Railway Signaling

Volume 21 October, 1928 Number 10

Pere Marquette Installs Centralized Control Signal System

Train movements directed by signal indication, and passing-track switches power-operated, on 20 miles of single track —Train movements recorded automatically

The movement of a lever in the controller's office at McGrew controls the operation of the switches and signals on the line

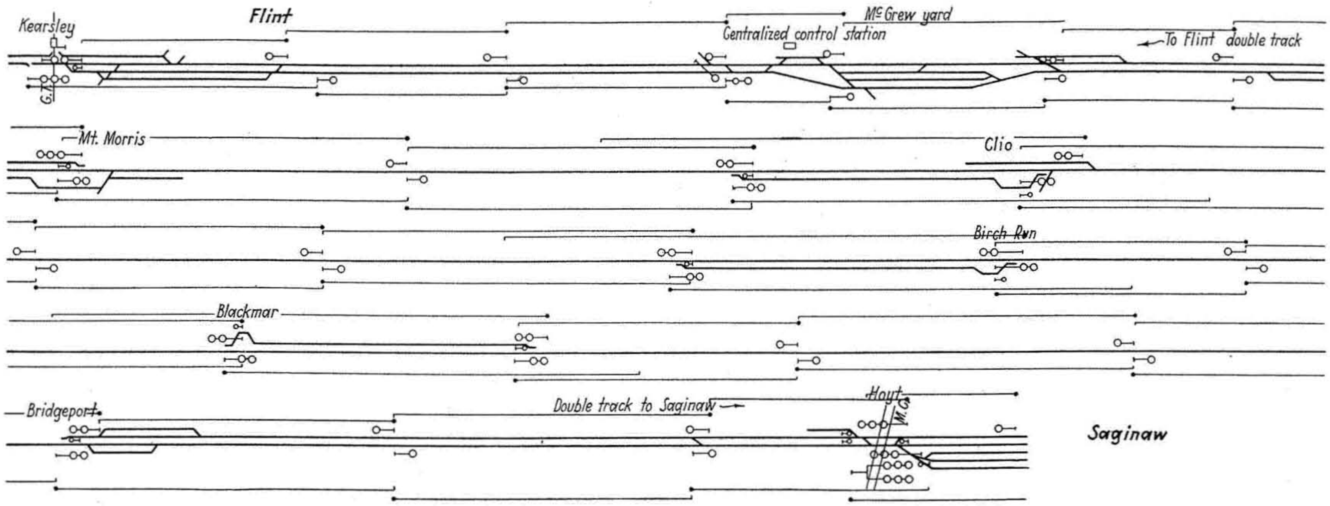
THE Pere Marquette has recently completed an installation of the Union Switch & Signal Company's centralized-controlled signal system between Mt. Morris, Mich., and Bridgeport, a 20-mile section of single track between two lines of double track. All train movements are directed by signal indication without written train orders, or rights to any train by direction or class. The signals, and also the power switch machines for the passing tracks, are controlled by a train controller located in the office at McGrew yard at North Flint. No operators are required at intermediate stations. Coincident with the installation of the centralized-control system, the three passing tracks were lengthened and the complete changes resulted in a decided improvement in train operation by eliminating train stops and reducing delays on the road, and also the spacing between trains has been reduced safely so that track capacity is increased.

The line traverses a rolling country with a maximum grade of 0.3 per cent. From Mt. Morris two tracks extend four miles south to Flint, while from Bridgeport the line is double track for 6.3 miles to Saginaw. Plans had been prepared for a second track between Mt. Morris and Bridgeport, which was estimated to cost about $750,000 for the 20 miles. About this time the centralized-control system was developed, and it was decided to install it rather than to build a second track. It is anticipated that this new system will increase the track capacity sufficiently to meet the requirements for several years, at a cost of about $160,000 for the track changes and signaling system. Also the signal equipment will be available without much change for use on the second track, when necessity requires further capacity.

Traffic Heavy at Certain Periods

This section of the Pere Marquette has become one of the busiest pieces of single track on the system, because trains from five different directions must use it. Referring to a map of the railway, it may be seen that traffic from Port Huron, Bay City, Ludington, and Grand Rapids converges at Saginaw for movement over this section of single track from Bridgeport to Mt. Morris. Northbound, traffic comes from Toledo, Detroit and Flint. From two to four solid trains of automobiles are handled north out of Flint on week days for west and northwest connections via Saginaw. Other automobile trains run from Flint to Ludington and to Port Huron.

Coal from Ohio, Kentucky, Pennsylvania and West Virginia is received by the Pere Marquette from connections at Toledo and is handled through to north Michigan and to Ludington, to be ferried across to Wisconsin for western connections. In addition, several merchandise trains are operated out of Detroit and Toledo for Saginaw.



Plan of the layout from Flint to Saginaw showing the location of the signals and main line passing track switches which are power operated and controlled from the centralized station

This traffic must all be handled over the section of single track from Mt. Morris to Bridgeport. Although it fluctuates considerably, it averages about 14 trains each way daily, of which 3 are passenger and 9 are freight trains. The operating difficulties were not occasioned by the number of trains in the 24 hours, but rather by the fact that the majority of the traffic must be handled over this section at night, especially from about 6 p. m. to 1 a. m.

Loaded cars are pulled from the automobile plants after 5 p. m. and must be moved out promptly to make connections. Deliveries of merchandise are also so arranged that this traffic must be moved over this section of the line during the early part of the night. Coal and other traffic must also be kept moving without delay. Therefore, the big problem in connection with the operation of the line from Flint to Saginaw is to handle a heavy train movement in a short period.

Previous Method of Operation

Prior to the installation of the centralized-controlled signal system, train operation was directed by time table, train orders and manual block. Southbound trains were superior by direction. No train was permitted to follow a passenger train in the same block, but a freight train was permitted to follow another freight train "under caution" after the expiration of 10 min., except where special rules governed. Freight trains were required to clear a passenger train at least 10 min. Form "19" train orders were used in this territory except for a few conditions which called for Form "31" orders.

The train sheet for March 31, 1927, a typical 24-hour period under the previous method of operation, showed three passenger trains each way and 11 freight trains northbound, and 13 freight trains southbound. On this date 7 "meets" were made at Mt. Morris, 10 at Clio, 3 at Birch Run, 2 at Blackmar and 2 at Bridgeport. Approximately 47 Form "19" orders and 25 Form "31" orders were issued to trains in this territory on that day. Considerable time was, of course, lost in handling these orders in addition to delays on passing tracks.

In addition to the centralized-controlled signal system for the single track, automatic-block signals were installed on the sections of double track so that all train movements from Flint to Saginaw can now be directed by signal indication without written train orders, except in emergency.

New System Controlled From One Point

With the new system, one man, known as the train controller, controls the switches, as well as the signals at each end of the sidings which are used to direct the train movements. Operators are retained at Hoyt to operate the interlocking at the crossing of the Michigan Central, although those at several other points were dispensed with. The new line-up of employees at these stations is as shown in the table. Therefore, the use of the centralized-signal system permitted a reduction of five telegraph operators.

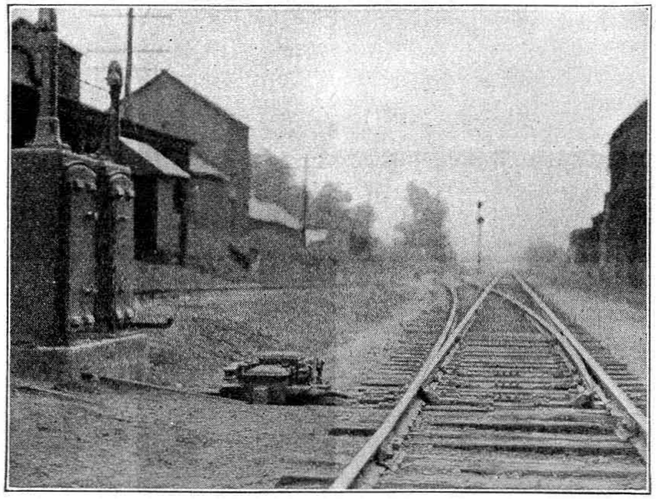
Table Showing the Number of Employees at Stations

	Employees at Stations Under Previous Method of Operation	Employees at Stations with Centralized Control	Reduction in Employees at Stations
McGrew Junction	3 shifts	3 Shifts	
Mt. Morris	1 "	1 agent	
Clio	3 "	1 agent	2
Birch Run	3 "	1 agent	2
Blackmar	None	None	
Bridgeport	2 shifts	1 agent	1
Hoyt	3 "	3 shifts	
			5

How the Machine Is Operated

The train controller and the control machine are located in the yard office at McGrew north of Flint. Across the top of the control machine is a miniature track model of the territory, with track indicators which show the location of any train occupying the track circuit, including any main-line switch of a passing track. The switch levers are in a horizontal row, each directly below the switch on the track model which it controls. The switch levers are provided with repeater lights, which indicate the actual position of the switch to show that it has followed the movement of the lever.

With the use of the new control system, the controller is informed automatically of the location of each train, and can postpone the fixing of a meeting



A dual control power operated switch machine at the north end of Clio

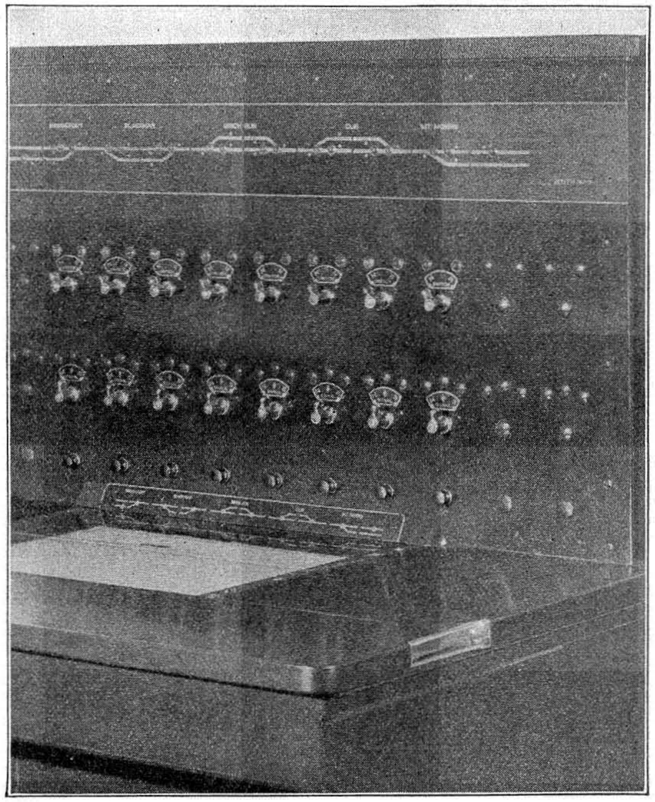
point until the trains are near a common point. Closer meets can, therefore, be assured with minimum delays. With this same purpose, the passing tracks have been lengthened. The one at Birch Run, in the center of the territory, is 8,700 ft. long, while the sidings at Clio and Blackmar are 7,900 ft. long. These passing tracks are laid with 90-lb. rail on good ties and are well ballasted with gravel. The No. 12 turnouts were replaced by No. 15 turnouts to permit faster speeds in movements to or from sidings. As a part of the new control system, all passing track switches are equipped with power machines controlled from a central point. One purpose of the long sidings is to permit a train to pull into a siding at fairly good speed without being required to slow down. Another advantage is that, especially with short trains, it is practicable to make meets without either train stopping.

The signal levers are located in a horizontal row below the switch levers. Only one signal lever is required to control a group of signals at one end of a passing track. The normal position of the signal lever is on center, which holds all signals at that particular location at "stop." The movement of the lever to the right governs the clearing of the signals for traffic in the corresponding direction, and its movement to the left clears the signals in the same group for traffic in the opposite direction. Whether the signal for the main track or a siding movement is to be displayed depends entirely on the position of the track switch.

Following standard interlocking practice, the signal lever in the control machine mechanically interlocks the switch lever, thus requiring the controller to return the signal lever to normal before he can reverse a switch. This simply acts as a reminder that the signal is clear before attempting to change the position of a switch.

A small button near the bottom of the boards, when set by the controller, gives an audible indication the instant a train enters the track circuit corresponding to the end of the siding under which this button is placed. This audible indication is in addition to the light indication received on the track diagram. Its use is to call the controller's attention to the arrival of a train at a certain point if he should be busy with other work and may be cut out at will.

For the operation of the centralized system, only two wires extend from the controller's machine at McGrew yard to Hoyt. These wires are No. 8 hard-drawn copper with weatherproof insulation, and are carried as open wires on the existing telegraph pole line. These wires carry the code impulses corresponding to the control sent out, or the indications brought in. In other words, only two wires are required to clear or set the signals at stop, to operate the switches, to light the indicators on the track model, to light the repeater lights on the switch



The automatic train graph chart is located under a removable glass plate in the top of the desk below the levers

levers, and to provide an automatic "OS" record of each train movement over each end of each siding.

The automatic block signaling between sidings is the A.P.B. type and is distinct from the centralized-control system. The customary line control wires used for the A.P.B. system are, of course, required.

Automatic Record of Train Movements

An automatic train graph is an important adjunct to the control board and is built into the control machine where the controller can conveniently make notations on the graph sheet. The automatic graph records the passing of each train over a track circuit located at each end of every passing track. Thus the controller has before him an automatically-made record of every train movement in the territory controlled. This gives him information as to whether a train is losing time, running on time, or making up lost time, because the automatic train "OS" is itself on the graph as it proceeds past each siding.

Roadside Control Features of System

At each end of each passing track are located control selectors for receiving the control impulses, the control relays, and the automatic storing and the impulse-sending equipment for indication purposes. When a code is sent out by the equipment in the controller's office, the proper selector at the wayside location is operated, closing the control circuit to pick up the control relay, which controls the operation of the signal or switch.

When the movement of a switch is complete and locked, a contact is closed which controls the operation of a code-sending device that sends a proper code to the controller's office to pick up a selector that in turn causes the bulb in the light on the control board to be illuminated, thus indicating to the controller that the switch has completed the movement and is locked.

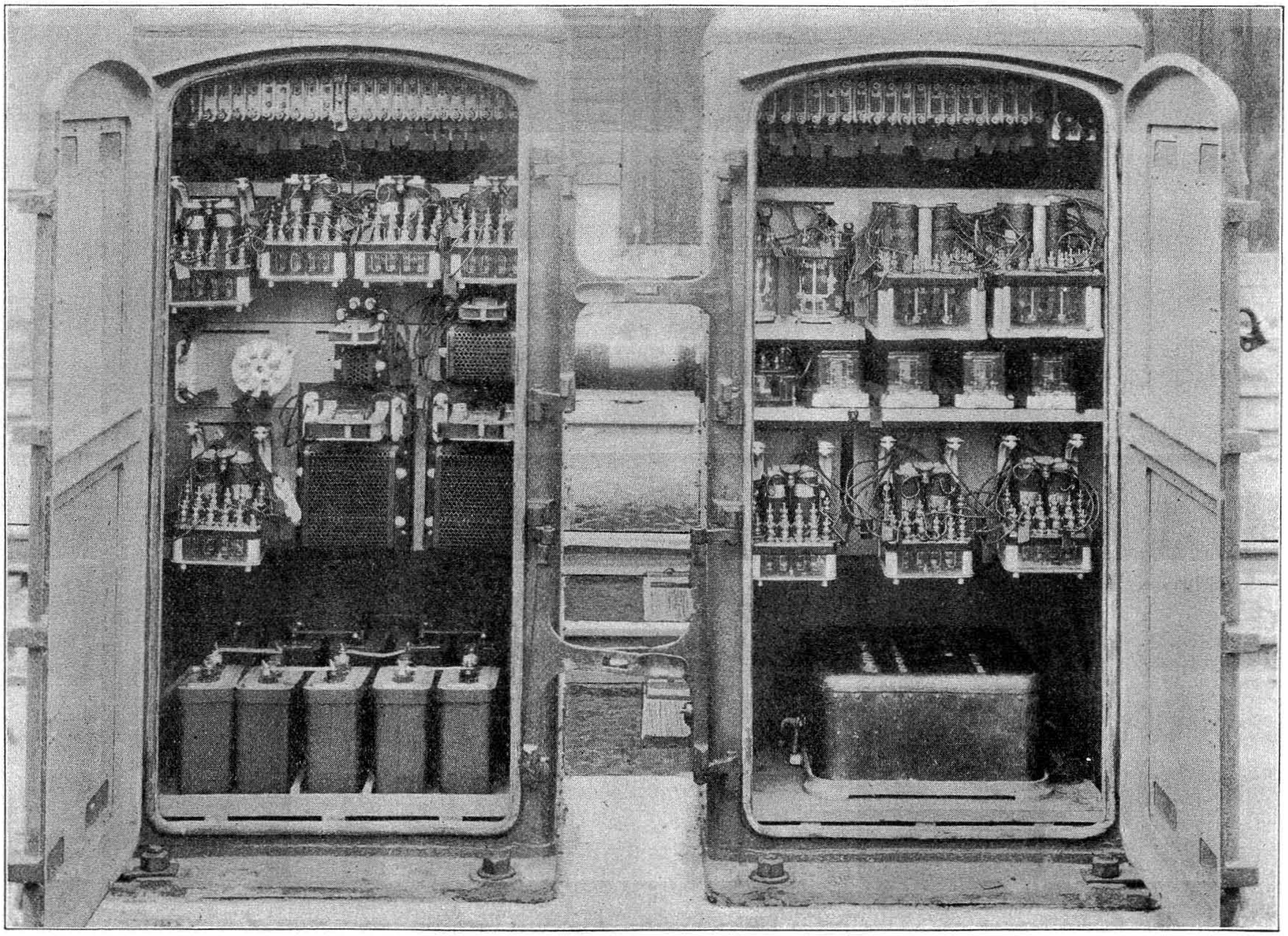
When a train occupies the track circuit on the main line at a switch, a track relay is de-energized, which causes a code to be sent to the controller's office, which operates a certain selector, and results in the indication light for that switch in the track model being illuminated. The graphic train chart mechanism is also operated to indicate the location of the train.

The three signals at a switch are all controlled by one lever in the controller's machine. The signal for a movement off the siding and the main-line signal in the same direction are controlled selectively, depending on the position of the switch.

The signals are semi-automatic, i. e., the control is carried through the track relay in such a way that a train will hold a protection signal at danger, regardless of the position of the lever in the controller's machine. These signals are also connected into the automatic signal controls so that permissive indications are given for follow-up movements, and absolute indications are given for head-on protection.

The signals are approach-lighted from head-block to head-block under the control of the controller when he completes his line-up of a movement over the section between corresponding two sidings. Electric locking is provided the same as in a modern interlocking plant. Detector locking prevents the movement of a switch under a train, regardless of the movement of the lever in the controller's machine. Approach locking prevents the movement of a switch after a train has passed a distant signal approaching a switch. However, the controller is free to change the indication of the signal from "proceed" to "stop" at any time. After the train has stopped, subsequent to passing a distant signal, a member of the train crew can communicate with the controller by telephone located at each siding. The controller may inform him that his train is to go into the passing track. The brakeman then inserts his switch key in release, which releases the approach locking and permits the controller to operate the switch.

Where local switching is to be done frequently, the use of a power switch machine under the control of the controller may cause delay. Therefore, at



Interior view of instrument cases at a typical location at the end of a passing track

such locations, a selector lever is provided by means of which the power machine can be cut out and the switch operated manually. Permission for such operation is secured by the conductor from the controller who fixes a certain time when the switch must be returned to his control.

Power Supply for the System

The a-c. floating power supply system is used for the operation of the signals, switches and also for the control system. The line feed is 110-volts alternating current, carried on two No. 8 hard-drawn copper wires with weather-proof insulation placed on the two pins on the field side of a new 10-pin cross-arm which was added to the existing pole line. Power is purchased at six different points between Flint and Bridgeport, which reduces the length of the feed sections to a maximum of four miles. The a-c. line does not extend throughout the territory but a gap of the length of one or two track circuits was left between each feed section, thus saving a mile or more of line wire at each of the six gaps.

The code circuit is entirely separate electrically from all other circuits. The code transmitter at switch locations is operated from the large battery but the coded current transmitted back to the controller's office for indications is taken from a set of 5 cells, 15-a.h. capacity cells which are provided for this purpose so as to keep the code circuit entirely separate.

Insulated wires are connected to the 110-volt line and run through the made-up cable to lightning arresters and to Union rectifiers for charging the batteries. At each switch location, there are two sets of main batteries, one set of 5 cells and one set of 7 cells. Part of the signals and control features operate off of each set, and the combined set of 13 cells is used to operate the switch machine. The batteries are Exide Type-KXHS, 75-a.h. capacity. Union Type-M, low-voltage movements are used, which will operate a switch in about 7 sec.

One cell of storage battery is used on each track circuit and is charged by a Union rectifier. The track is bonded with Lunco stranded bonds, using 3/8-in. channel pins. The track wires are No. 9 solid-copper insulated and are run in redwood trunking.

Underground parkway cable is used between the case and the signals or switch machines. This cable has a lead covering, two wraps of steel tape and a covering of jute. Okonite insulated wire was used throughout, while the parkway cable came from the Hazard company.

Gates Replaced by Flashing Signals

Number of automobile accidents reduced, with decided saving in operating costs, on the Indianapolis Union Railway

By T. R. Ratcliff
Engineer Maintenance of Way, Indianapolis Union Railway, Indianapolis, Ind.

THE Indianapolis Union railway, which operates the Indianapolis Union station and the Indianapolis Belt railroad, has recently completed the installation of flashing-light crossing signals for the protection of street traffic at 17 crossings where flagmen were formerly used, and to replace gates at 6 crossings. This type of signal was also installed at four street crossings that previously had no protection. These signals have reduced the number of accidents, and have made possible a saving in operating expense that will pay for the improvement in three years.

The tracks at the Union station are elevated above all streets, but the Belt railroad, which forms almost a complete loop about two and one-half miles outside the main business center of the city, has 62 street crossings at grade. Six of these crossings were formerly protected with gates and 20 were protected with flagmen. No change was made at three of the streets protected by flagmen because the street traffic was light, and signals could not be operated from track circuits or grouped with other streets to effect a saving in operating expenses. Five of the streets protected with gates carry heavy street traffic while the railroad traffic approximates 125 to 175 freight trains each 24 hours. Five of the street crossings protected by flagmen have equally heavy street and railway traffic, and frequently it was difficult and dangerous for flagmen to protect the traffic at these points.

In the two years and four months ending March 17, 1927, there were 210 crossing accidents at the six streets protected by gates, 195 of these accidents being caused by automobile drivers running into gates, resulting in damage to gates or the automobile. During this same period, there were 46 accidents at all other street crossings on the Belt railroad.

In order to improve these conditions, authority was requested from the Board of Safety of the City of Indianapolis to make a test installation of flashing-

Flashing signal at Shelby street crossing of Belt railroad

lights, with a S-T-O-P sign and bell on each side of the tracks, at the crossing of Madison avenue with the Belt railroad, to take the place of the flagmen used heretofore for protecting that crossing. The railway traffic at this point consists of about 175 freight train movements each 24 hours while the street traffic over