Michigan Central Makes Extensive Improvements in Signaling System On 513 Miles of Main Line

Typical signals in automatic and interlocking territory

Many new signals — Improved power supply — New aspects — Color-light train-order signal — Take-siding signals — Automatic train control

T
HE Michigan Central will soon complete a program of extensive improvements in the 513 miles of double-track main line from Niagara Falls (Bridgeburg), Ont., to Chicago. It amounts to practically a new signal system on the 247 miles from Niagara Falls to Windsor, while, between Detroit, Mich., and Chicago, color-light signals are replacing the semaphore type only at all home interlocking signals. Throughout the entire route an a-c. floating power supply is being provided to replace primary batteries. Intermittent inductive auto-manual train stop is being added between Niagara Falls and Windsor so that such protection is now complete on the entire route between Buffalo and Chicago.

Previous Layouts

In 1920, the lower-quadrant two-position signals between Detroit and Chicago were changed over to three-position upper-quadrant signals. Between Detroit and Niles, Union Style-B signals are in service, while, from Niles to Chicago, G.R.S. Model 2-A mechanisms are used. All these signals are of the 10-volt direct-current type and were operated on primary battery with primary on track circuits as well. These signals are spaced with blocks 4,000 to 8,000 ft. long.

In accordance with the orders of the Interstate Commerce Commission, company forces installed the General Railway Signal Company intermittent inductive train-stop system between Detroit and Niles in 1926, and, in addition, this equipment was extended voluntarily, in 1927, to complete the Chicago-Detroit route. The 1930-31 improvement program in this territory includes a changeover to the a-c. floating power supply and the addition of certain signal units to existing signals.

Wherever the block is not longer than 5,600 ft., a double-distant aspect of two “Yellows” is now provided at the signal next in the approach, the indication being “Prepare to Stop at Second Signal.” The second yellow is displayed by an inoperative light unit mounted to the right of the mast and 5½ ft. below the top light. This is a special unit, which was made by the General Railway Signal Company, and which is equipped with an 8½-in. lens and a 10-volt 5-watt lamp. It is normally dark and is fed through a 400-ohm neutral line relay controlled over a two-wire line circuit. Train control is effective at the signal displaying the double yellow aspect.

The middle unit of three-unit color-light signals at interlockings is inoperative unless the track layout affords routes to require an operative signal. The lower unit, a call-on signal, is operative to only two indications: red for Stop, or yellow for “Proceed at Restricted Speed.” Each signal unit has a single-filament bayonet base 10-volt 5-watt lamp. If the lamp in the top arm burns out, the distant signal immediately changes to the Cau-
GENERAL ORDER NO. 22

The Color Light signals that replace the four and three arm Semaphore signals between Special and Kinsmen stations display three lights in a vertical line, on the left hand side of the signal mast to govern the movements of trains, and—

Wherever such signals are at Telegraph Offices, there will be added, a light in the manner of a semaphore, at the top of the mast for Train Order indications, (Rules 285 and 285A, and—)

Wherever Train Order indications are combined with Automatic Block signals—where there is a right hand light added to the Color Light Automatic Block signal (Rule 285A, 285G and 105H), below.

The Train Order indications, as seen from approaching trains, apply to all tracks and are so interconnected with the left hand light on all lines to prevent conflicting indications.

When 20 orders are to be delivered, for which a stop is not required, a yellow light is displaced in the train-order signal and also a yellow light on the lower unit of the interlocking signal. When 31 orders are to be delivered, for which a stop is required, a red light is displayed on the train-order signal and a red light is the only color that can be displayed on any of the three interlocking signal units.

When 19 orders are to be delivered, for which a stop is not required, a yellow light is displaced in the train-order signal and also a yellow light on the lower unit of the interlocking signal. When 31 orders are to be delivered, for which a stop is required, a red light is displayed on the train-order signal and a red light is the only color that can be displayed on any of the three interlocking signal units.

At train order offices within the limits of interlocking plants an SA signal unit is located at the right of the mast on a line with and 2 ft. 9 in. from the top unit of the home signal; in automatic signal territory this SA unit is located in a similar position on such of the automatic signals as are properly located with respect to local train order offices. The train-order unit is controlled by a three-position lever controller near the operator's desk. The aspects presented by the signal are shown in the accompanying diagram. The circuits are so arranged that a train-order indication for either a 19 or a 31 order cannot be given with a clear block or a clear route. The circuits are also arranged for checking a lamp failure, this being accomplished at interlocking signal locations by displaying a train-order light only when there are orders to be delivered, thus corresponding to the usage, at interlocking plants where a separate train-order signal is not used, of withdrawing the flag by day and the lantern at night.

At automatic block signal locations, green, the "No Order" light, is displayed when no orders are to be delivered and the block is clear. The aspect is two horizontal green lights. When the block indication is "Approach—Prepare to Stop at Next Signal," there is a yellow and green light horizontal, and when the block is red, "Stop—Then Proceed in Accordance with Rule," there is a red and a green light horizontally arranged. When 19 orders are to be delivered, for which a stop is not required, two yellow lights are displayed horizontally, and when 31 orders are to be delivered, for which a stop is required, two red lights are displayed horizontally. If there is a lamp failure in either the train-order signal or the automatic block signal, it causes the other to display red, and at the same time the block signal in the rear to display "Approach—Prepare to Stop at Next Signal."

It will be noted that by this arrangement, the lamp failure is checked so that a light out requires a "Stop" indication, and it also prevents the display of a clear block when either 19 or 31 order indications are given. At the automatic signal with a train-order signal, if either lamp filament burns out, the other signal goes red.

A "Take-siding" signal was added on the automatic signal located 3,000 ft. or more in the approach of certain passing track switches. This take-siding signal consists of an A. & W. No. 1184 lamp unit with a 6%\(^2\) in. Lebby reflector and an 8%\(^2\) in. round red, and a 5-watt, 10-volt lamp. This unit is mounted at the right of the mast and 5%\(^2\) ft. below the signal unit.
Normally, this take-siding unit is dark, and, when in operation, flashes about 35 times a minute, this operation being controlled by a 400-ohm flasher relay which is controlled by a two-wire line circuit from a stick push-button located in the nearest telegraph office.

Changes in Canada

On the line between Niagara Falls (Bridgeburg) and Windsor, Style-B 2-position lower-quadrant d-c. signals were installed between 1901 and 1904. The home signals were spaced 8,000 ft. to 10,000 ft., the distant signal being about 3,000 ft. from the home signal. On this division there are few curves and no heavy grades, so that the line is particularly well suited for high-speed operation of both passenger and freight trains. Therefore, when it was decided to extend the automatic train-stop system, it was considered desirable to re-locate the signals and lengthen the blocks to provide for the longer braking distances required for modern train-speeds. In view of the fact that the signals had rendered about 30 years of service, it was decided to make a thorough job of replacement. Therefore, when revising the block lengths, the semaphore mechanisms were all replaced by Type SA three-indication color-light signals.

Counting both home and distant signals, there were 554 signal masts, as compared with only 328 signals under the new arrangement, in which most three-indication signals are spaced 7,000 to 9,000 ft. With this block length, the ordinary three indications are adequate, no double-yellow indication being required.

As a part of the change-over, all semaphore train-order signals were replaced with color-light signals mounted on the interlocking signals or automatic block signals, as explained previously.

Excepting where the location of the signal was fixed, as at interlocking plants, it was necessary to move practically all the signals. The cast-iron foundations, as well as the mechanism cases, masts and ladders were moved to the new locations and utilized as a part of the new system. With a supply of such layouts to start, the new signal locations were constructed in place on sections of about 20 miles at a time and cut into service. The old locations were then dismantled, the masts and ladders being cut off to give a height of 17 ft. from the top of the rail to the center of the new SA signal. The old signal mechanisms, up-and-down rods, etc., were removed. The scrap was left on the ground, the foundation, case, mast and ladder being loaded on push cars and hauled to the next station, where they were loaded.
in cars and shipped to stations down the line according to a definite schedule in the construction program.

The work of constructing the new locations was divided between three groups of men, one of which groups erected the signals and cable posts, and ran the cables, a second group mounted the apparatus and made all the connections, and a third group set the train-control inductors.

The line control circuits and the power-feed circuits are run on a lower arm on the Western Union pole line. The line control circuits are No. 10 double-braid weather-proof Anaconda High-Tenso wire, which is an alloy of copper having a tensile strength of 771 lb. and a conductivity of 55 per cent as compared with copper of the same size. These wires are run on Hemingway No. 43

At each signal location a wooden case is attached to the pair of screw-type plug fuses rated at 10 amp.

The 110-volt wires go from the plugs to a G.R.S. Type-K Size-2 transformer from which the rectifiers are fed. The rectifiers are G.R.S. Type-TXS double-wave copper-oxide, those used for charging signal batteries are rated at ½ amp. and those for track batteries at 1 amp. On the installation in Canada, a set of 5 cells of 78-a.h. Exide DMGO-7 storage cells is used for the signal and line circuits and 1 cell of Edison B4H is used for each track circuit. On the change-over between Detroit and Chicago, all the storage batteries are Edison.

All control circuits are the two-wire polarized type using G.R.S. Type-K and U. S. & S. Co. Model-12 line relays. Almost all track relays are new, G.R.S. Type-K 4-ohm, and the slow-release relays are G.R.S. Type-K, 40-ohm. The older type relays were utilized for the approach-lighting circuits, etc.

The Raco-type impedance lightning arresters, used for the line circuits, are located in the box on the cable post. A ⅜-in. by 8 ft. Copperweld ground rod is used.

No trunking is used on this installation, all underground circuits being in Trenchlay cable made up with no metallic protection whatsoever. The runs from the relay cases to the rail are No. 8 flexible 7-strand cable run 18 in. below the bottom of the ties.

This same No. 8 single-conductor flexible cable is used for the two separate runs from the relay case to the train-control inductor which in each instance is approximately 75 ft. in the approach of each signal. These cables are placed about 8 in. apart in the trench and are brought up on opposite sides of the rail-section bootleg and then run in a long loop to the terminal box on the inductor, as shown in one of the views.

The rail is bonded with stranded plug-type bonds made up of seven No. 10 galvanized iron wires. The rail is either 105 lb. or 127 lb., and the insulated joints are the 6-hole continuous type of the Rail Joint Company, insulated on one end only.

This reconstruction program was handled by signal department forces. A crew of about 34 men completed the 96-mile section from Windsor to St. Thomas between October 7 and December 31.

The 110-volt circuit from the line is brought into this box and taken to a cable post in which are housed the lightning arresters, transformer rectifiers, batteries, etc. The 110-volt circuit

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