operator thus has this information at once.

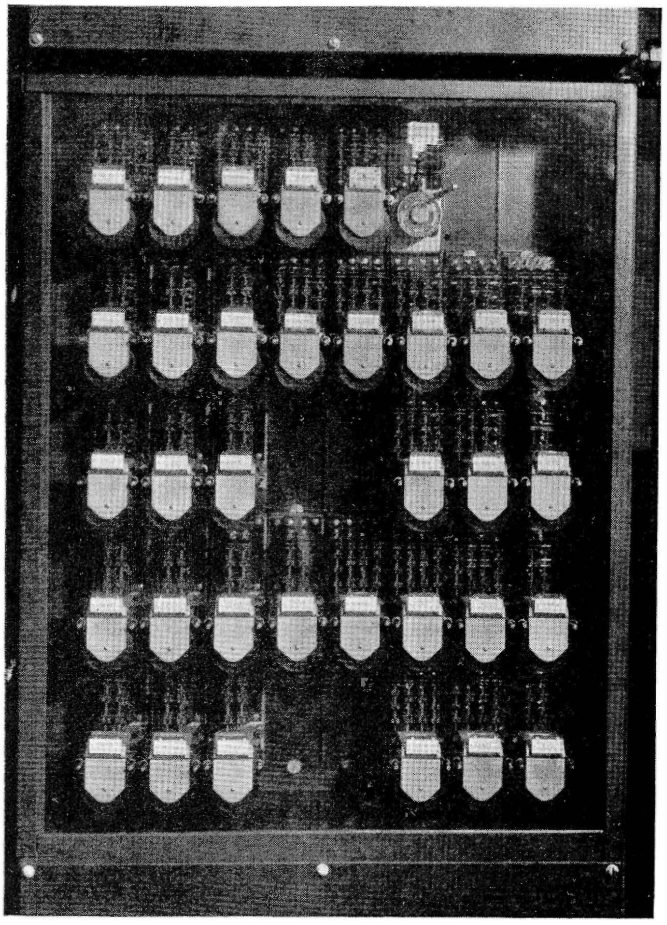
A red lamp in the face of each switch lever is illuminated when the switch is electrically locked and not free to be thrown. Since pre-conditioning is prohibited, this light constitutes a "Hands Off" light. If the operator should throw the switch lever when this light is lighted, the switch will not operate even though electric locking is subsequently released. Both the lock light and the out-of-correspondence light will remain lighted. The operator is obliged to return the switch lever to the last position, and, if the lock light is extinguished, he is then free to throw the switch.

Only Two Signal Levers Required

An analysis of this layout showed that only a limited number of routes could possibly be used simultaneously. All westward moves from any one of yard tracks 2, 4, 6, 8 or 10, to the eastward freight track or over switch No. 1 reversed on the connection to the main track, represented one category in which only one of five signals, 2LA, 2LB, 2LC, 2LD or 2LE, could be cleared at any one time. Eastward moves into any one of the yard tracks, 2, 4, 6, 8 or 10, from the eastward freight track or the lead from the main line represented another category in which only one of the signals, 2RA or 2RB, could be cleared. Obviously neither 2RA or 2RB could be cleared when any one of the five opposing signals, 2LA to 2LE inclusive, was cleared. Based on these facts, one lever, No. 2, at the lower left of the panel, controls all of the seven signals, 2RA, 2RB and 2LA, 2LB, 2LC, 2LD and 2LE. When the lever is thrown to the left one of the 2L signals clears, depending on whether all yard switches are normal or which of the switches, 9, 7, 5 or 3, has been reversed. When the lever is thrown to the right, signal 2RA or 2RB clears, depending on whether switch 1 is normal or reverse.

When signal lever 12, at the upper left of the panel, is thrown to the left, with all yard switches normal, signal 12LA clears. If any of the yard switches, 15, 17, 19 or 21, has been reversed, the corresponding 12L signal clears for a movement from that track. If lever 12 is thrown to the right, signal 12R clears for a movement along the ladder track or into any one of the yard tracks for which the switch has been reversed. Thus, as long as crossover 11 is normal, movements to or from each group of yard tracks can be handled independently in either direction by the two signal levers. When crossover 11 is reversed, no signal for a route controlled by the left position of signal lever 1, nor any signal for a route controlled by the right position of signal lever 12, can be set up. Therefore, when crossover 11 is reversed, signal lever 1, when thrown to the right, controls signal 2RA or 2RB, depending on whether switch 1 is normal or reversed, and signal lever 12, when thrown to the left, controls any one of the six signals 12A to 12F inclusive, depending on whether all the switches are normal or any one reversed. When a signal lever is thrown and the corresponding signal clears, a white lamp in the face of the signal lever is lighted. Since the yard signals are not track circuit controlled, the lamp remains lighted until the operator puts the signal to stop by placing the signal lever normal.

Having cleared a signal, all of the switches involved are automatically locked. After the train accepts and passes the signal, all the switches involved are automatically locked by the detector locking. Therefore, even though the operator might inadvertently throw a switch lever, no action of the switch would take place. If the operator clears the signal for a train on any approach circuit, and then "takes the signal away" by moving the lever, no switch in the route can be moved and no opposing or conflicting signal can be cleared for a period of 15 sec., which allows time for the train to stop short of the signal or to enter the home signal limits and thereby maintain the locking on the switches and lock out opposing and conflicting signals.



The Type-A relays are enclosed in a sealed case with transparent cover

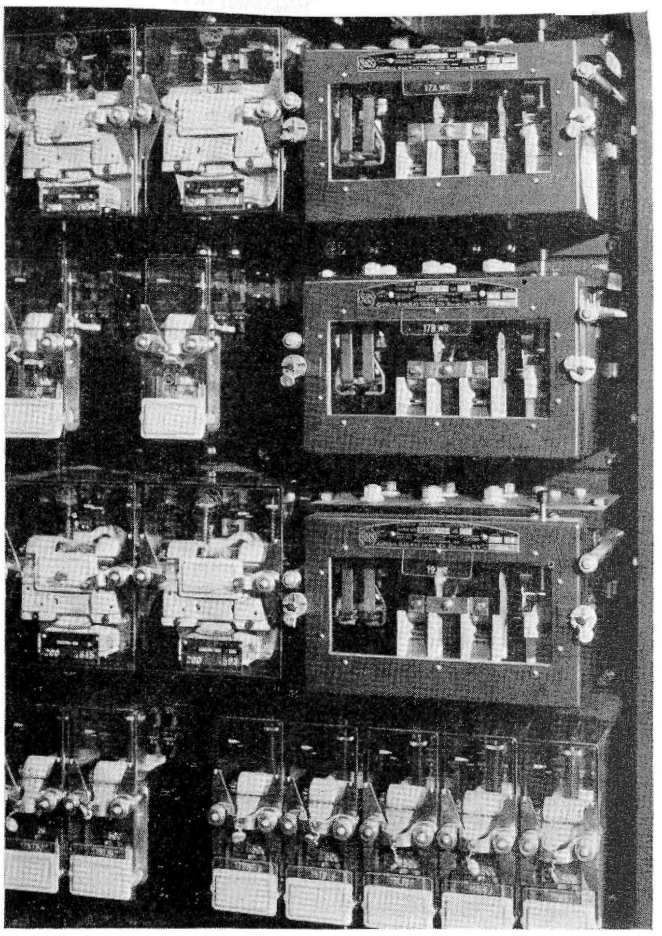
Circuits for the Yard Plant

Direct-wire circuits are used for controls and indications between track layout at the west end of the yard and the control machine in Tower 3. All vital or safety circuits are local in the field with the relays located in a welded-steel factory-wired housing at the field location. For the non-vital circuits between the housing and Tower 3, a common wire is used for practically all of the circuits. One wire and common from each switch lever controls a polar relay in the field which in turn controls the operation of the switch. This same wire, through the use of a series relay in Tower 3,

is used to indicate when the switch is locked. A second wire and common is used to indicate switch position at Tower 3 by means of a polar relay repeating a switch-repeater relay in the field. This same wire is also broken through the detector track relay so that a track-occupancy indication may be obtained, in conjunction with a locked indication, over the same control wire. Thus only two wires and a common are required to control and indicate the position of each switch, and, at the same time, to indicate whether the switch is locked and whether its detector track is occupied.

One wire and common is used in conjunction with each of the signal levers to control a polar relay in the housing which in turn clears a "left" signal when operated by one polarity and a "right" signal when operated by the opposite polarity. The signal will, of course, not clear until all switches in the route are in their proper position and are electrically locked in that position.

The signal indications and the rest of the track indications are brought in over individual conductors in association with a separate a-c. common. These indications are obtained direct from an a-c. source without the use of any relays in Tower 3. In this connection, it should be noted that the short track circuit on the yard tracks are not provided with relays and are normally on open circuit. The presence of an axle on the track circuit completes a circuit to light the indication light through a suitable step-up transformer. The aerial cables between the interlocking and Tower 3 include 1 No. 6 wire, which is common for the diagram lights, and 48 No. 14 wires, of which 2 are spares.



Detachable Type-B relays and three tower-type switch controllers in the instrument rack

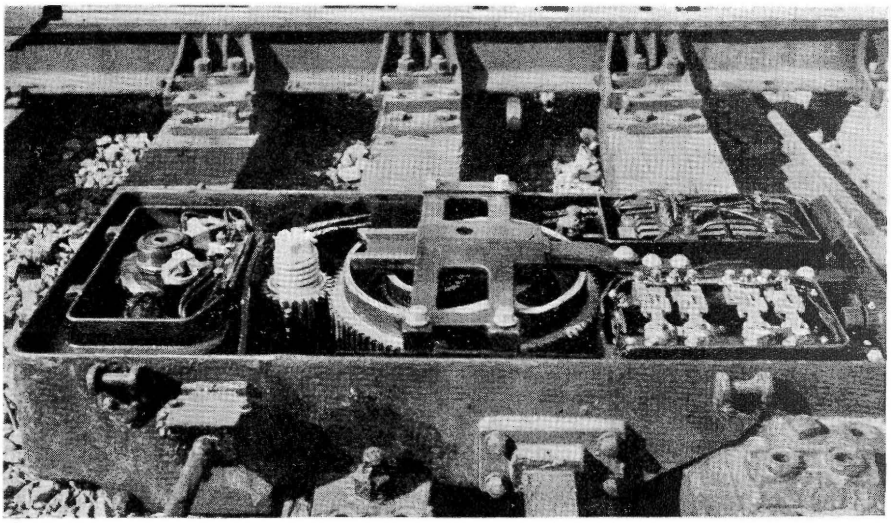
Switch Machines Overhauled

The switch machines, which were in service at these interlockings, are the Model 4, equipped for operation on 110-volts d-c., using individual direct-lever control and dynamic indication. In order to use these switch machines in the new interlocking control systems, several changes and additions were necessary, and the machines were completely overhauled. In the new system of control, a plug-in tower-type controller controls the operation of each switch directly.

Space was available in the case of each machine to house a point-detector for the control of a polar switch-repeater relay. The point detector is the over-and-locked type, and was installed together with connecting rods, etc. The pole-changers were rebuilt or replaced with new ones. New lock blocks were installed. New covers for the locking compartments, of the type to permit the locking to be visible, were provided. The motor shafts and bottom bearings were all replaced. The commutators were turned down, and new brush holders and brushes were provided. The coils were re-taped. The main cam gear wheel of each machine, as well as the bridle rods, were replaced with new ones.

The 110-volt battery, for operation of the switch machines, consists of 56 cells of 120-a.h. Exide EMGS-7 storage battery. A set of six cells feeds the signal control circuits. A set of 16 cells, with a center connection, is used to feed the small relays of the NX network. These various sets of batteries are on floating charge through dry-plate rectifiers.

(Continued on page 641)



The switch machines were completely rebuilt, point-detectors were installed and various other parts were replaced or repaired

permit operation of the lever. After operation of the emergency release, the electric lever lock on the switch lever is released, and the lever can be moved to the opposite position and the red lever indication lamp is lighted, *but* the switch does not operate. At this time, a special lamp unit adjacent to the main signal is lighted, which is an indication to the motorman of an approaching train that the plant is not in normal operation. He stops his train short of the signal. With his car controller in the "off" position, he can remove a key from his controller and place it in a key-hole controller on a box so located on the wayside that he can easily reach it when opening the door of his compartment. When the key is turned in this controller, circuits are completed to cause the switch or switches to operate to the position corresponding with the positions of the switch levers, as is indicated by the red lever indication lamp being extinguished. The leverman then returns the emergency release to normal position. Then the leverman reverses the signal lever and operates the push button corresponding to the signal; after which the signal displays the "call-on" aspect and the train-stop trip at the signal clears. In the meantime, the motorman removes his key from the wayside device and returns it to its normal position in his car controller, so that he is ready to accept the signal and proceed.

Emergency Operation of Switches

Although great care has been taken to prevent the failure of the air supply to this plant, nevertheless arrangements have been provided such that if the pressure does fail, the switches can still be operated to keep trains moving.

In case of an air pressure failure, the raising of the hasp on an A-10 electro-pneumatic switch machine, affords access to a receptacle in which a crank can be inserted to crank the switch from one position to another. Once the hasp has been raised, the openings to the normal air supply are cut "off" and locked "off" by a latching arrangement which cannot be reset until released by means of a key in a Yale lock device, and this key is retained in the possession of the maintainer on duty at the plant.

This new interlocking was installed under the direction of Ed Blake, Superintendent of Way and Structures of the Hudson & Manhattan. The interlocking equipment was furnished by the Union Switch & Signal Company, which prepared the detail plans and performed the construction work.

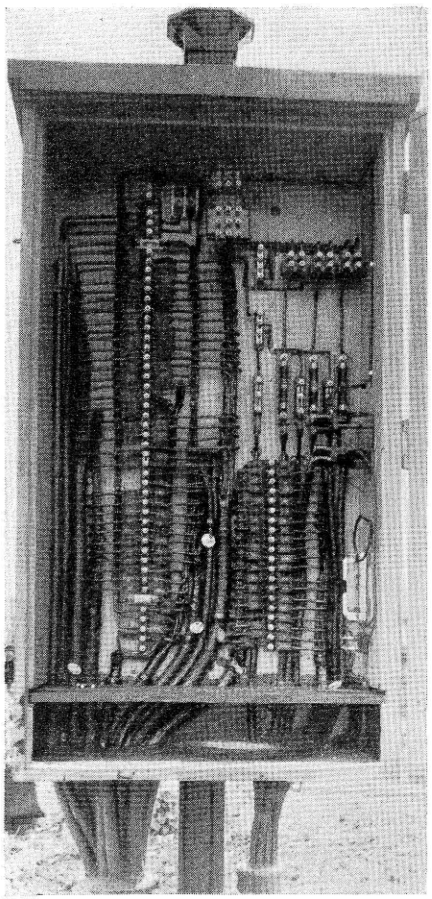
New Interlocking at Windsor, Ont.

(Continued from page 637)

Underground parkway type cable was used to install an entirely new wiring distribution system between the signals, switches and the instrument room or house. Between the west end of the Electric Yard and Tower 3, aerial cables are used including two 19-conductor, one 12-conductor cable No. 12 and a single conductor No. 6. These cables are about 2,200 ft. long and are supported on poles spaced 100 ft. apart, using Copperweld stranded messenger and Raco cable strap hangers. The messenger is grounded at each end and at the middle point.

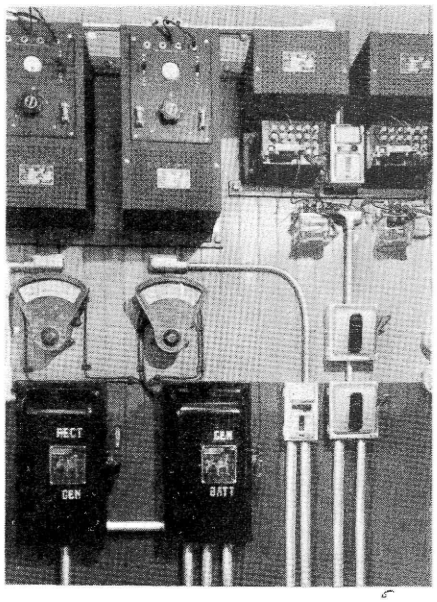
Instrument and Battery Housings

A room 18 ft. by 8 ft. 9 in., in the southeast corner of the Windsor station building was used to house the relays and other accessory equipment required at the control station of the Windsor plant. Another room 11½ ft. by 12 ft., which was partitioned off in one corner of the baggage room, is used to house the storage batteries. Near the location of old Tower 2, an 8-ft. by 10-ft. sheetmetal house was provided to include the relays, batteries and accessory equipment required in the plant controlled from Tower 3.



Junction box near signal 12 LA

On account of the fact that 600-volt d-c. traction energy is used on the rails, the track circuits are of the a-c. type. As a part of the improvements, the old galvanometer type a-c. track relays were discarded, and new Type-N vane a-c. track relays were installed. These track relays for the Windsor plant are all in outside relay cases and are repeated by Type-B d-c. plug-in relays in the relay room at the station, and those in the yard interlocking are all in the sheetmetal house.



Battery charging apparatus

Quick-Detachable Relays

The control relays of the interlocking systems are all of the G.R.S. Type-B quick-detachable plug-in type and are mounted in panels supported in angle-iron frames which rest in rubber shock absorbers on the floor. The small relays for the control of the NX networks and the various indications on the control panel of the Windsor plant are the G.R.S. Type-A, quick-detachable type, and are mounted in sealed cabinets with transparent covers.

These new interlockings were planned and installed by signal forces of the Michigan Central, under the direction of R. E. Green, assistant signal engineer. L. Rupert, circuit engineer, was assigned to this project to develop the plans and inspect the construction and installation. F. M. Brown, signal supervisor, had general supervision of the construction. The new control machines, signals, relays, rectifiers and replacement parts for the switch machines were furnished by the General Railway Signal Company.