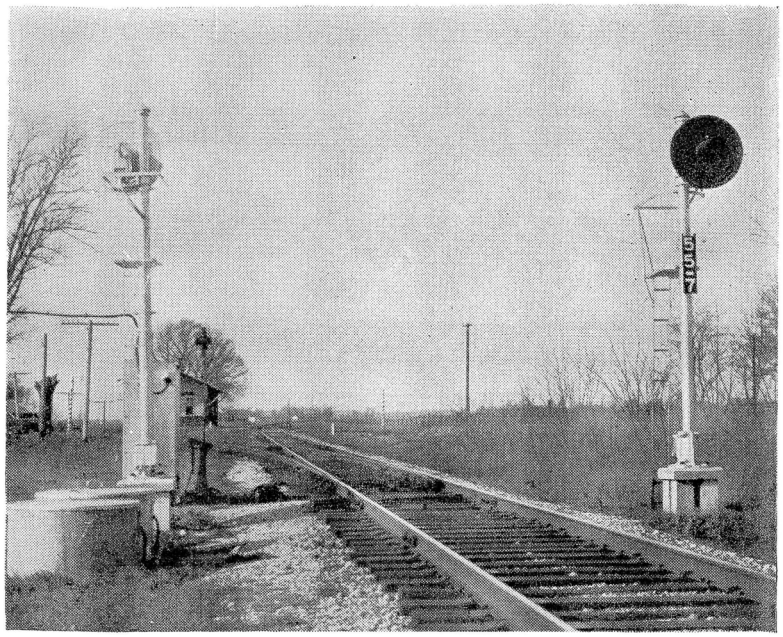


Typical double signal at the end of a siding showing sheet-metal relay case; concrete battery tubs and sectional types of concrete foundations

Milwaukee Installs Automatic Block

Safety increased and train time reduced on a single-track line handling six to eight passenger trains and four freights daily

AUTOMATIC block signaling has recently been installed by the Chicago, Milwaukee, St. Paul & Pacific on 49.6 mi. of single track line between Fox Lake, Ill., and Janesville, Wis., this being a portion of a route between Chicago and Madison, Wis. This route uses the multiple-track, Chicago-Milwaukee main line for 32.3 mi. between Chicago and Rondout, from which point the Madison line branches off to the northwest through Fox Lake and Janesville. Walworth, 73.5 mi. from Chicago, is the western terminal of the suburban passenger trains. In the Fox Lake-Janesville territory, the scheduled traffic includes six through passenger trains, two suburban passenger trains which operate only on the Fox Lake-Walworth section, and four freight trains; thus totaling 12 scheduled trains daily. Extra freights are operated as required, and extra passenger trains are operated to handle the football crowds between Chicago and Madison.

Train Speeds to 75 m.p.h.

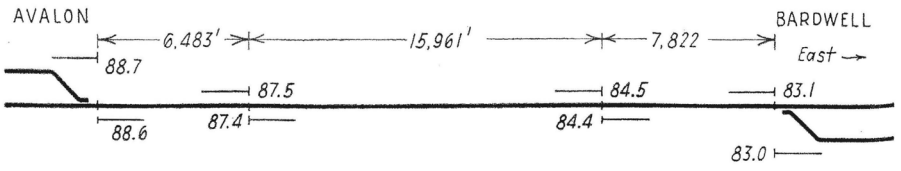
In the 49.6 mi. between Fox Lake and Janesville, there is one scheduled meet between a passenger train and a time freight, and one passenger train passes the local freight while it is working at Walworth. Other than these, there are no scheduled meets or passes. The through passenger trains, such as the "Varsity," are hauled by Diesel-electric locomotives, and the maximum permissible speed is 75 m.p.h. The maximum speed for freight trains is 45 m.p.h.

Improved Safety for Train Operation

Previously, the train movements were authorized by timetable, train orders and manual block. Following trains, such as sections of special football passenger trains, had to be spaced from block office to block office, thus introducing considerable delay. Now, with the automatic block, the following trains can be spaced much closer. For example, a freight train waiting on a siding for a passenger of the same direction to pass, can proceed at once when the passenger train gets beyond the first intermediate signal. Also in numerous instances, a freight train can be advanced one or more sidings ahead of a passenger train whereas previously with no automatic signals, the freight would be held on some other siding. Other advantages of the automatic block signaling are that it provides protection to detect broken rails; to check for misplaced switches; and to detect cars on turnouts that are fouling the main track.

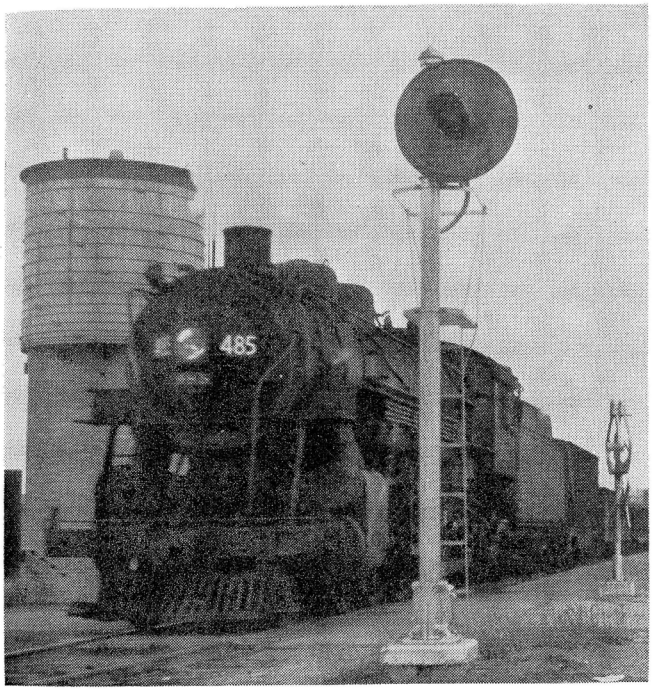
Long Intermediate Blocks Saves Train Time

The new signals are the searchlight type, and the controls are in accordance with conventional absolute permissive block practices. At the west end of Fox Lake, the head-block signals are located 494 ft. west of the last



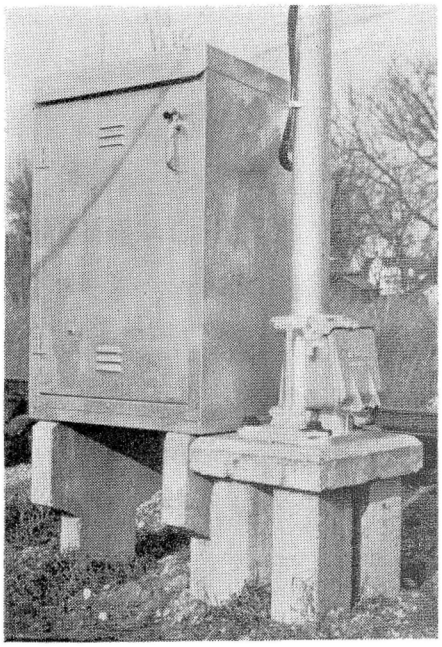
Plan illustrating long intermediate block

switch so that this 494 ft. of main track can be used by suburban trains when switching into or out of the west end of the yard, without holding eastward trains at the next station west. At other sidings where no switching moves are involved, the head-block signals are located about 15 to 20 ft. from the siding switch. In each overall siding-to-siding block the two end automatic blocks are full train-stopping distance in length, and the "middle" automatic block extends for the remaining distance which may be up to 4.5 mi. Referring to Fig. 1, the block from signal 83.0 to its approach signal 84.4 is 7,822 ft. long, and the block from signal 88.7 to signal 87.5 is 6,483 ft., thus leaving the middle block, between signals 87.5 and 84.5, to be 15,961 ft. which is 3 mi. This arrangement of block lengths permits maximum time for a freight train to get in the clear without stopping a following train that is to pass. Also, when an eastbound freight is waiting, for example on the siding at Avalon for an eastbound passenger train to pass, the shorter block out to signal 87.4 allows the passenger train to clear this block more quickly, and thus permit the freight to depart that much sooner.



Left—The leave-station headblock absolute signals are not numbered

Right—View of sectional type concrete signal foundation



Signals Continuously Lighted

The signals are the searchlight type and display standard A.A.R. Signal Section aspects, red, yellow and green. The lamps in the signals are burned continuously, rather than on approach control, in order to furnish information concerning the approach of trains to men on motor cars. The lamps are the double-filament type rated at 8 volts, 13 plus 3.5 watts. The lamps are normally fed at about 7.5 volts which is somewhat under rated voltage, thus giving a longer life. The lamps are replaced about every three months, and, on this basis, there are very few burnouts in service. Where long track circuits ranging from 7,900 ft. to 10,800 ft. would fit into the controls, modern coded track circuit equipment was installed, thereby eliminating the costs for insulated rail joints, track wires, relays, batteries, etc., at the cut sections that were eliminated. In the 49.6 mi. between Fox Lake and Janesville, there are 10 coded track circuits that range from 7,900 ft. to 10,812 ft. in length. These coded track circuits operate continuously at 180 codes per minute, and are used only for detection. The remainder of the track circuits are the conventional d.c. neutral type using relays rated at 2 ohms. The rail joints are bonded with Cadweld bonds.

The line controls for the signals are on three line wires, one of which is common for the other two. The line circuits extend directly to the 250-ohm operating coils of the searchlight signals, thus dispensing with the need for line relays. Raco Clearview type arresters, made by Railroad Accessories Corp., are used to protect these line circuits.

Mostly A.C. Primary Power Supply

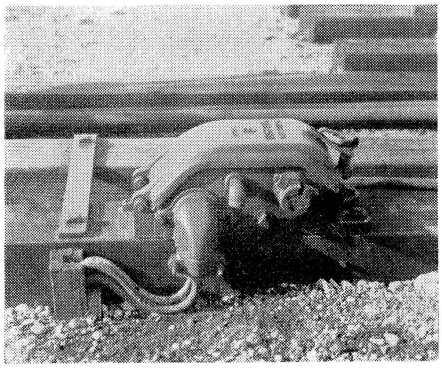
The a.c.-primary system of power supply, including primary battery, is used on this project except that the a.c.-floating system, including storage batteries, is used for the line circuit feeding to the country from each station-entering head-block. A 220-volt single-phase a.c. power distribution circuit extends in both directions from various power feed locations so that this 220-volt power is available at all signal locations. Thus, the power line is not continuous, thereby saving several miles of wire. The lamps in the signals are normally fed from the low-voltage side of the transformers, and in case of an a.c. power outage, a power-off relay transfers the lamp feed to the battery.

Some Coded Track Circuits

Each conventional track circuit is fed by three cells of Edison 1,000 a.h. primary cells with a rectifier connected across the battery to carry all but about 10 m.a. of the normal discharge. The average life of such a battery is about 60 months. In gaps where there is no a.c. power line circuit, there may be a cut section where coded track circuits feed both directions. At such locations, each track circuit is fed by two 1,000-a.h. primary cells, and a code transmitter operates continuously from a set of 16 cells of 1,000-a.h. primary battery.

With exceptions as noted later, there is at each signal a set of 13 cells of 1,000-a.h. Edison primary battery with a rectifier floating across it to take all but about 10 m.a. of the normal load, which is the line circuit to the rear. The average life of such a battery is about 60 months. If the a.c. power distribution fails, a power-off relay is released to connect the signal lamp to this set of primary battery. At each station-entering head-block signal, the line battery consists

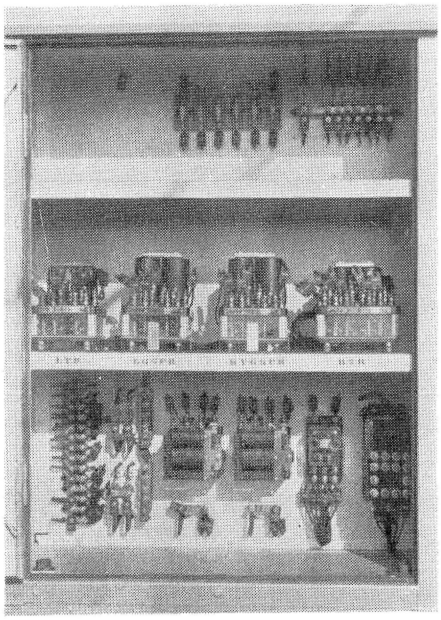
of five cells of 9.2-a.h. storage battery which is on floating charge. The reason for using a storage battery rather than primary at these locations is that the load is very light and the cost of a duplicate set of primary cells was not considered to be warranted. The batteries are housed in circular concrete wells. The wiring is run in buried cables. The leads from the battery; the feed circuit to the signal lamps; and the track connections are No. 9. The control circuits from the case on the line side to the signal on the other side of the track are No. 14. The aerial cables from the line pole to the signal case are No. 14.



Cable entrance at switch box

Pole Line Rebuilt

The previous pole line had only a few telegraph wires on brackets. The poles were replaced as required and a 10-pin arm installed on each pole to carry the communications line wires as well as the new signal line wires. The three signal line control wires and the two 220-volt a.c. wires are No. 10 copper. These line wires were furnished by the Anaconda Company, and have the new Duraline weatherproof covering.



Relay case at a headblock location

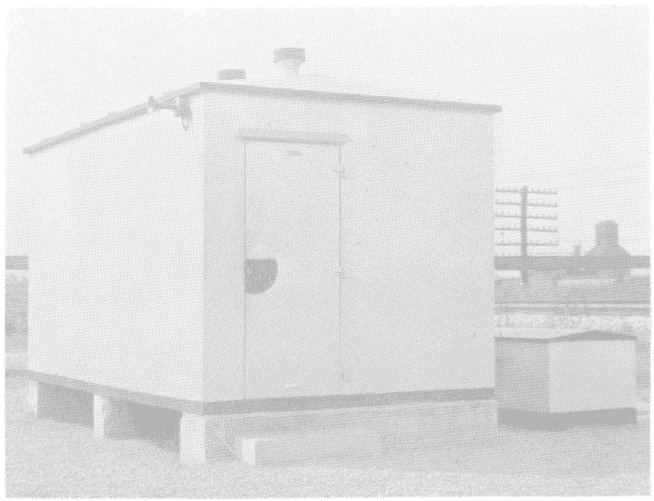
This automatic block signal installation was planned and constructed by signal forces of the Milwaukee, under the direction of L. B. Porter, superintendent telegraph and signals, the major items of equipment being furnished by the Union Switch & Signal Co.

Modern Interlocking On Lehigh Valley

(*Continued from page 97*)

mounted on a panel on the north wall near the terminal board. The line code apparatus is mounted on the west end of the house. The relays, which are Type-K, are wall-mounted on boards on the two side walls. Type KB motor-driven time relays and Type-TG thermal relays are used in the approach locking circuits.

Inside this house, No. 16 stranded insulated wire was used for all circuits except the power wires, which are No. 9. The wiring, relays and other equipment were installed in this house at the signal shop in Sayre, Pa. and a complete check was made of the circuits. Hooks and chains were inserted through the ventilators in the roof for attachment to the steel frame, permitting the building to be picked up by a derrick and set on a car. In a similar manner it was unloaded and set on the foundations at Tifft Junction.



Large sheet-metal instrument house and battery box at Tifft Junction on Lehigh Valley

Old Plant Continued In Service Until New One Was Ready

The old mechanical interlocking was continued in service while the new relay cases, instrument house, batteries and circuits, as well as the new signals and switch machines, were installed. Test bars were installed on the switch machines so that they would operate and indicate. The new searchlight signals were in place and in operation but were covered so as not to be seen by enginemen. Accordingly, a complete operating check was made of the signals, switches and circuits throughout the plant. On the day of the changeover, the old mechanical interlocking was abandoned, and the new remotely controlled electric interlocking was cut into service in approximately six hours.

Constructed by Railroad Forces

The project was installed under the direction of Chief Engineer of Signals and Telegraph, J. F. Yerger, and under the supervision of Signal Supervisor, T. P. Heitzman, and General Signal Inspector, C. Nelson. The circuits and installation were designed by W. J. Varner. Signal Foreman W. J. Hibbard was in charge of the field work. The major items of signal equipment were furnished by the General Railway Signal Company. The wiring of the house and cases was done in the signal shop under the direction of Shop Supervisor, I. E. Harshbarger.