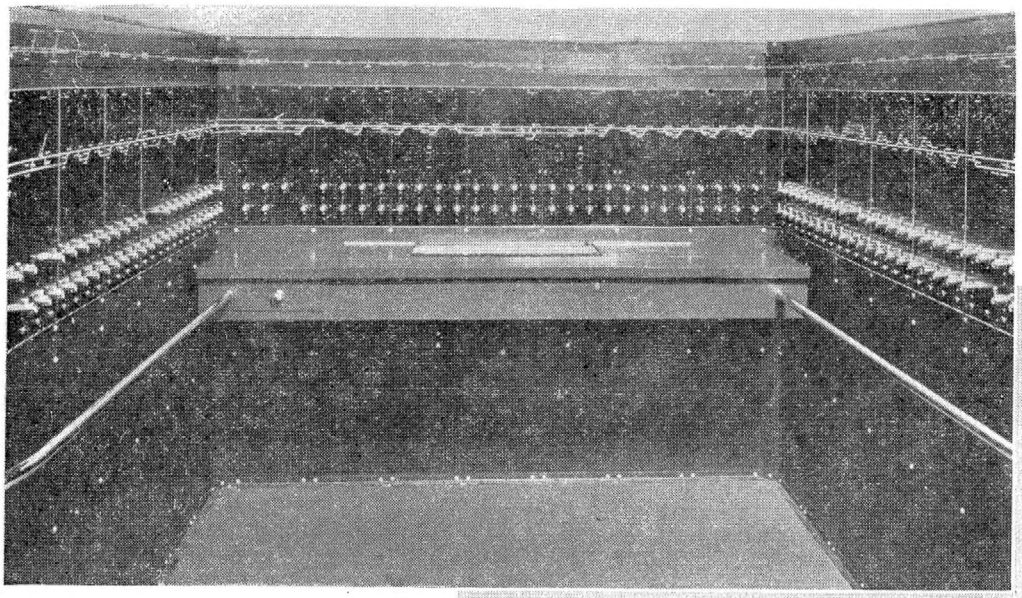
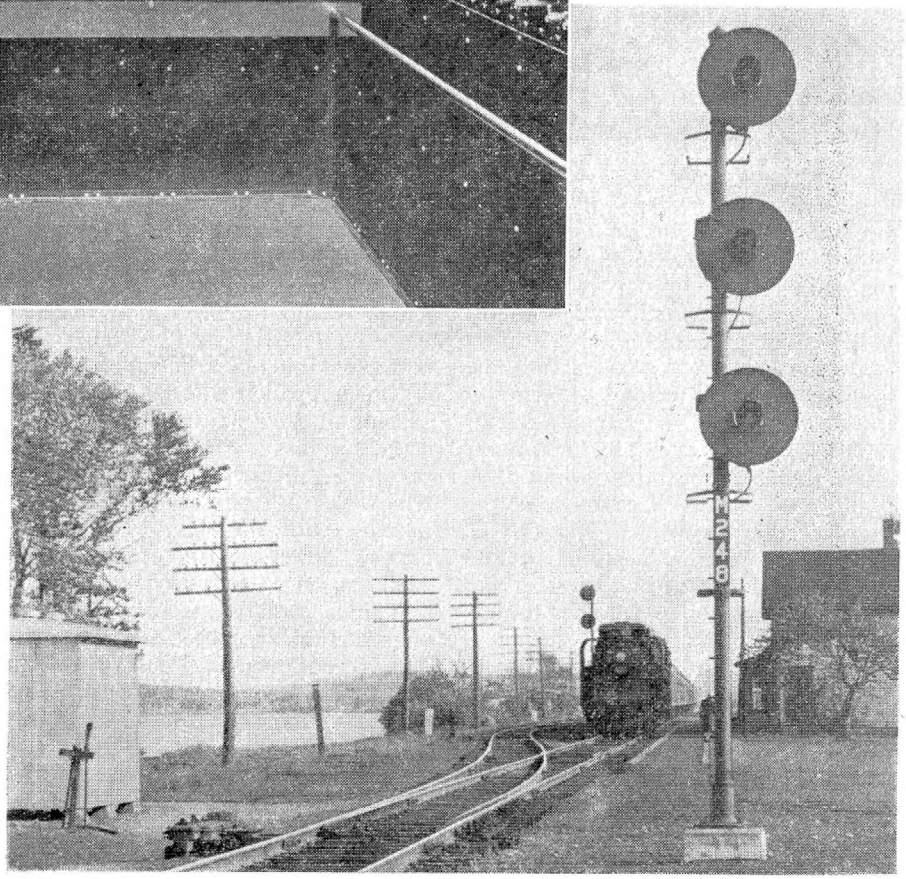


The C.T.C. machine at Moncton controls 124.7 miles. Below — Westbound Ocean Limited at Folly Lake depot



Project between junctions near Moncton, N. B., and Halifax, N. S., has increased the track capacity and saved train time on a line which handles large volumes of war traffic

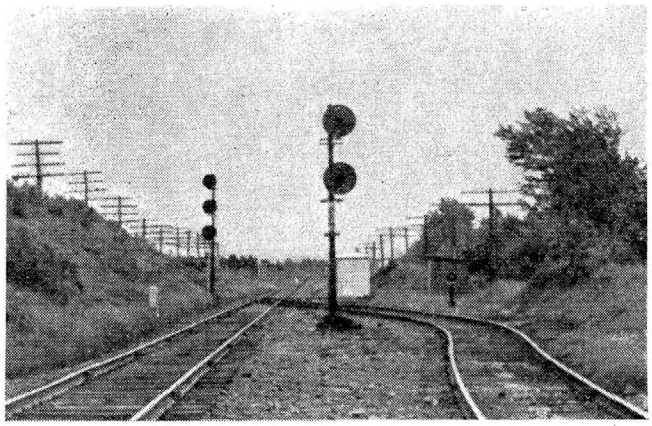
C.T.C. On 185 Miles on Canadian National

As a means for increasing the track capacity and reducing train delays on a very busy territory, the Canadian National Railways installed centralized traffic control on 185 miles of line, mostly single track, between Catamount, N. B., which is 12.1 miles west of Moncton, N. B., and Windsor Junction, which is 16 miles west of Halifax, N. S. Included in this territory is an operating district 124.7 miles long, between Moncton, N. B., and Truro, N. S., and the benefits of the centralized traffic control, given as follows, apply to this section.

Comparing operation for March, 1941, with those for March, 1943, the average overall speed of through freight trains was increased from 13.84 m.p.h. to 18.06 m.p.h., i.e., from approximately 9 hours overall time to 6 hours 54 minutes. These savings were made in spite of the fact that 115 more trains were operated in March, 1943, than for the same month in 1941. Comparing the corresponding months, the gross ton miles increased from 134,955,395 to 154,749,549, or 14.67 per cent, and the net ton miles increased from 62,932,913 to 77,350,643, or 22.9 per cent.

An engineman who has been running freight trains on this division for several years stated that under the previous practice of using timetables and train orders with hand-throw switch stands, about 10 to perhaps 12 hours would be required to run a freight train either way between Moncton and Truro, whereas, with the centralized traffic control, he recently made a run in 6 hours, in which he passed 2 trains and met 12 trains. In some instances, he has made the run in 5 hours. A freight conductor, when asked his opinion, expressed a statement to the effect "Give us but one meal a day if you must, but leave the C.T.C. in service."

One of the dispatchers explained that the saving in train time was due in part to the power switch machines and in part to the use of signals rather than timetables and train order to



Typical layout showing siding thrown to 21 ft. centers to locate signal between the two tracks.

authorize train movement. For example, with the power switches a train on a siding can pull out, proceed on the main line, and enter another siding, in a period from 20 to 25 minutes more quickly than if hand-throw switches were in service. With the previous practice, trains had to get in the clear of superior trains at least 10 minutes, or clear ahead of the time of other trains at the next siding. The illuminated track diagram and the graphic train recorder on the C.T.C. machine shows the locations of and progress being made by trains, so that the dispatcher knows whether time is available to advance trains for close meets, which can be done safely with the signal protection. As a result approximately half the meets are so closely timed that neither train stops. Figuring the saving due to the power switches and to close meets rather than long waits on sidings, it is easy to see how the C.T.C. can be used to save a couple of hours or more for freight trains in either direction between Moncton and Truro.

Train Orders Before

With the previous practice, a dispatcher would issue from 45 to 65 train orders in eight hours on the 65 miles between Moncton and Springhill Junction. In some instances, orders simply could not be issued fast enough, and, as a result, trains would be waiting at some places for orders. On some occasions when superior trains were running late, freight trains would wait for extended periods of an hour up to two hours on some sidings because orders could not be issued and delivered. On the other hand, with C.T.C. in one instance there were 22 "trains on the board" between Moncton and Amherst East, 49 miles, which allows an average spacing of 2.2 miles to the train. Nevertheless by careful manipulation these trains were all "getting signals" which means that they were all kept moving with no delays on sidings.

Any other means of increasing track capacity, such as installing second track, would have taken years of construction, if the material could have been secured. However, the centralized traffic control was installed in five months on the entire Moncton-Truro territory, thus giving relief quickly.

Location of C.T.C. Territory

The general location of this territory between Halifax and Moncton is evident by a study of a map showing the extent of the 24,000 road miles of the Canadian National Railways between the ports of Halifax and Sydney on the Atlantic Ocean, westward through Truro, Moncton, Quebec, Montreal, Toronto, Winnipeg and Jasper to Vancouver and Prince Rupert on the Pacific Coast.

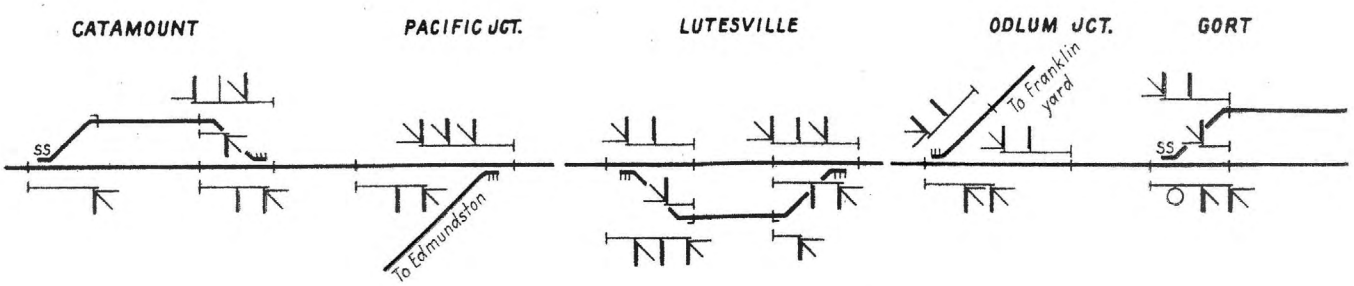
In normal times, ocean liners come and go at the port of Quebec, which is at tide water, although 832 miles from the ocean. Many ocean freight vessels likewise dock at Quebec, while many more use the St. Lawrence river up to the city of Montreal or on up the Great Lakes to various inland ports. In the winter, however, between December and March, navigation is closed on the St. Lawrence and the Great Lakes, whereas the port of Halifax is open water the year around.

War conditions resulted not only in a shortage of ships but also in the desirability to minimize the mileage of shipping routes although this resulted in increases in rail haul. A third factor is that overall time, as for example between Montreal and Liverpool, can be reduced by increasing the rail mileage and reducing the ship mileage. A further factor is that the difficulty of locating submarines in the Gulf of St. Lawrence made it impracticable to use these waters for shipping. All of this leads to the fact that as Canada increased its war program, more and more eastbound traffic was routed between various parts of the Dominion and the port of Halifax on the Atlantic Ocean. Westward traffic consists of fruit and agricultural products from Nova Scotia, as well as coal and steel from Sydney. Coal is mined on a branch line and delivered to a yard at Springhill Junction, and likewise coal from a branch line is delivered to a yard at Maccan.

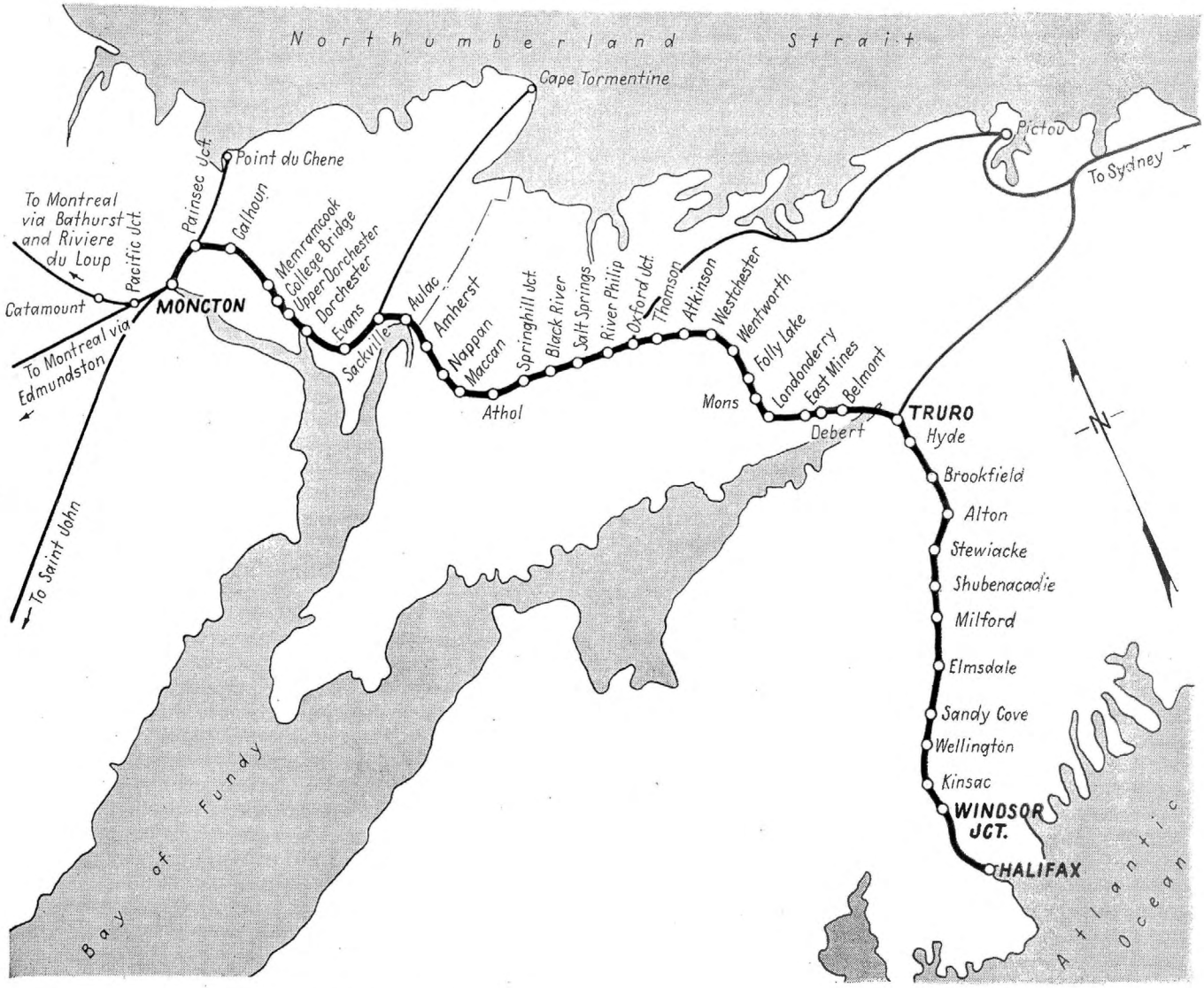
Only One Railroad to Halifax

The 124.7 miles of line between Moncton and Truro is the only railroad traversing the isthmus which connects Nova Scotia to the continent proper. With the Bay of Fundy to the south and the Northumberland Straits and the Gulf of the St. Lawrence to the north, the line across the isthmus, which forms the boundary between Nova Scotia and New Brunswick, is 18.5 miles long. The railroad crosses this boundary at the Missiguash river near Amherst, about 45 miles east of Moncton.

Near Moncton, three railroad lines converge. One line, extending north and east via Bathurst and Riviere du Loup to Montreal, handles the through passenger trains and local freight. The second line, extending



Track and signal plan of the C.T.C. territory from Moncton west to



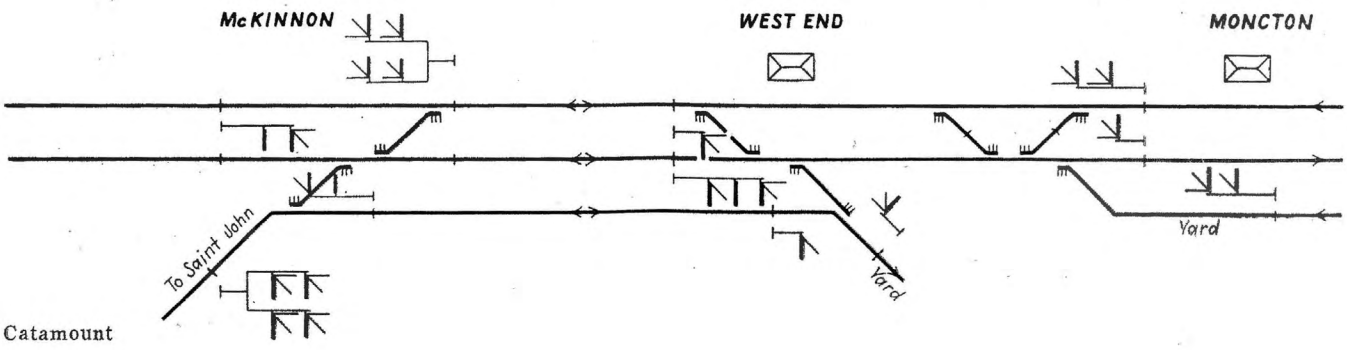
Map of the C.T.C. territory on 185 miles between Catamount, N.B., and Halifax, N.S

from Moncton west through McGivney, N. B., and Edmunston, N. B., to Montreal, handles most of the through freight. A third line from Moncton extending south to Saint John, N. B., handles local traffic as well as through business to and from Boston, Mass., and other points in the United States.

At Truro, N. S., 125 miles east of Moncton, the principal main line extends south 64 miles to Halifax, and a second line extends north and east 22.4 miles to Sydney, N. S., on Cape Breton Island. Thus the territory between Moncton and Truro is a busy section, with traffic to and from various points to the west converging at the one end, and likewise Truro is a converging point for traffic to and from various centers and ports in Nova Scotia.

Not only from the standpoint of heavy traffic but also on the basis of numerous curves up to 4 deg., long heavy grades, and total rise and fall of line, the 125-mile section between Moncton and Truro is said to involve the most difficulty in train operation of any similar mileage on the Canadian National Railways, except for sections in the Rocky Mountains in Alberta and British Columbia. In consideration of all these physical difficulties, the benefits effected by the centralized traffic control are all the more striking.

The reasons for the long grades and large total rise and fall is that the



track is only 25 to 30 ft. above tide water at several places while between these points the line passes over ridges varying from 225 to 615 ft. above sea level. The mile-post numbers read west from Truro. Two miles west of Truro the railroad crosses the North River at elevation 40 ft. above tide water. Between this bridge and the crest of a grade at M.P. 4, there is about 1 mile of 1 per cent grade ascending westward. Between M.P. 4 and East Mines, about 9.5 miles, the line is slight rolling and in general ascending westward to an elevation of 200 at East Mines. Between East Mines and Folly Lake, 11.1 miles, the line ascends from 200 ft. to 615 ft. elevation, with grades ranging up to 1.47 per cent. This is the ruling grade westbound on the eastern half of the territory, the normal tonnage rating for freight trains being 1,930 tons. From Folly Lake the line descends westward for about 23 miles to an elevation of 100 ft. at Oxford Junction. In this section the ruling ascending grade eastward varies from 0.8 to 1.11 per cent for 2 miles through and just east of Westchester. The tonnage rating fixed by this grade is 2,420 tons.

Between Oxford Junction and Springhill Junction, the line is rolling with some short grades about 1,000 ft. long ranging up to 1.1 per cent. The elevation is 270 ft. at Black River siding and then decreases to 200 ft. at Springhill Junction and to about 85 ft. at a point 2.1 miles west of Springhill Junction West. In this 2.1 miles which is a ruling grade eastward, the grade is 0.9 to 1.05 per cent all the way, the tonnage rating being 2,300 tons.

From Maccan through Nappan the grade is slightly rolling and at elevation ranging from 25 to 50 ft. Just east of Amherst the elevation is 105 ft., sloping down to 25 ft. on the marsh just west of Amherst. Between this point and Sackville, about 10 miles, the line is on marsh land in the valleys of the Missiguash and the Sackville rivers at elevations ranging from about 25 ft. to 35 ft. Starting at an elevation of 40 ft., two miles west of Sackville, the line ascends westward for 3.8 miles to 225 ft. at Evans, this being a ruling grade westward. This grade includes five long curves, one 2 degree, three 3 degree and one 3 degree 30 minutes. The rating fixed by this grade is 2,260 tons.

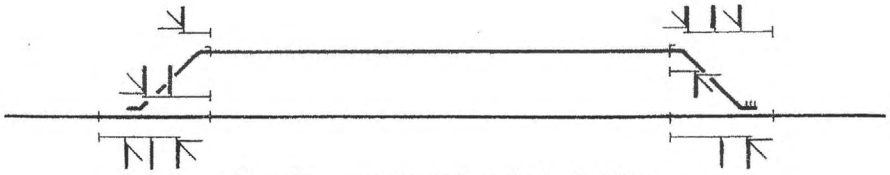
From Evans to Dorchester the grade descends westward practically all the way for 4.5 miles, and much of this is from 1.00 per cent to a maximum of 1.25 per cent. In addition the curvature is bad, there being five curves ranging between 2 degrees and 3 degrees, five curves at 3 degrees 30 minutes, and one at 4 degrees. This section of 4.5 miles from Dorchester to Evans is the ruling grade eastward on the west half of the Moncton-Truro territory, the tonnage rating being 2,040 tons.

For about 10 miles from the east end of Dorchester to a point west of Memramcook, the line is on marsh land in the valley of the Memramcook river at an elevation ranging from 20 ft. to 30 ft. Between Memramcook and Painsec Junction the line passes over rolling country with some short grades up to 1 per cent. With an elevation of 150 ft. at Painsec Junction, the line descends to 50 ft. at Moncton.

Between Moncton and Truro there are three junctions with branch lines. At Painsec Junction a line extends 11.6 miles to Point du Chene. At Sackville, N. B., there is a junction with a line extending 36 miles to Cape Tormentine, car ferry service being operated across the Northumberland Strait to Borden for connection with rail lines on the Prince Edward Island. At Oxford Junction, a line extends 81 miles north and east via Pictou to connect at Stellarton with the main line between Truro and Sydney.

Large Volume of Important Traffic

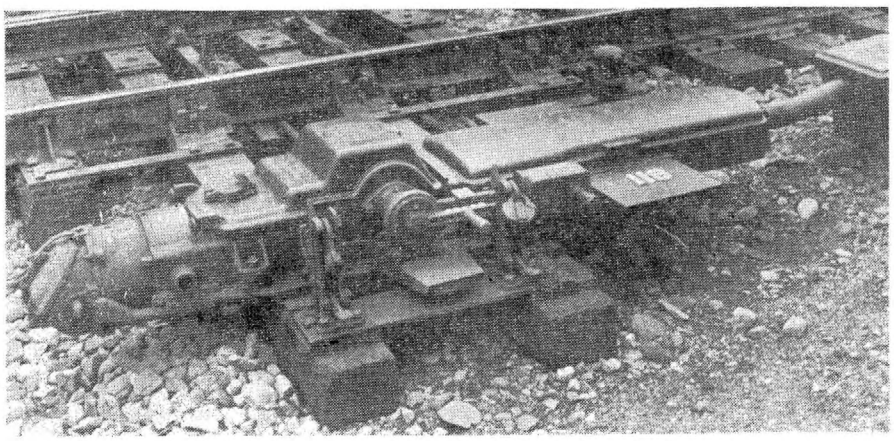
Three scheduled through passenger trains are operated each direction daily, and a second section of the Ocean Limited in each direction daily has been operated since early in the war. Each train consists of about 14 cars with a maximum of about 16. Two passenger trains, one in each direction daily, to and from the Tormentine-Prince Edward Island line, use the C.T.C. territory between Moncton and Sackville.



Signaling arrangement at typical siding

Approximately 15 through freight trains are operated in each direction daily. The local freight trains operate on short runs, but in effect there is a way freight each direction daily except Sunday on the entire territory. A switcher crew makes a round trip from Truro to Debert and East Mines daily, and similarly a switcher crew with headquarters at Sackville works out to Amherst and returns to Sackville daily. A large coal mine is located on a branch line out of Springhill Junction, and certain trains set out empty cars and pick up loaded cars at the yard which lies to the south of the passing track.

On an average day, therefore, the traffic on the Moncton-Truro territory includes 8 through passenger trains, about 30 through freight trains, and 10 to 20 local freights, branch passenger, switcher moves, mine pickups and work trains, totaling anywhere from 50 to 80 train movements, some of which are not over the entire territory. For example on June 2, 1944, there were 78 train movements on this territory.



The power switch machines are of the dual-control type

Track Layout and Sidings

The arrangements at the ends of double track, at special siding layouts and junctions are considerably more complicated than a conventional single-track line with a succession of

single siding layouts. Therefore, from the standpoint of track arrangements, switch operations, signaling and the control of train movements by signals, this Moncton-Truro territory includes numerous practices that may be applicable to similar problems elsewhere.

Double track extends through Moncton and to Painsec Jct., 7.2 miles east of the station at Moncton. Similarly double track extends 7.5 miles westward from Truro to Belmont. Also double track extends between Maccan and Springhill West, 9 miles. Thus the three sections of double track total 24 miles, the remaining 100 miles between Moncton and Truro being single track.

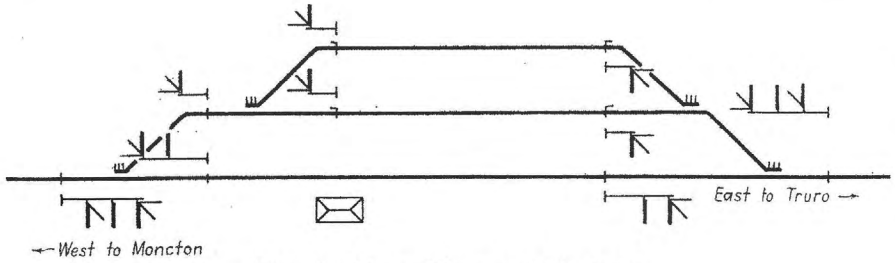
On the sections of single track between Painsec Junction and Maccan, as well as between Springhill and Belmont, there are sidings at the towns which are indicated by dots on the accompanying map. Also extensions of second track form single sidings at Painsec Jct., at Maccan, and at Springhill. Except for a few instances, the turnouts at the sidings are No. 12.

With certain exceptions, the single sidings have capacities ranging from 60 to 70 cars. At Evans, there is a long siding with two crossovers near the middle at the crest of the grade from each direction. This arrangement saves time when a train has to double the hill either way up to Evans. Similarly there is a long siding with crossovers at Springhill Junction and at Sackville. At Folly Lake, there are two sidings both on the north side of the main track. At Upper Dorchester there is a siding on each side of the main track. At Folly Lake, trains are routed to the right-hand siding, i.e., westbound trains take the siding on the north side, and eastward trains take the siding between the main track and the westward siding. For this reason the main track station-entering signals are the same as at a single siding. Similarly at Upper Dorchester, the main track signal governs to the siding to the right in each instance.

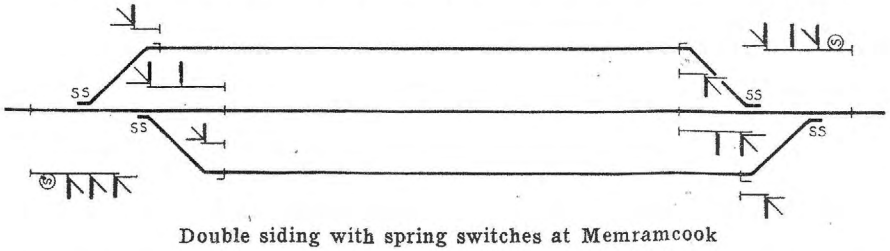
With certain few exceptions, the centralized traffic control includes electric switch machines at the siding switches, at the ends of double track, and at the crossovers. The distance between Dorchester and Upper Dorchester is only 2.7 miles, and from Upper Dorchester to College Bridge, 2.8 miles. For these reasons, with the C.T.C., there is not much occasion to use the sidings at Upper Dorchester for the passing of through trains. Therefore, the switches of these sidings, one on each side of the main track, are equipped with spring switch mechanisms rather than switch machines. Similarly, spring mechanisms were installed at the switches of the single siding at River Philip, and at Memramcook.

Signaling Arrangements

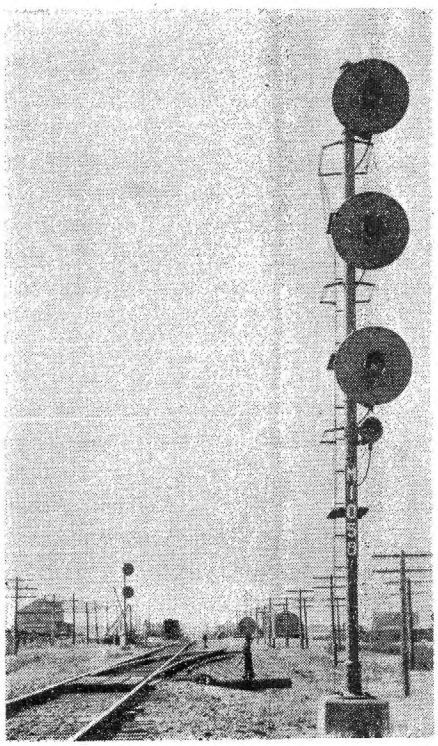
The signals are the searchlight type, and the C.T.C. controlled signals display aspects which are the same as those which are standard for interlocking home signals on the Canadian National. At the end of a power-operated siding, the station-entering signal has three signal units. The upper unit displays three aspects which apply to straight through train movements on the main track. The middle unit is a fixed red marker to represent a medium speed route which does not exist in such a layout. The bottom unit is a searchlight mechanism which normally displays red, but when the switch is reversed, this unit displays yellow under two reds, indicating proceed at slow speed into a siding.



Layout of two sidings at Folly Lake



Double siding with spring switches at Memramcook

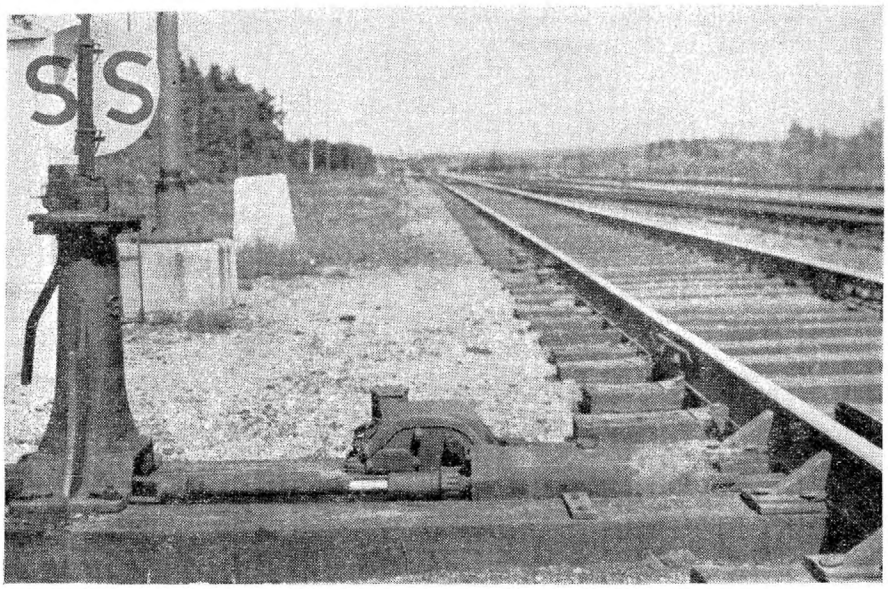


Station signal with a spring switch "S" marker

At the end of double track at Belmont and at Maccan, with the power switch set to route a train from the single track over the diverging turnout to the right hand main track, the top unit of the signal displays green, which indicates proceed on normal route. These turnouts are No. 12, and the rules specifically limit the speed for such movements to 20 m.p.h.

Siding Signals at Right of Track

The main-track station-leaving signals each have two units, the upper being a three-aspect searchlight unit, and the lower is a red marker to complete the standard "Stop" aspect. These leave-station main-track signals are on masts at the immediate right of the track governed, at a point opposite the fouling on the turnout. Where a siding is on the north side of the main track, as for example at Wentworth, the west end of the siding was thrown over to 21 ft. centers to allow clearance between the tracks to locate the signal at the immediate right of the main track. Where sidings are on the south side of the main track, the east end of the siding was thrown over to allow clearance. On account of the crossovers between the main track and the eastward siding at



Spring switch at east end of the east crossover at Springhill West

Sackville, it was not practicable to throw the siding. Therefore, mainline signal M86.8 is a two-unit dwarf located between the main track and the siding.

The leave-siding dwarfs are searchlight mechanisms, mounted on 2-in. pipe masts to bring the center of the lens 36 in. above the level of the base of rail for such signals between tracks at 13 ft. centers, or at 48 in. above the level of rail for a dwarf on the field side of the siding. These extra high mountings are used to minimize interference by snow.

Signaling at Spring Switches

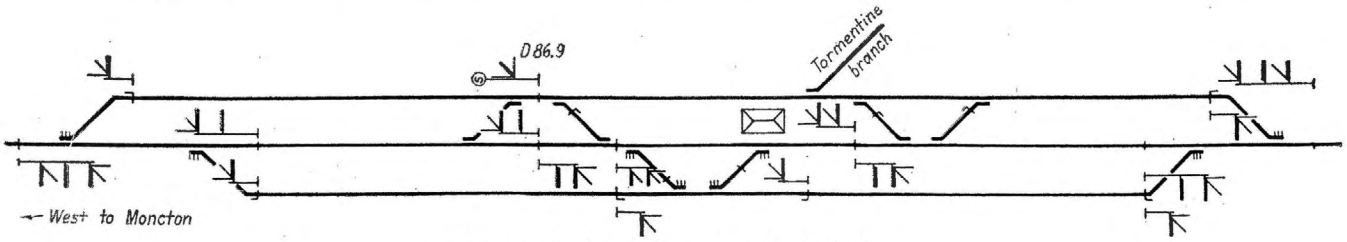
When a train is to be directed to stop and enter a siding equipped with a spring switch mechanism, as for example at the west end of Memramcook, the station-entering signal M105.8 is controlled to display an aspect of red over red over red over a lighted unit outlining a letter "S" on a black background. This aspect indicates that the train is to stop, that the head brakeman is to throw the hand-operated stand to reverse the switch. When the switch is reversed, the signal will display an aspect of red over red over yellow, directing the train to enter the siding, after which the switch is placed normal. When the train is to depart, the leave-siding signal displays the usual aspects, and the train trails out through the spring switch without stopping.

Sackville Was a Busy Place

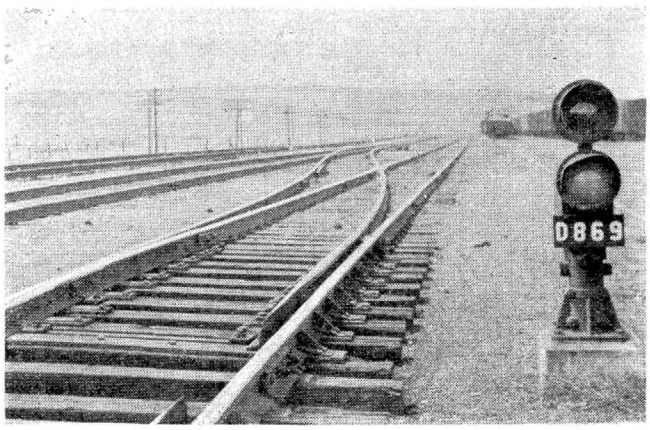
At Sackville, the branch line from Cape Tormentine makes a junction with the siding which lies to the north of the main track, this junction switch being operated by a hand-throw stand. This is a long siding, about 1.6 miles in length, with a power switch at each end, and a set of hand-throw crossovers connecting to the main track at each end of the station platforms.

A westbound passenger train from Cape Tormentine can use the west portion of this siding to enter the track through the power switch, or if this part of the siding is occupied, and the dispatcher is to authorize the train to enter the main track at the hand-throw crossover west of the station, he controls dwarf signal 86.9 at the crossover to display an aspect of a letter "S" over red. This authorizes the trainman to reverse the crossover switches, after which the letter "S" is extinguished and a yellow or a green aspect is displayed on the dwarf, depending on whether one, or two or more, automatic blocks ahead are clear. After the train enters the main track, the crossover switches must be placed normal. Normally the dwarf signal 86.9 displays a yellow aspect.

The C.T.C. controlled signals for each direction on the main line are located at each end of the station platform limits so that with a passenger train standing at the station within these signal limits, a second train, as for example an eastbound Cape Tormentine train, can be brought up to the hand-throw crossover to enter the siding. Such a move would be made if the west part of the siding north of the main track were occupied. A second siding, having a total capacity of 146 cars, is



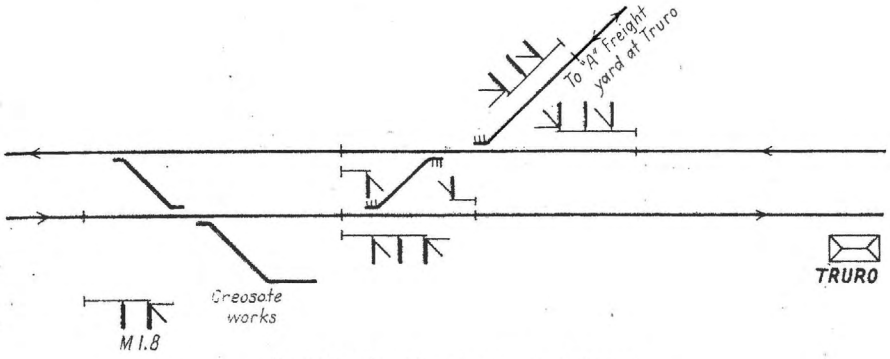
Track and signal plan through Sackville



Signal at hand-throw crossover at Sackville

located south of the main track. This siding has a power switch at each end and a set of two power-operated crossovers at the center.

When operating with timetables and train order, Sackville was frequently congested with trains, especially at noon time when two through passenger trains meet here.



Layout of hold-out signal at Truro

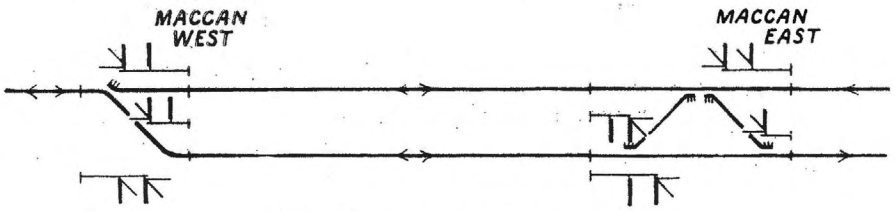
With the C.T.C., however, the train movements are directed more efficiently, thereby preventing delays and congestion at Sackville.

Hold-Out Signal at Truro

About 2,700 ft. west of the station at Truro there is a junction switch leading from the westward main track to the freight yard. West of this switch there is a crossover between the main tracks. These power switches and associated semi-automatic signals constitute the C.T.C. field station which is the most remote from the control office at Moncton. West of this crossover there are several industries and especially a large creosote plant which is served by a spur from the eastward main track. In order to protect switching moves on this track, eastward signal M1.8, which is 5,500 ft. west of the crossover, can be held at the Stop aspect by the C.T.C. control, thus holding out eastbound trains, until the switcher can clear the main track.

Maccan Layout

In order to get the equivalent of a passing track at Maccan, a set of two power crossovers were installed at M.P. 68, at the east end of Maccan, shown as Maccan East, and the signaling is arranged to run trains in either direction on either of the two tracks between Maccan East and Maccan West. One reason for not moving the end of double track eastward to the new crossovers was that the single switch at Maccan West is so located that an eastbound train can pass through this turnout and get a run for a 0.7 per cent grade that starts at Maccan East, M.P. 68, and extends 4.5 miles to Springhill West.



Either-direction running at Maccan

Springhill Junction

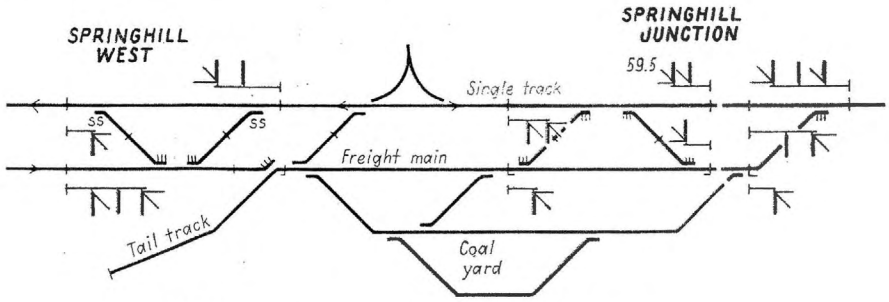
All trains take coal and water at Springhill Junction. In many instances the freight trains set out or pick up cars at this stop. The eastbound passenger trains cross over at Springhill West and use the "north" track from Springhill West to Springhill Junction as single track. The switch at the east end of this crossover is equipped with a spring mechanism, the points being set normally for westbound train movements from the single track to the right-hand track west of this crossover. Therefore, for an eastward train movement from the eastward main track over this crossover to the single track, the train springs the points.

The eastbound passenger train engines are cut off at the station and are run ahead to get coal and water. The train is left west of the controlled crossovers at the station, and the engine moves to the coaling plant east of the controlled limits. Under this circumstance, the dispatcher can clear the low-speed signal to permit the engine to return to its train. This is a so-called "Call-on" aspect, but under no other circumstances can this aspect be displayed on this signal with the main track occupied.

Eastbound freight trains approaching Springhill West are routed to the so-called freight main which is a continuation of the second main track. This freight main is adjacent to the yard so that cars can be set out or picked up without interfering with the movement of other trains on the single-track main line. Westbound freight trains, likewise, are routed to this freight main, and, when ready to depart, they use the west crossover at Springhill West. This crossover has a power machine at the east end but a spring mechanism is used at the east end because no selection of routes in the facing-point direction need be made at this switch.

Runaway Protection

The crest of the grade is about midway between Springhill Junction and Springhill West, and from Springhill West the grade descends at about 1 per cent for 2.6 miles. Years ago a string of cars drifted west from Springhill Junction, down the eastbound main track and met an eastbound passenger train. For this reason an extra switch, leading to a tail track, was installed in the so-called freight main just east of Springhill West. This switch is normally set to divert westbound



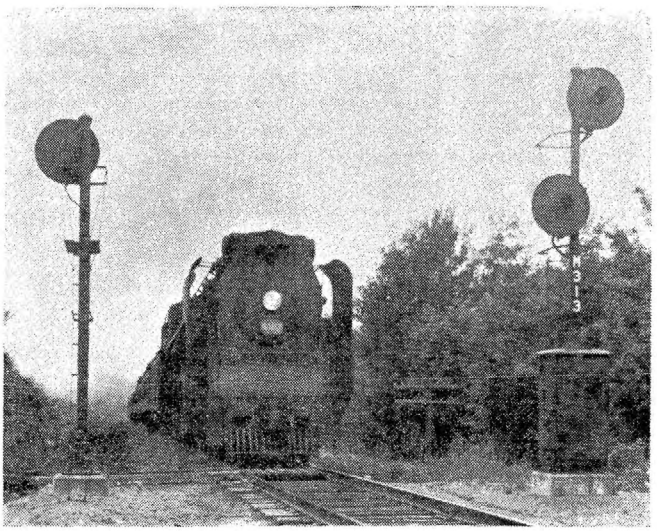
Track layout between Springhill West and Springhill Junction

cars to the tail track. When an eastbound freight train is to be routed to the freight main, the west switch of the east crossover at Springhill West is lined accordingly but the signal does not clear until the train is about 4,000 ft. from the signal, at which time the derailing switch is automatically reversed and the signal clears. After the rear of the train clears the derailing switch, the switch automatically returns to the derailing position without any action on the part of the dispatcher.

A Westbound Move

For a westbound train movement from the freight main to the westbound track on the double track, the dispatcher sends out a control to the east switch of the crossover, and a trainman, in telephone conversation with the dispatcher, pushes a control button in the telephone booth. This combined control causes the derailing switch to be reversed; then the signal clears for the train to depart. As soon as the rear of the train clears the detector track circuit, the derailing switch returns automatically to its normal derailing position to divert cars to the tail track.

To provide runaway protection for a westward freight stopping on the main track to pick up or set out at the west end of the yard, a hand-operated crossover was installed between the main track and freight main track just east of the end of double-track crossover. This crossover and the tail track are used for the movement. The hand-operated crossover is left reversed throughout the movement so that if cars should run away, they would enter the tail track. This crossover is also used for locomotives turning on a wye located at that point.

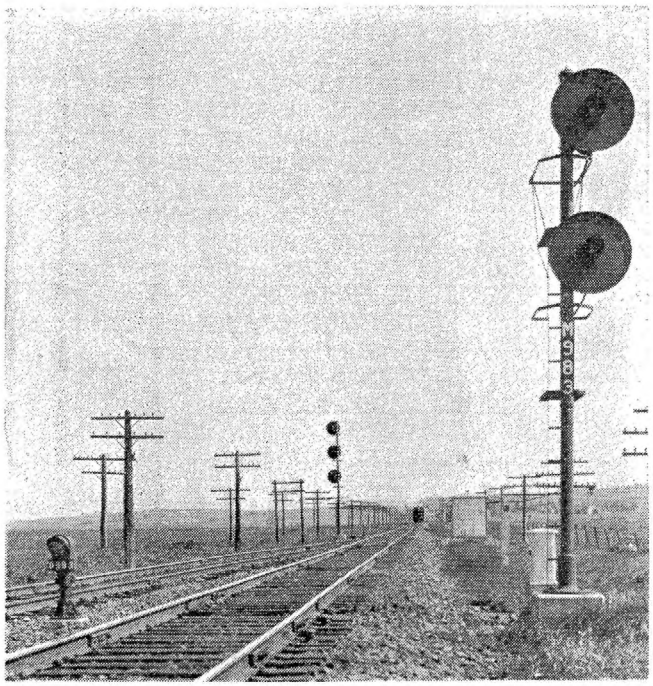


Four-aspect intermediate Signal M313

Special Arrangements of the Intermediate Signals

Where the distance between sidings is comparatively short, as, for example, 1.8 miles between Debert and East Mines, or 2.7 miles between Mons and Folly Lake, no intermediate automatic block signals were installed, there being a total of seven such instances on the Moncton-Truro section. In these cases, the manual block as well as automatic block is from station-to-station, and the semi-automatic leaving signal at one siding acts also as a "distant" signal to the semi-automatic station-entering signal at the next siding.

Where the distance between sidings ranges from 3 miles, as for example between East Mines and Londonery, to 4.2 miles between Wentworth and Westchester, there is one double location of intermediate signals. On the Moncton-Truro territory as a whole, there are a total of 13 such station-to-station blocks with one double location of intermediates. On the 31 miles of single track between Painsec Junction and Sackville, semaphore automatic signaling was in service previously, and in this section the intermediate signals were left as they were until after the war.



Typical dwarf and high signal at the end of a siding

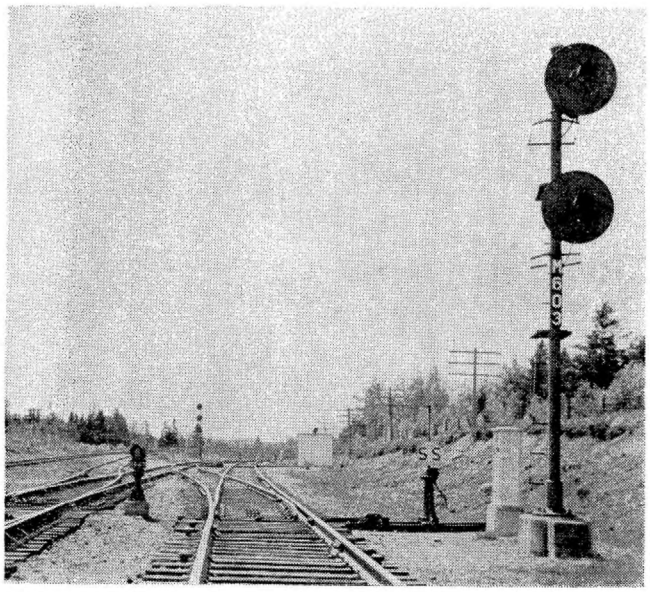
Yellow-Over-Yellow Aspect

Where the siding is short or where the grades are descending so that there would not be train braking distance between the signals at the two ends of a siding, then the signal in approach has two searchlight mechanisms. It normally displays the yellow-over-red, Approach, aspect, but if the signal ahead is displaying the Approach aspect then the "distant" signal displays the yellow-over-yellow, Advance-Approach, aspect, which indicates proceed prepared to stop at the second signal. On these double-"arm" intermediate signals, the upper unit is to the right of the mast, and the lower one is to the left, thus presenting a "stagger" of the two lamps. If the most restrictive aspect, red-over-red, is being displayed, this "stagger" designates that the aspect is "Stop and Then Proceed" in contrast with the two red lamps in a vertical row which indicates "Stop." The intermediate signal displays the Approach aspect, regardless of whether the station-entering semi-automatic signal ahead is displaying the Stop aspect or the red-over-red-over-yellow aspect to direct a train to enter the siding.

Prior to the C.T.C. installation, train movements were authorized by

timetable and train orders, and, prior to the war, one dispatcher handled the Moncton-Truro section, but after the war traffic increased, two dispatchers were required, one for the Moncton-Springhill section and one for the Springhill-Truro section. These dispatchers were located in the office at Moncton.

In a similar manner, the one C.T.C. control machine in the dispatcher's office at Moncton now controls the entire 124.7 miles of territory between Moncton and Truro. On account of the heavy traffic which has been handled since the C.T.C. was placed in service, two dispatchers have been assigned on each trick to operate this machine.



Westward signals at east end of the east crossover at Springhill West

As shown in one of the illustrations, the machine is arranged in a "U" with a center panel and two wings which are 6 ft. 3 in. apart, thus allowing space for the two dispatchers to be seated at their work. Normally, one dispatcher handles the Moncton-Maccan section, and the other handles the remainder to Truro. The C.T.C. code line circuits between the office and the field stations are arranged so that the two dispatchers can work independently.

The illuminated track diagram on the C.T.C. control machine has lamps which indicate occupancy of all portions of the main track. Ordinarily one lamp indicates occupancy of a section of single track between sidings. The longest time block is eastward from Dorchester to Evans which is a ruling grade. To assist the dispatcher in knowing the progress being made by a train on this grade, there are two track-occupancy lamps for the Dorchester-Evans block, so that he will be informed when the train is half way up the hill.

On the diagram, the lines representing the passing tracks include holes, in which token plugs with tags are inserted by the dispatcher as a reminder that the corresponding siding is occupied by a certain train. The tags have arrows which indicate the direction which the train is headed. A red tag indicates a through freight, white a passenger train, yellow a way freight, green a work train, and blue for special purposes.

Electric Train Graph

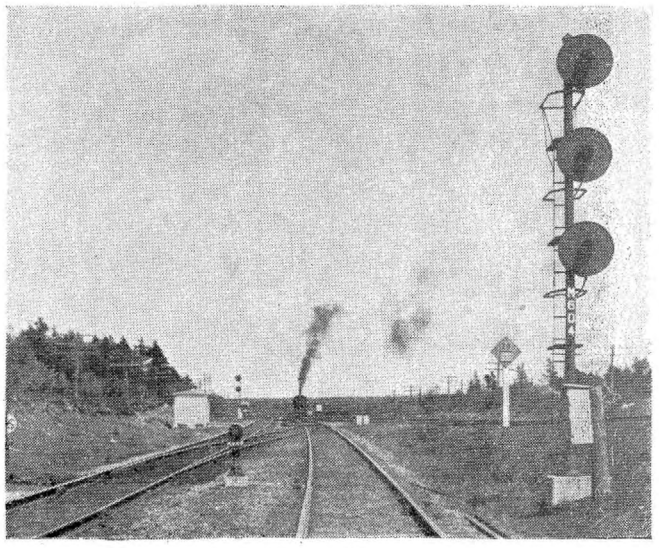
An all-electric graphic train recorder is mounted in the desk portion of the control machine. The recorder sheet moves at the rate of 2 in. per hour. When a train occupies any one of 58 OS track circuits, a corresponding stylus is energized with a-c. current of proper voltage to burn a mark on the paper chart. At his convenience, the dispatcher connects these marks with pencil lines, thus completing a record of the train movements in the form of a time-distance chart.

On a separate heading sheet, a record is kept of the train and engine numbers, the names of the enginemen and conductors, number of loads and empties, tonnage, etc. Each morning the sheet for 24 hours is torn off the graphic train sheet, on the line representing the previous midnight, and the heading sheet is pasted to it, and this becomes the official record of train movements. The paper for the chart is 24 in. wide and comes in rolls 125 ft. long, which is sufficient for 31 days.

The Truro-Halifax C.T.C.

A second portion of the centralized traffic control, extending between Truro and Windsor Junction, includes 2.5 miles of double track between Truro and Hyde, and 45.7 miles of single track between Hyde and Windsor Junction. Double track, with automatic block signaling for right-hand running, has been in service for many years on the 15.8 miles between Windsor Junction and Halifax.

On the Truro-Windsor Junction territory, the line crosses rolling country with elevations ranging from about 40 ft., at river crossings, to a maximum of 182 ft. at a point between Hyde and Brookfield. From Milford to a point 2 miles south with elevations of 100 ft., the grade ranges from 0.5 to 0.7 per cent. The south side of this hill is about 1 mile long, ranging from 0.64 to 0.89 per cent. These are the ruling grades. The curvature is light, except on a short section just north of Wellington, where there are nine curves ranging up to 2 deg. 5 min. within a distance of three miles. As a result of the light grades and curvature,



View looking east at Springhill West with tail-track on bank at right

this Truro-Windsor Junction section is "fast track," as compared with the Truro-Moncton territory.

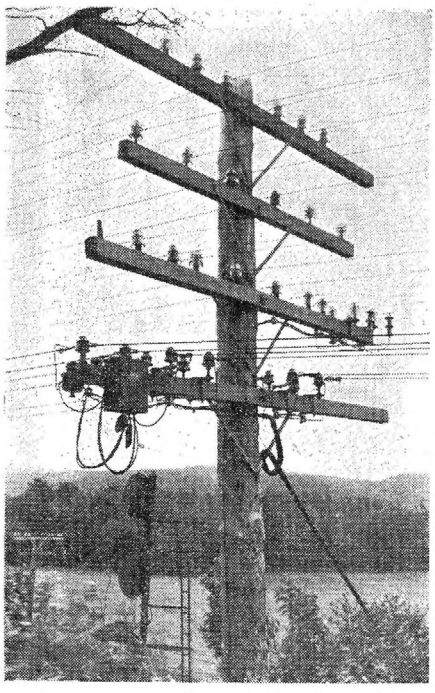
Switch Operation and Signaling

Between Hyde and Windsor Junction there are 9 single sidings ranging from 70 to 90 car capacities. When installing the C.T.C., three additional sidings were taken out of service: Lantz, between Elmsdale and Milford; Enfield, between Elmsdale and Sandy Grove; and Hilden, between Brookfield and Hyde. As part of the C.T.C. project, electric switch machines were installed at these 18 remaining siding switches. The end of double-track switches at Hyde and at Windsor Junction are operated by spring and buffer mechanisms. The turnouts at the ends of the sidings are No. 12, and those at the ends of double track are No. 20.

The signaling arrangements are practically the same as previously discussed except that rather than throwing the sidings at one end to provide clearance for the station-leaving signal between the main track and siding, the signal is installed on a bracket mast on the field side of the siding. The practice was adopted because of the weather and a lack of men as well as time to throw the track over.

One Pair of Intermediates With Four Aspects

The distance between sidings is approximately 3 miles, plus or minus, except for the instances in which sidings were removed; as for example, the distance between Milford and Elmsdale is 5.6 miles. In all instances, however, there is only one double location of intermediate signals between sidings, this practice being adopted in contrast to using more intermediates because of the comparatively high train speeds, thereby reducing the delay, if any, for a train to leave a siding after being passed by a train of the same direction on the main track.



A bottom arm was added to pole line to carry the new signaling wires

The lengths of the sidings are such that the distance between signals at the two ends ranges from 3,750 ft. to 4,250 ft., which is not considered to be adequate for train stopping distance at 65 m.p.h. For this reason, all intermediate signals are equipped with a second searchlight unit which normally displays red, but when the second signal ahead displays the Stop aspect, the intermediate displays the Advance-Approach, yellow-over-yellow aspect, which indicates "proceed preparing to stop at second signal."

Halifax Control Machine

The centralized traffic control between Truro and Windsor Junction is controlled by a machine in the dispatcher's office at Halifax, one dispatcher being assigned to the operation of this machine exclusively. In addition to 4 through passenger trains each way daily, the Truro-Halifax district also handles three passenger trains each direction daily on the run between Halifax and Sydney via Truro. On a good average day there are about 10 through freight trains and a local freight each way daily, thus, with special extra trains, the average is 40 to 48 train movements daily.

When operating by timetable and train orders, the passenger trains were given preference to the extent that during the inbound morning and outbound evening rush hours, the freight trains lost considerable time on sidings or in the yards after being ready to go. With the C.T.C. there are, in numerous instances, as many as 20 trains "on the board," and they are handled in a manner such that there is very little time lost while waiting.

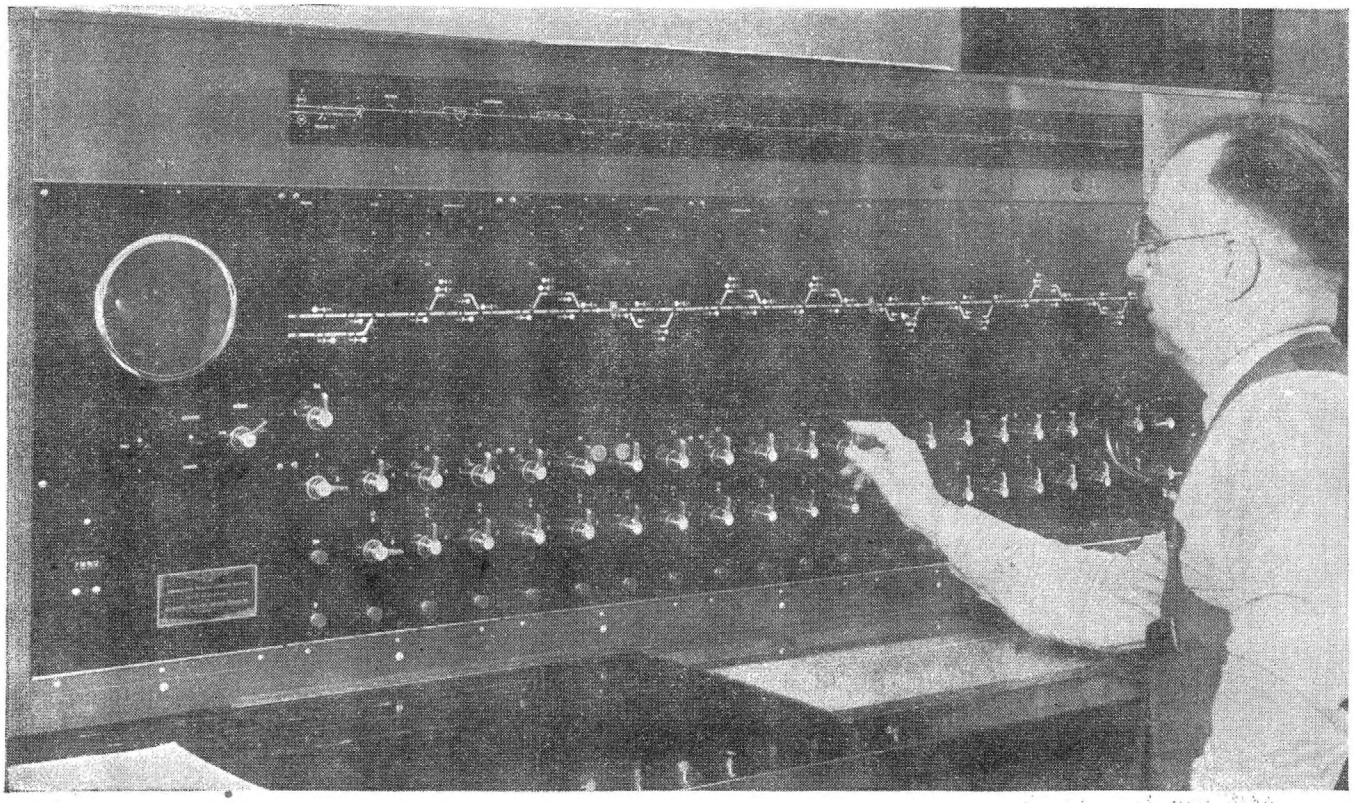
On the average, a through freight can now make the run in either direction between Truro and Windsor Junction in about 45 minutes less time than previously. The freight trains which previously lost time in the yard and which are now moved when they are ready to go, save a total of an hour to two hours or more. Considered as a whole, therefore, the C.T.C. saves an average about 1 hour and 30 minutes for the through freight trains on this 45 miles of territory.

If the passenger trains are running late they can easily make up time, and extra passenger trains can be handled much faster than previously. On certain occasions there has been a preponderance of traffic southbound into Halifax, for instance, in an 11½ hour period there were 18 extra southbound trains operated into Halifax from Truro, in addition to the regular scheduled trains. As explained by the dispatcher, this volume of traffic could not have been handled without serious delay if the C.T.C. had not been in service.

Dwarf signal on high mast on account of deep snow

C.T.C. West of Moncton

A third portion of the C.T.C. project extends west from Moncton to Catamount, 12 miles. At West End, which is at the west end of the Moncton freight yards, there is a C.T.C. control machine which includes the control of the switches, crossovers and signals from Moncton to, but not including, Pacific Junction. This territory includes, at



The C.T.C. machine at Halifax controls the Truro-Windsor Junction territory

West End, a track layout, including 4 crossovers and a yard lead switch, as well as either-direction signaling on all three tracks between West End and McKinnon, at which point there is a junction with the line to Saint John, including two crossovers. Also, the West End machine includes control of signals at the end of double track at Gort, M.P. 2.5, the control of a power switch and signals at a junction switch leading to Franklin Yard, M.P. 3.4, and the power switches and signals at a single siding at Lutesville, M.P. 5.5.

At Pacific Junction, M.P. 10.8, where the freight line via Edmunston connects with the main line via Campbellton, a mechanical interlocking was replaced with an electric plant which includes remote control for a power switch and signals at the east end of the siding at Catamount, which is 12 miles from the freight yard at Moncton. Thus the overall C.T.C. projects from Catamount through Moncton and Truro to Windsor Junction totals 185 road miles, which is said to be the longest continuous territory on which train movements are authorized by C.T.C.

Items of Special Interest

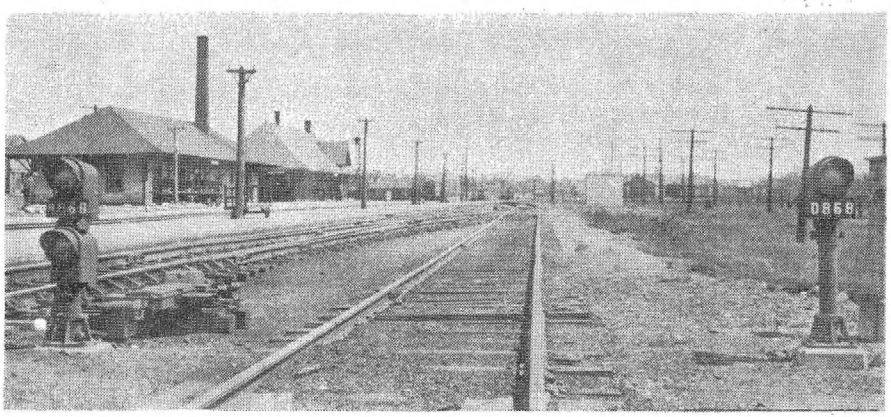
The 88 switch machines on the Moncton-Truro section are the low-voltage type, for operation on 20 volts d-c. The operating time of switches vary, depending on the lubrication of the slide plates and whether the switch is binding; however, with 20 volts at the motor, one of these machines will operate a switch with 20-ft. 100-lb. switch points in about 10 to 12 seconds, using about 8 amp. to start and about 5 amp. while moving the switch and locking up.

On the Truro-Windsor Junction territory, the 20 switch machines are the same 5D dual-control type, but are rated to operate on 110-volt d-c., the reason for adopting the high-voltage machines being to speed up the operation and thereby afford a means for crushing ice, snow, coal or twigs that might obstruct the points. With 110 volts at the motor, one of these machines will operate an average switch in about 3 seconds, using 8 amp. to start and about 5 amp. when moving the switch.

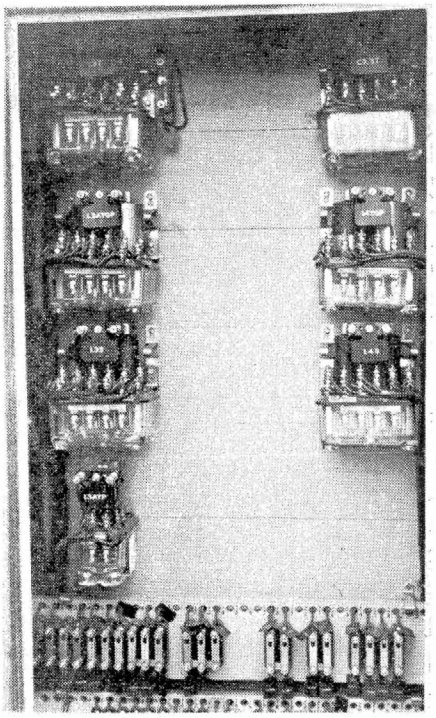
On the Truro-Windsor Junction section, small electric space heater, operating on 110 volts a-c., were installed in the switch machines as a means for preventing the formation of frost. One heater, rated at 15 watts, is installed in the controller compartment of each machine, and a second heater, rated at 25 watts, is installed in the contactor compartment.

Electric Locking of Power Switches

If a proceed aspect of a C.T.C. controlled main-track signal is "taken away" by lever control, approach locking is in effect. If no train is occupying the approach section, the switch involved may be operated at once. If a train is occupying the approach section, an automatically-controlled time-element relay introduces a delay period before



View looking east at Sackville station



At intermediate signals the relays are mounted in the sheet-metal cases

the switch can be controlled. On account of no approach track circuit through sidings, time locking is in effect in connection with leave-siding dwarf signals, the timing being the same as for the high signal governing in the same direction.

Track and Line Circuits

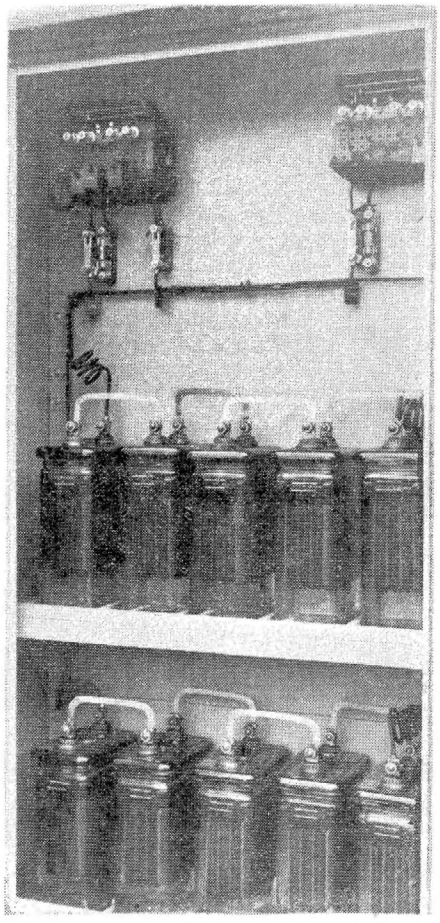
Direct-current neutral track relays are used throughout this project. The maximum length of the track circuits is 4,250 ft. Primary secondary track relay combinations are used on the OS switch detector section in order to secure quick shunting as well as a shunt that will hold.

The local signal line controls are of the conventional A.P.B. type, using one line wire in combination with a common for the controls for each direction, thus totaling three wires which are No. 10 Copperweld with weatherproof covering. Extra line circuits are required for the control of the Advance-Approach aspect where used on the intermediate signals. Also, extra line circuits are used for the approach locking and the track-occupancy where there are more than two automatic blocks in a station-to-station block.

Telephone on Line

Previously there was a telephone circuit between Moncton and Truro, using two No. 9 bare copper wires. Each passenger train and each freight train caboose is equipped with a portable telephone which can be connected temporarily by clips to these line wires in case of an emergency. When changing over to C.T.C., this telephone line circuit was used also for the C.T.C. code controls between the office at Moncton and the field stations on the territory between Springhill Junction and Truro. A new pair of No. 10 Copperweld line wires with weatherproof covering were installed for the C.T.C. code between Moncton and Maccan.

The telephone circuit between Truro and Halifax is on a pair of No. 9 copper wires independent of the C.T.C. circuit. The C.T.C. circuit is operated with filters and condensers for telephone use and each circuit is brought into each telephone location where a double throw switch is provided for connecting the phone to either circuit. There is a loud speaker on each circuit in the dispatcher's office. The loud speaker on the regular telephone line is normally used, while that on the C.T.C. line has its volume reduced so that it is used for calling only. When the dispatcher is talking on this line, the loud speaker equipment is reversed.



Rectifiers and storage batteries in a case at an intermediate signal

Distribution of A-c. Power

Power at 110, 220, or 550 volts is purchased locally at various stations and distributed in both directions from these stations on a signal power circuit consisting of two No. 6 copper with weatherproof covering. The a-c. power feeds through rectifiers to charge storage batteries which for the most part are of the Exide KXHS-7 type. Where track circuit feeds are located between the ends of the a-c. power circuits from two directions, each track circuit is fed by three cells of Edison 1,000-a.h. primary cells in multiple.

The sheet-metal instrument houses at the switch layouts, as well as the cases at the intermediate signals, were wired complete at the factory. The distribution of materials and the erection of the signals, as well as pouring the concrete signal foundations, was aided materially by work train service, including the use of power cranes for setting the instrument houses in place. The instrument houses were set on concrete piers except where the filling was considerable, at which locations frame work made of heavy timbers was used. In the course of a few years after the war, dirt will be filled in to bank around these houses, and, after fully settled, foundations will be placed under the houses.

The circuits between the instrument houses and the switch machines or signals are in underground cable. The switch motor leads are No. 6 for long runs and No. 9 for short runs; the connections to track are No. 9, and the other circuits are No. 14, with the exception that No. 9 is used for lamp circuit. The lamps in the high signals are rated at 14.4 watts, 11.3 volts, and in the dwarfs at 5 watts, 10 volts. The lamps in all the signals, except the leave-siding dwarfs, are on approach control.

The centralized traffic control was installed under the general jurisdiction of R. G. Gage, chief electrical engineer, Canadian National Railways. The General Railway Signal Company, Rochester, N.Y., furnished the major items of equipment, such as signals, switch machines, relays, code line apparatus, and the C.T.C. machines, and the construction was done under contract by the General Railway Signal Company of Canada, Ltd. The pole line work, including the installation of the new line wires, was done by the forces of the Communications Department of the Canadian National.