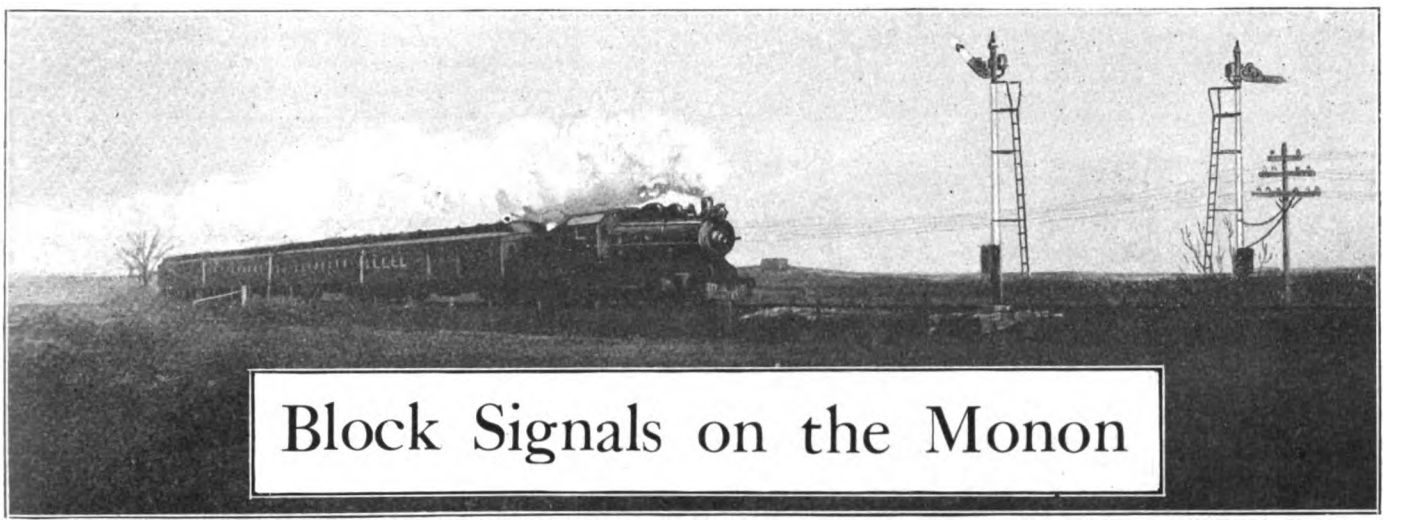


Block Signals on the Monon

Passenger Train Approaching Intermediate Location

Absolute Permissive Installation Recently Completed on Forty Miles of Single-Track in Indiana

By E. G. Stradling,
Signal Engineer

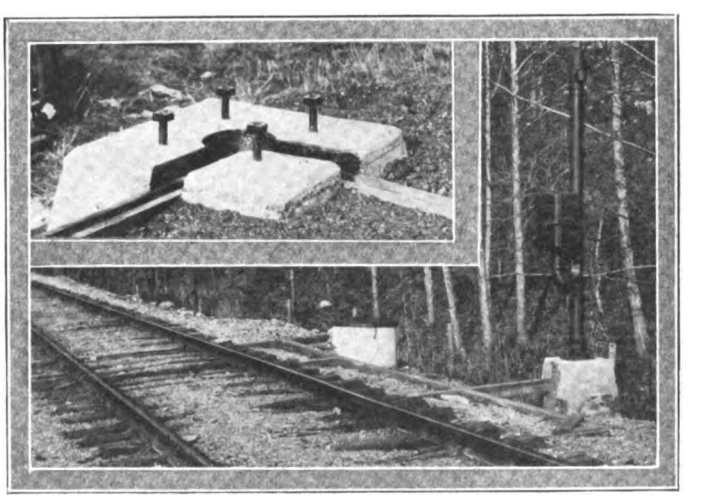
THE Chicago, Indianapolis & Louisville, known as the Monon Route, has in previous constructed automatic block nals on its main line from Chicago a far south as Bloomington, Ind., a distance of 200 miles. During an inspection trip of officials in 1915, it was decided to extend the block system an additional 40 miles to Orleans, which is the junction point of the main line and the French Lick branch. In the fall of 1915, before the advance in prices, orders were placed for the material; in the spring last year the railroad company's construction forces were organized and the work was carried on during the summer under favorable weather conditions. As fast as a strength of 5 or 10 miles was completed, it was tested out and put in service by the maintenance force.

The 40 miles between Bloomington and Orleans traverses that portion of Indiana which produces the Bedford stone extensively used throughout the United States for building purposes. The line is very crooked, as it winds around the hills containing this stone, there being in the 40 miles 93 curves, aggregating in length a fraction over 50 per cent of the total. The question of grades was also a serious problem, particularly the approaches to the town of Bedford, which reach 1.5 per cent at points in each direction for a distance of about four miles.

Under these conditions the location of every signal required careful consideration. A copy of the profile was secured and the signal locations marked upon it in the office. In preparing this tentative plan the first move was to secure from the operating department a statement as to all the points which the dispatchers commonly use as meeting points for trains. With this in mind the required number of signals between meeting points was decided upon and the relative spacing of the signals figured out. With these locations marked on the profile a trip over the track was made and frequently it was found necessary to shift the locations on account of physical conditions such as curves, cuts, fills, bridges and the like.

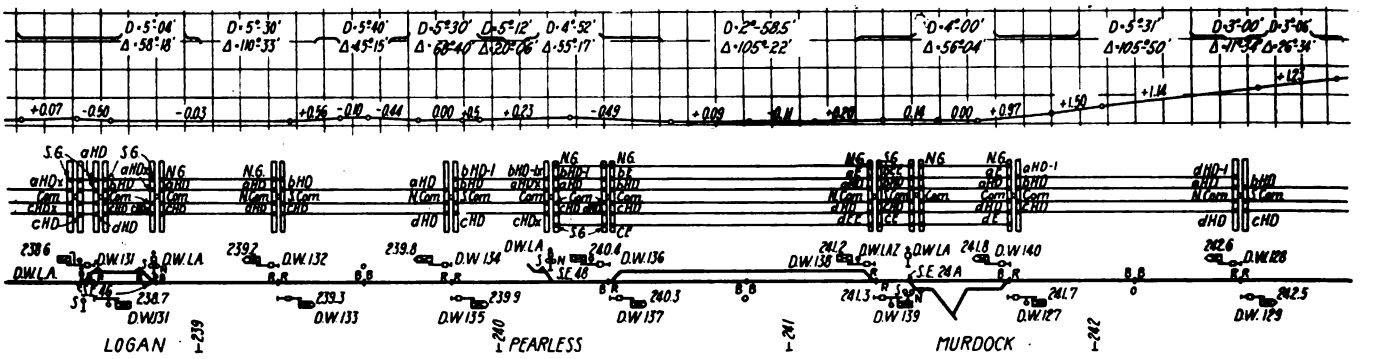
The following points had to be considered: First, to give the engineer of an approaching train as good a view of the signal as possible. With double locations this required the consideration of trains approaching from both directions and sometimes the presence of a curve or a grade would require the favoring of trains from one direction over the other. Second, for the sake of economy, locations were selected which would not require much blasting and as little grading as possible. Third, the proximity of a pole in the pole line to be used was also considered, to prevent the use of a long and expensive cable connection between a signal and the line wires. Another element that entered into the problem was the question of track circuits. The maximnm length of track circuit having been decided upon according to the physical conditions, principally the nature and condition of the ballast, it became a question of the number of circuits between signals. As the locations were selected, stakes were set 10 ft. 10½ in. from the center line of the track, thus marking the center of the foundation for the guidance of the concrete gang.

After all the locations were staked out in order to satisfy all concerned, an inspection party was arranged which included the superintendent, road foreman of engines, general roadmaster, inspector of bridges and buildings, and members of the signal department. A few of the locations were changed on this trip principally at the suggestion of the road foreman of engines, who knew where tonnage trains could be more easily started if stopped by a signal.



Standard Signal Foundation with Trunking Entrance from Two Directions
Cable Post and Concrete Battery Box Location

The Monon has had in operation since 1912 100 miles

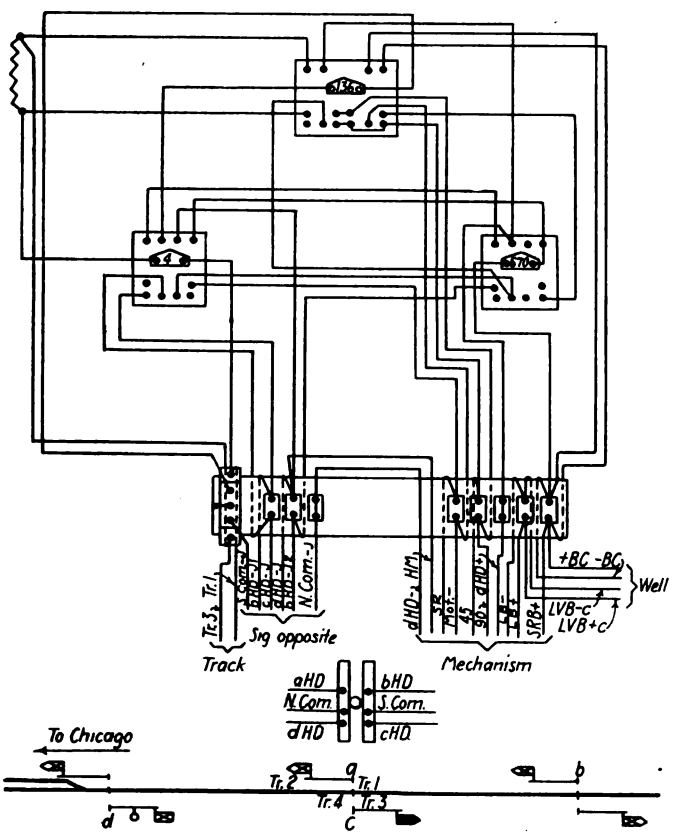


Section of Location Plan, Showing Information Included and Typical Characteristics of the Line

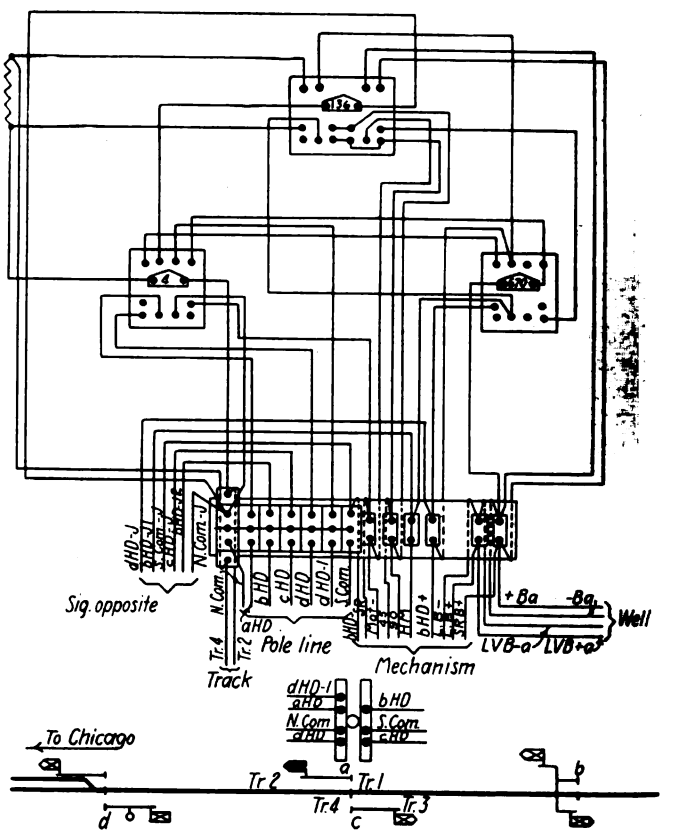
of A. P. B. automatic block signals which have given ample opportunity to observe the advantages of such a system. Therefore it was decided to use the same system for the new signals. A straight line map such as is shown was prepared on profile tracing cloth using a scale of 1,000 ft. to the inch. On this map is shown the profile and curvature of the road, the location of the track as a straight line with all main line turn-outs and side tracks. Then there was added the location of all signals. cable posts, switch indicators and a diagram of the line wires required. At the same time the block signals were installed a number of the turn-outs were equipped with pipe-connected derails and these derails are also shown on the plan. Where a double signal location comes at a switch having a pipe-connected derail it is advisable to place the battery well on the opposite side of the track from the derail, then if any cars are shoved over the derail and along the ground they may knock down a signal, but there is a chance of saving the battery well and its contents.

The location plan also gives the signal numbers in miles and tenths of miles from Chicago. On the plan a D. W. number is shown for each signal, referring to a detail wiring plan of that number which applies to that signal. The detail plans shown are typical of the wiring in the relay boxes. The wires in the relay box bear the same lettering as the respective wires on the pole line diagram.

There are no interlocking plants on this piece of track. Some points, however, called for special signaling. The sidings at Guthrie, Logan and Yockey being very short, and so situated as not to be often used as meeting points, only one set of signals was installed for each siding instead of having a double location at each end. In the illustration of the signals at Logan, it will be noted that the signals are back at the fouling point at the north end of the siding, thus permitting a train to approach and head in from either end of the siding without blocking an opposing train. Each of these signals is equipped with a red square ended blade and a vertical marker light. The trainmen understand that they can have a train on the main track facing such a signal and that the opposing train can approach this point without being blocked. There is one of these signals at the leaving end of each



Detail Plan of Signal Location Wiring

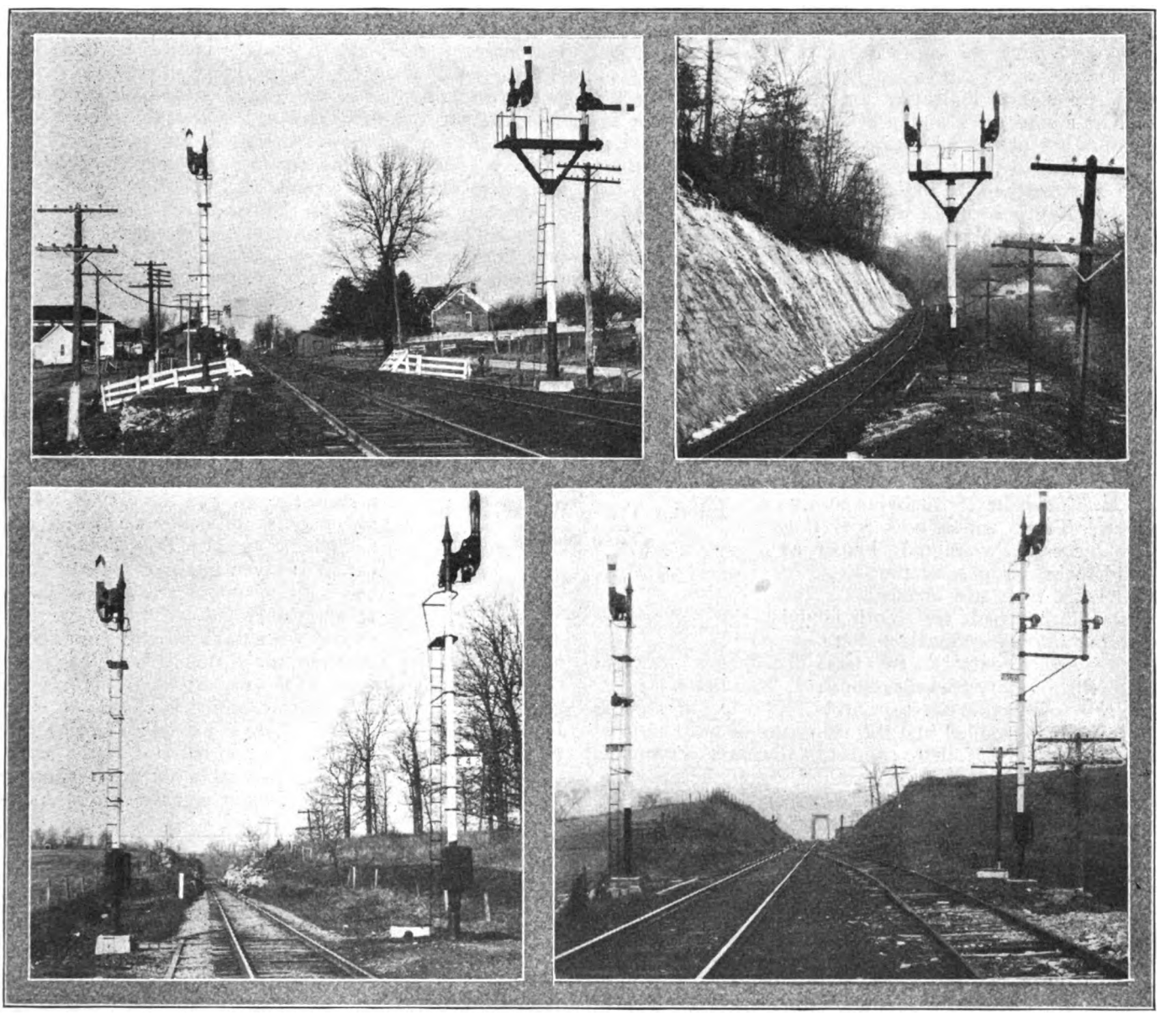


Another Typical Plan, Showing Wiring in Relay Box

fully signaled siding, which are commonly spoken of as starting signals. Trains using any short siding which is equipped with only one set of signals must back out of the siding and in this manner receive a signal indication for proceeding.

At Murdock there is an extensive yard for handling stone. Considerable yard work is done both at Murdock and Thornton in making up trains. The main track is used for this and the two being adjacent, as can be seen on the location plan, it was decided to install a double starting signal at the south end of Thornton with a starting signal at the north end and also a starting signal at the south end of Murdock Thus a train may switch between these two points without interfering in the approach of another train, but if a soundbound train leaves Murdock and passes the starting signal at the south end of Murdock it then sets stop signals against any opposing train as far as Bedford the next meeting point. When a northbound train leaves Bedford it will set stop signals against any southbound train, including the starting signal at the south end of Murdock, and when it reaches a point one block out from Murdock it will set the southbound starting signal at stop at the south end of Thornton.

At Clear Creek there is a junction between the main line and the Smithville line, also at Orleans there is the junction with the French Lick branch. At these points there was installed a double-arm bracket signal. The signals are in their respective relation to the tracks which they govern and are selected through the switch box on the junction switch. These switches, being set normally for the main line, are operated by a member of the crew of any train using the branch line.



Double-Arm Bracket Signal at Junction Signal Location Requiring Practically No Grading

Double-Arm Bracket Signal at Intermediate Location Single Set of Signals at Passing Siding at Logan

A standard signal foundation with the trunking entrance from two directions is shown in one of the illustrations. Most of the foundations, however, have only one entrance. This entrance is made deep enough for a hand and arm to be inserted for the purpose of reaching wires. Also the center of the foundation has a round cavity made by the use of a conical-shaped block. Then when a wire is dropped down through the signal mast from above it will find its way into this cavity, the cavity

having a larger diameter than the inside of the signal mast. The end of the wire can thus easily be seen and reached. From the bottom of this cavity in the foundation there is a piece of ½-in. pipe that leads down through the foundation and comes out of the side about 2 ft. below the top. This serves as a drain and also as a duct for the No. 6 copper ground wire, which extends to a damp place where it is soldered to a 6-ft. ground rod.

A cable post and a No. 3505 concrete battery box used for track battery are shown in another illustration. The trunking layout in this picture is arranged with as few joints as possible and it makes a convenient and neat arrangement. Also some saving in labor for the construction force is effected by having straight runs of trunking from a bootleg to the battery well or cable post foundation.

Where switch indicators are used at plain turnouts such as a spur track or the beginning of a siding the indicators are placed approximately 4 ft. from the switch stand, but if a crossover in a long siding requires a set of indicators then the indicators are placed at the switch on the side track end of the crossover, as this is the first switch opened when a train leaves a siding by means of the crossover. Both ends of the crossover to the main track are connected by means of switch boxes to the signal system, thus requiring the side track switch as well as the main track switch to be kept in the normal position except when a movement is being made through the crossover.

On that portion of the track where the grade is excessive, the regular A. P. B. circuit is used for following movements up grade, but for down grade movements an overlap is used in addition to the regular circuit. Polarized line circuits using six cells of R. S. A. battery and 136-ohm polarized relays with No. 10 B. & S. copper weatherproof line wire were installed. No. 9 copper wire was used for all rail connections and for motor circuits. Sixteen cells of R. S. A. battery were used for motor circuits. Three cells of R. S. A. battery in multiple with a fixed resistance unit were used on all track circuits. The number plates used have the figures on both sides of the plate so that the number of the signal can be noted when read from either direction. A few years ago nine miles of the road was paralleled at a mile or so distant by a new track of easier and more uniform grade. As both lines are operated, the new track had to have a distinguishing feature the same as a branch line, therefore all bridge signs, etc., including signals, bear a prefix of the letter E to their number and the number starts with zero at the junction at the north end. The new line carrying the most traffic was the line signaled and not the old line. The signals on the balance of the installation have numbers without any prefix, which indicate the distance from Chicago.

"Hold Main" Signals Installed by L. & N.

The Dispatchers Located 53 Miles Away Can Indicate to Inferior Trains When Not to Take Siding

By F. H. Bagley
Assistant Signal Engineer

An interesting signal installation has recently been made on the Louisville & Nashville at Lafollette, Tenn., and is now operating with success. Two signals, known as "hold main" signals, of the G. R. S. model 2A type, are clamped to the masts of the north and south bound entering automatic signals and are under the direct control of two train dispatchers located at Knoxville, Tenn., 53 miles south of Lafollette.

North of Lafollette, to Corbin, Ky., Union style S signals were installed in 1912, using the overlap style of control. From Lafollette south to Etowah, Tenn., model 2A signals have just been installed, using the absolute-permissive scheme of control, this installation being described in the January issue of the *Railway Signal Engineer*. Automatic signal territory, therefore, extends both ways from Lafollette. The territory between Corbin and Etowah constitutes one division, but is divided between two dispatchers, both located in the same office at Knoxville. The division is made at Lafollette, the section between Lafollette and Corbin being loaded with mine tracks, making it a heavy job for one dispatcher, and the other section from Lafollette to Etowah, a distance of 113 miles, being through a more level country with industry tracks not so concentrated except within the limits of Knoxville. Previous to the installation of the "hold main" signals, it was the rule that all second class and inferior trains approaching Lafollette should take siding. Since these signals have been installed, the rule is that all second class and inferior trains approaching Lafollette and observing this signal to indicate "hold main" will continue down the main track and get orders there. When the signal does not display the "hold main" indication, the train must take the siding.

The southbound hold-main signal is controlled by the dispatcher whose territory is south of Lafollette and the northbound signal is displayed by the dispatcher whose territory is north of Lafollette. There is a short track circuit, 500 ft. long, ahead of each hold-main signal which serves to announce the train to the dispatcher, by an audible indication, after it has passed the signal. This audible indication is given in the dispatchers' receiver by means of an "answer-back" selector operated by the track relay of the short track circuit, the selector operating to give a predetermined number of impulses to the dispatcher's circuit. At the second double signal location each way from Lafollette, which is about 2½ miles from the hold-main signal, there is placed an OS selector to announce automatically the approach of trains to the dispatcher in sufficient time to enable him to display the hold-main signal. The hold-main signals, with the answer-back and OS feature, are controlled over two wires of the dispatching circuit. The selectors are of special design, furnished by the General Railway Signal Company.

One of the Dispatchers Pointing to His Control Board

For the control of these signals, there is a cabinet con-