New Block Signaling on the North-Western

Some Features of the Recently Completed Absolute-Permissive System Between Evansville, Wis., and Harvard, Ill.

The Chicago & North-Western recently completed and put in service, on its line between Evansville, Wis., and Harvard, Ill., a system of automatic block signals which comprises some interesting features. The line which was equipped is single track except for a stretch of about five miles between South Janesville and Janesville. The entrance to the Janesville yard is at South Janesville. The total length of single track included in the signal system is about 35 miles.

The signals are arranged for "absolute-permissive" operation, giving head-on protection between stations, while allowing following movements. The average block length is about one mile. The diagram, Fig. 1, shows the track layout and the signaling.

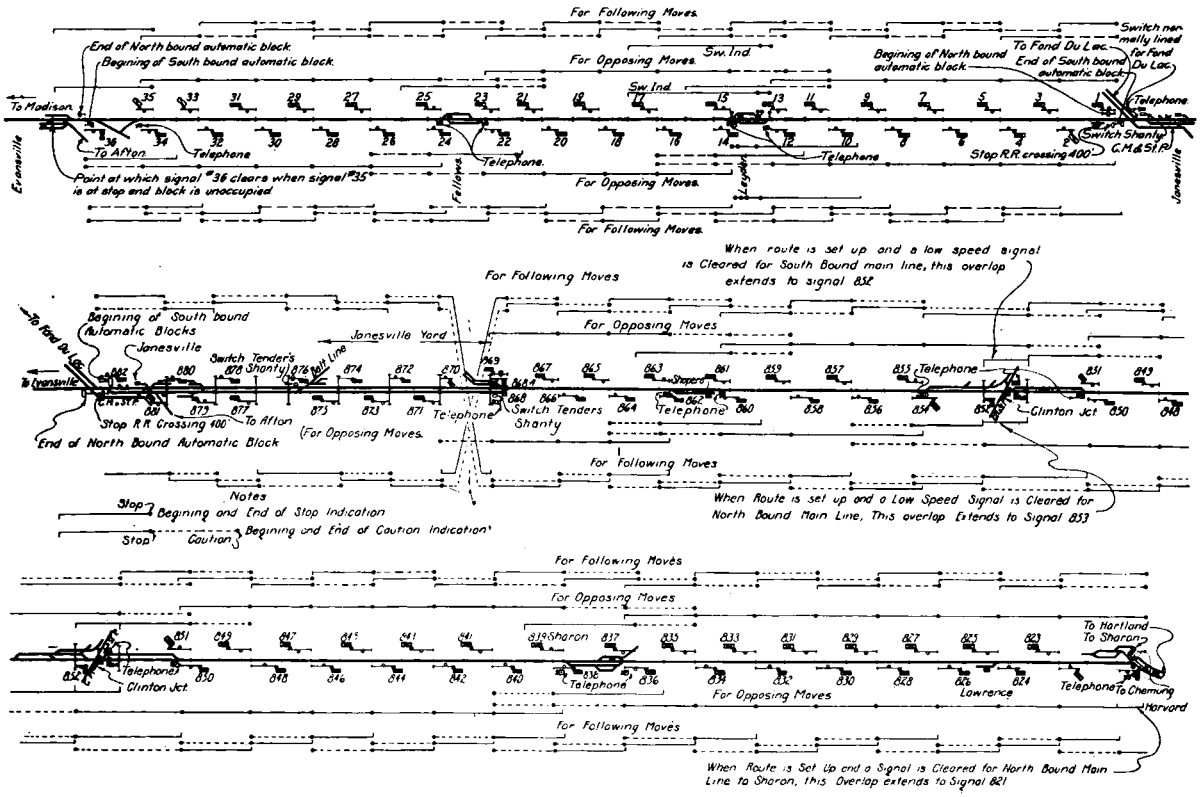

Fig. 1. Track and Signal Diagram—Evansville, Wis., to Harvard, Ill.

The control lines are given for both following and opposing moves as noted, the full line, in each case, showing the beginning and end of the stop indication and the full and dotted line the extent of the control of the caution indication. The symbols representing the signals show the block signals with diagonal lights and the home signals with vertical lights.

When a train enters the stretch of track between any two sidings it sets all the signals for the opposite direction at stop. For example, in Fig. 1, between Clinton Jct. and Sharon (the left-hand half of the bottom section of the track plan), a train leaving Sharon and going toward Clinton Jct. sets all the signals at stop from 852 at Clinton Jct. to 838 at Sharon. As it proceeds, however, the two signals immediately behind it stay at stop and caution respectively, the third one going to clear. To illustrate, signal 839 at Sharon, Fig. 1, stays at stop until the train going toward Clinton Jct. passes signal 841, when signal 839 goes to caution. It is then the second signal behind the train. But when the train passes signal 843, signal 839 becomes the third signal behind the train, and clears up. Fig. 2 illustrates the operation of the signals for a movement similar to the one just described, and shows how the signals work for two trains proceeding toward a meeting point. Train C sets the signals against train B as soon as it gets past signal 1 (see line 2). This line also illustrates the signal operation at each siding. It will be noted that the signals at the outgoing ends of B are home signals, having vertical lights, as distinguished from the block signals which have diagonal lights. Signals 1, 10, 11 and 22 are home signals. When signal 1, going to stop behind train C, puts signal 10 at stop, the next two signals, 12 and 14, go to caution. The same is true of signals 9 and 7 when train A, passing signal 22, puts signal 11 at stop. The purpose of thus extending the caution indications on the approaches to sidings is to avoid letting an engineman get a stop signal after having passed an arm at clear, and without an intervening caution signal. If there were only one caution signal approaching each "stop" signal, as for example, if signal 14 on line 4 were at clear instead of at caution when train C passed the point where it put signal 12 at stop, train A, passing 14 at clear, would suddenly encounter a stop signal at 12. Having signal 14 at caution, however, serves to interpose the necessary cautionary indication ahead of signal 12; and in the foregoing case train A would pass 14 at caution, as indicated in line 4 in the diagram.

The signals for the entering ends of the sidings are controlled by overlaps, as shown in Fig. 1.

Summarizing the operations detailed in the foregoing, and taking Sharon, Fig. 1, as a typical siding:

FOR HEAD-ON PROTECTION.

When a train passes signal 836 or 839, all opposing signals to the next station assume the stop position.

Signals 837 and 838 assume the stop position when a train passes the overlap points as indicated.

Signals 840 and 838 are in the caution position when 836 is in the stop position.

Signals 837 and 835 are in the caution position when 839 is in the stop position.

FOR FOLLOWING PROTECTION:

Each signal is in the stop position while a train is between that signal and the next.

Each signal is in the caution position while the next signal is at stop.

the masts look, from a distance, as if they were bent. This optical illusion has resulted in a number of requests to the signal department to straighten up the signals.

Fig. 4 shows the mechanical interlocking tower at Clinton Jct. The building was erected by the division forces, according to the signal department's standard plans. Several interesting features are embodied in its construction. One is the "I" beam which extends from wall to wall of the tower and supports the machine, displacing entirely the usual framing for that purpose. The up-and-down rods are two-inch pipe. This is heavier than the material ordinarily used, but the top and bottom ends are run out to 1¼ in. and fitted with standard jaws. The larger rods make it possible to do away with guides. This construction is much more satisfactory than the old type, as it leaves more

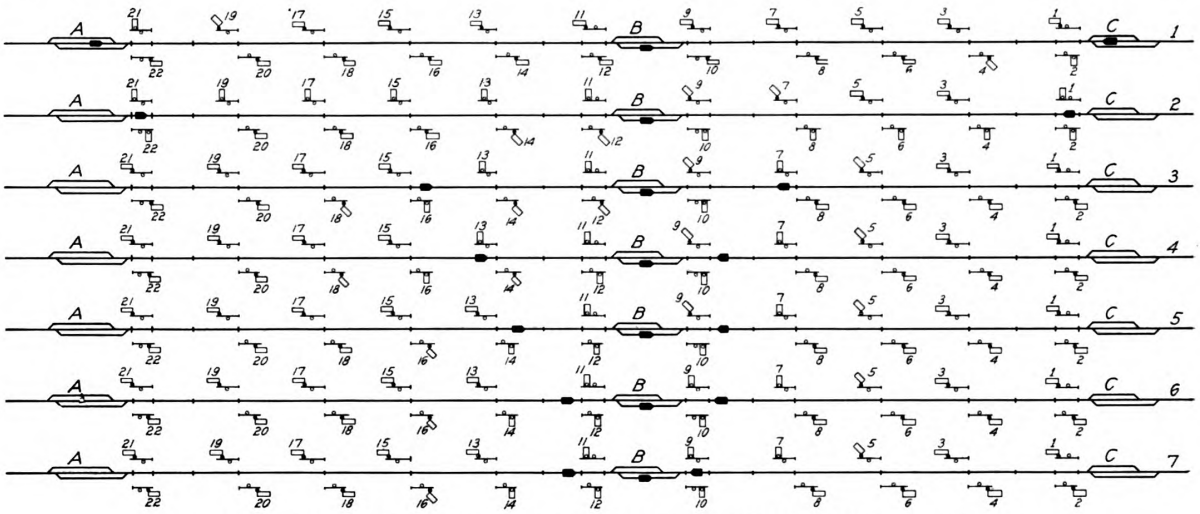

Fig. 2. Showing Signal Operation for Two Trains Approaching a Meeting Point.

In the "absolute-permissive" operation of signals on single track, the circuits are double track circuits with the addition of stick relays. There is a stick relay for each intermediate signal. The function of these relays is to select the direction in which a train is running. That is, they will be energized for those signals governing the direction in which the train is running, and de-energized for those signals governing in the opposite direction.

Each stick relay is picked up when the circuit is closed through a back point on the relay of the track circuit immediately in advance of a signal when the signal is at the 45-deg. position or higher, and is held up through a back point on the 45-deg. control relay, and will consequently stay up through the block. When a train drops the 45-deg. control relay before the track relay—as happens when a train is running in the direction opposite to that in which the signal governs—the signal being at the 0-deg. position when the track circuit is entered, the stick relay will not be picked up. Each 45-deg. control relay passes through the 45-deg. control relay at the next signal ahead and the stick relay at that signal in multiple, so that if the stick relay is down, each 45-deg. control relay, in dropping, drops the next 45-deg. control relay. But if the stick relay is up, the 45-deg. control relays have no effect upon each other. In this way the opposing signals between two stations are dropped to the 0-deg. position. There must be at least two track circuits between opposing signals.

The signal aspects are shown in Fig. 3. The design is such that the distance from the pivot of the casting to the center of the blade is nine inches greater than the R. S. A. standard provides for. This makes a distinct signal, and one which, in its clear position particularly, can easily be seen at long range.

It is interesting to note the fact that the marker lights, being at the same height on the masts of the signals which are opposite each other at the double locations, have the effect of making

room in the tower, looks better, is more permanent, and costs less. The other feature of interest is the provision for fastening indicator cases and other apparatus to the walls. Four-by-four strips were sunk into the brick wall flush with the surface on which the plastering is placed; and these, being spaced at con-

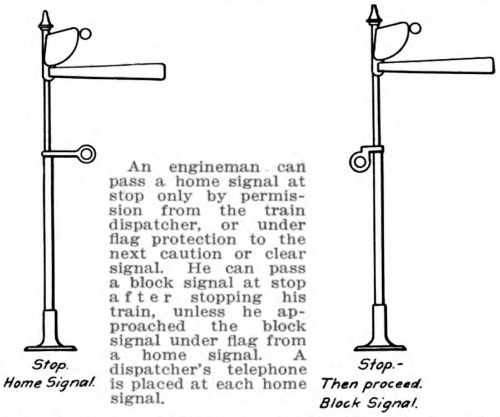

Fig. 3. There is a Difference Between "Home" Signal and "Block" Signal.

venient distances apart, hold the screws which are used in the wood cases provided for the indicators.

Fig. 8 shows the method of interior wiring for the circuit controllers on the mechanical interlocking machine in the Clinton Jct. tower. Galvanized iron conduit and condulets were employed; and, although there are quite a number of controllers on this locking bed, their arrangement is pleasing in appearance and permanent.

Fig. 9 shows the standard arrangement of relay cases. The

track relays, stick relays and control relays all occupy the same relative position in each box; and thus the wiring and lightning arrester placing are duplicated in all of them.

THE CROSSING BELL AT LAWRENCE.

At Lawrence, Ill., a crossing bell is located at the "double" location of signals 824 and 825, see Fig. 1. This bell isn't rung

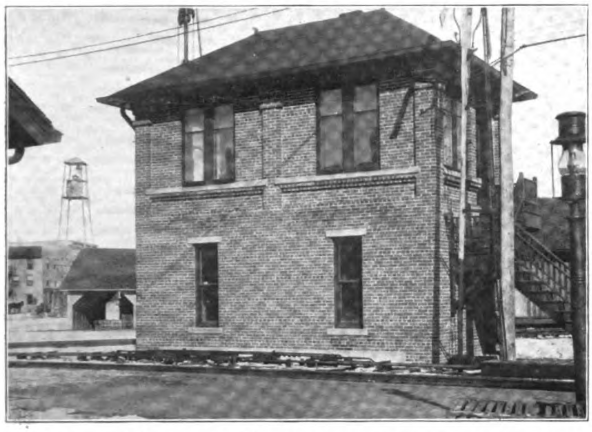

Fig. 4. The Interlocking Station at Clinton Junction.

from the track circuits directly as in the ordinary case, but the stick relays used in connection with the automatic signals are employed to control it. The track sections on each side of the bell were made 2,600 ft. long to provide the proper ringing

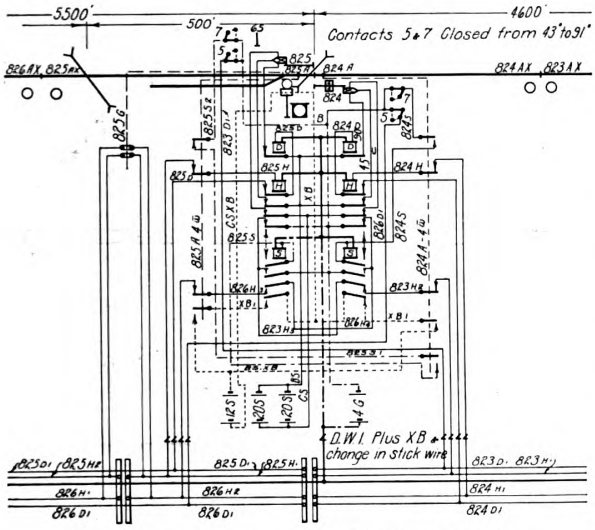

Fig. 5. The Wiring at a Double Signal Location.

distance, and the track relays are at the bell location. As a train approaches the bell from either direction the stick relay corresponding to the track circuit occupied remains down, and when the train is receding from the bell the stick relay corresponding to the track circuit occupied is picked up. This feature controls the crossing bell perfectly. The scheme is shown in the circuit diagram, Fig. 5, in which the bell circuit is in dotted lines.

The intermediate siding at Lawrence is also located near the signals 824 and 825 and has no switch indicators. But none is necessary, as a train can leave the siding only when both signals are clear. With the standard arrangement of stick relay circuits, if a train should, when leaving the siding, foul the main line before opening the switch, the stick relay 825s (see Fig. 5) would be picked up, which would put 823 to the 45-deg. position instead of stop. To obviate this difficulty the stick relay circuit 825s passes through a back point of the 824A track relay in addition to the 825A track relay, which means that in order for the 825s relay to be picked up a train must be in 824A section before 825A section (as it also depends on signal 825 being at

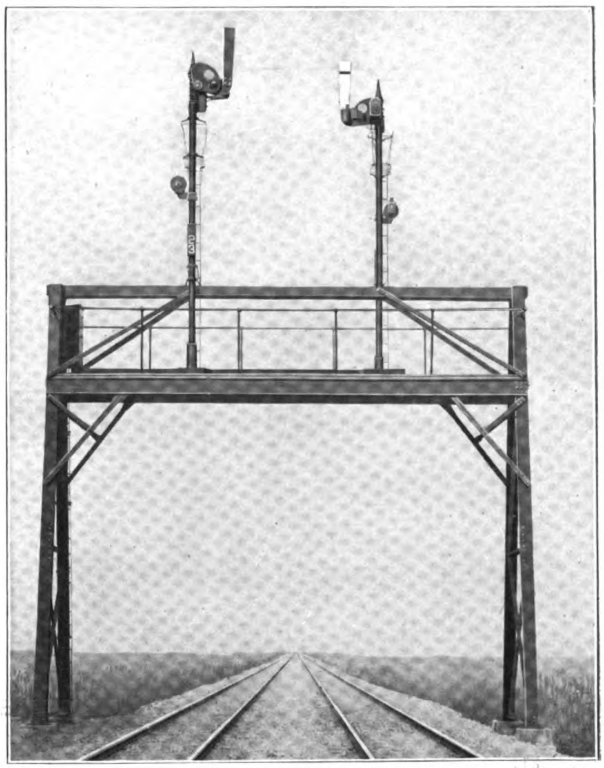

Fig. 6. The North-Western Standard Two-Track Signal Bridge.

the 45-deg. position or higher), which would only occur for a north-bound train (from Harvard).

THE SOUTH JANESVILLE "AUTOMATIC INTERLOCKING."

At South Janesville the single track runs into double track, which extends to Janesville. At the same location a double-track lead to the Janesville yard connects with the main line. The signal installation at this point has some resemblance to an interlocking plant, although the switches are handled by a switch tender.

The arrangement of tracks and signals is shown in Fig. 7. The high signals work automatically when the proper route is lined up. The upper blade on signal 869 governs to track 1. The

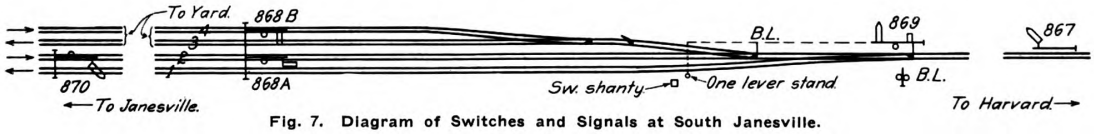

Fig. 7. Diagram of Switches and Signals at South Janesville.

lower blade on signal 869 governs to tracks 3 and 4, is operated by a pipe line from a one-lever stand near the switch shanty, and bolt locks the switches in the proper position. This arrangement allows freight trains to enter the yard without having to stop for signal 869. Signals 868A and 868B are home signals

for the single-track section up to Shopere, the next station, and operate the same as any home signals located at the end of station grounds. A double switch indicator is located at the end-of-double-track switch. The southbound indicator gives information as is usual on double track; while the northbound

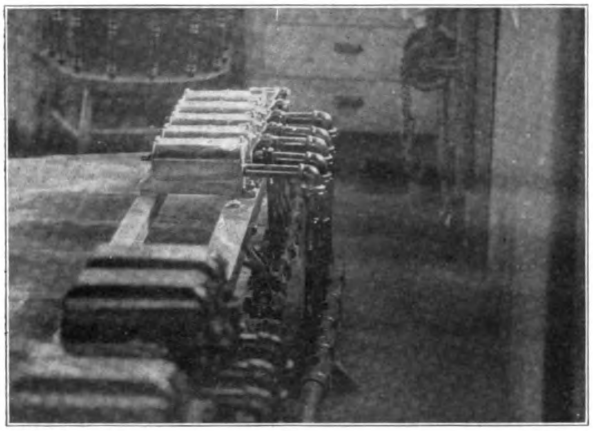

Fig. 8. Interior Wiring Construction, Using Condulets.

indicator operates the same as signals 868A and 868B, except that the switches do affect it, so that the indicator is at stop when a train leaves Shopere northbound. The same information from both the north and south is given by indicators inside the shanty. With this arrangement the switch tender has informa-

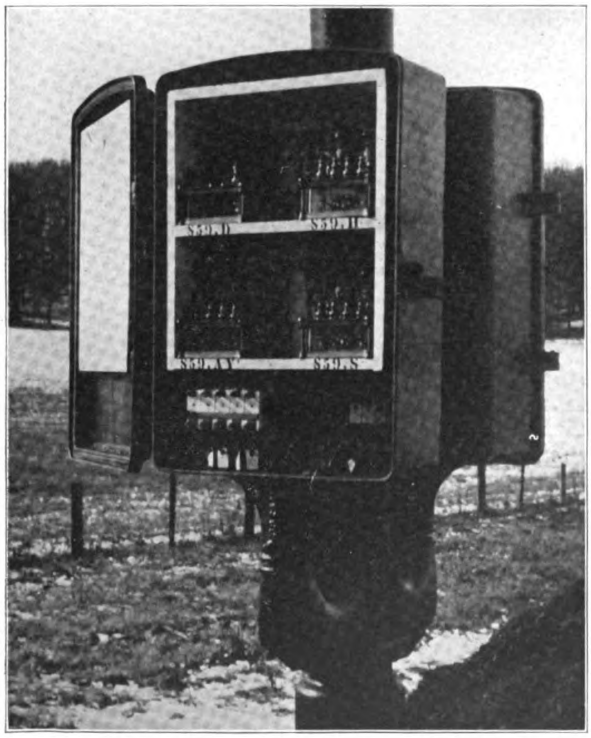

Fig. 9. All of the Relay Boxes Are Arranged the Same as This One.

tion as to approaching trains, whether he is inside or outside. A low-speed signal governing to the yard, and similar in operation to that described, is used with signal 876.

In Fig. 1 the controls are crossed over at South Janesville because the North-Western runs left-handed on double track.

The Evansville to Harvard installation is part of 137 miles of automatic block signaling which the North-Western has recently completed. Another line protected extends from Butler to North Lake, Wis., a distance of 30 miles, out of Milwaukee. This portion finishes the installation of automatic block signals on the new Wyeville line from Milwaukee as far as Clyman Junction, Wis., where the Janesville-Fond du Lac line crosses the new cut-off, a distance out of Milwaukee of 52 miles. Another portion recently protected is that between Madison and Baraboo, Wis., a distance of 36.9 miles. In addition to this, the new double track freight belt line, which was recently completed and put into operation about Chicago, has been equipped with automatic signals. This line extends from the new Proviso freight yards of the North-Western on the Galena division, just east of Elmhurst, through Des Plaines, on the Wisconsin division, and northeastward to the Milwaukee division at Blodgett,

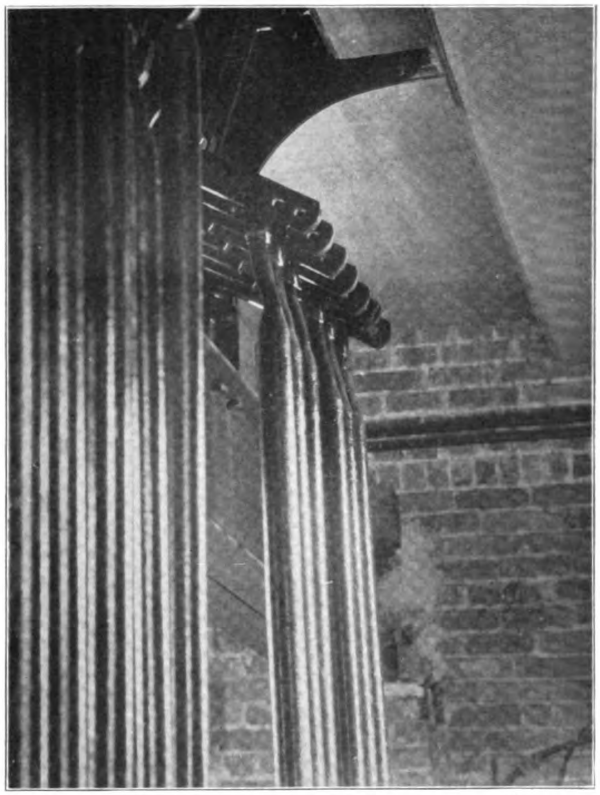

Fig. 10. Showing the "I" Beam Machine Support in the Clinton Junction Tower, and the Heavy Up-and-Down Rods.

where it connects with the outer double track line of the Chicago & North-Western Railway between Chicago and Milwaukee.

The material for the Harvard to Evansville installation was furnished and put in by the General Railway Signal Company. This company also put in the interlocking plant at Clinton Jct.

This scheme of "absolute-permissive" operation, and the circuits for its control, were designed by the engineers of the G. R. S. Co. This installation is the first one of the "absolute-permissive" type to be made in the United States. The Buffalo, Rochester & Pittsburgh started an installation of this kind before the C. & N.-W. work was begun; but the latter job was the first to be completed and put in service.

The capacity of this stretch of single track, which lies between two long stretches of double track, has been greatly increased by the new automatic signals. As an example, it took more than an hour to get four important passenger trains southbound, from Clinton Jct. to Harvard, under the old arrangement, block station at Sharon being closed. Now it can be done in less than half the time.