

Above — Typical head block double-signal location at east end of Bluffs
Right — Eastbound home signal at the drawbridge plant



Automatic Signaling Installed On the Wabash

As a means for improving safety, as well as expediting train movements, the Wabash Railroad has recently installed automatic block signaling on 50 miles of single-track line between Markham, Ill., and Kinderhook, Ill. This territory is a portion of a direct east and west line between Decatur, Ill., and Moberly, Mo., on a short route between Kansas City, Mo., on the west, and Chicago, Ill., and Detroit, Mich., on the east. Through passenger trains are routed over other Wabash lines between Moberly and Decatur via St. Louis, Mo. The direct line between Moberly and Decatur via Hannibal and Jacksonville has the advantage of being 54 miles shorter than the route via St. Louis. Furthermore, the routing of through freight via the Hannibal line avoids several hours delay required for transfer in the St. Louis terminal area. For these reasons, all east-and-west through freight of the Wabash is routed over the Hannibal line. The passenger service on

this line is handled by one gas-electric train each direction daily. The schedules include four through freight trains each way daily and extra trains are operated as required. On the average about 20 trains are operated daily.

Why the Installation Was Made

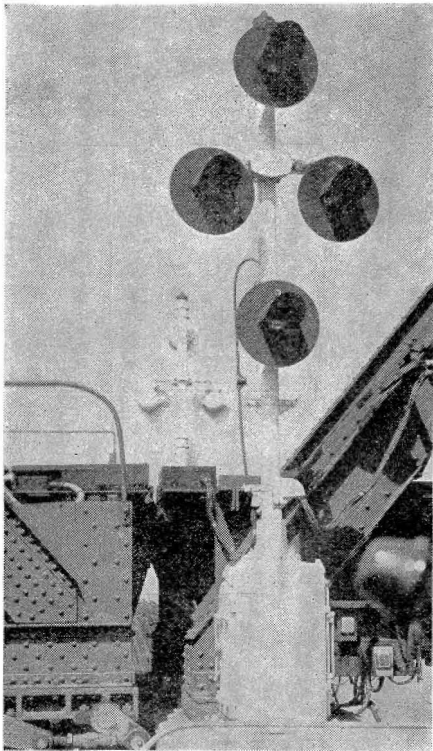
This is an important main line on which there has been a material increase in traffic. The 50-mile portion between Markham and Kinderhook was chosen to be equipped with signals in order to improve the safety of train operation in the sections where sighting distances were short on grades and curves. Another item is that the operation of helper locomotives causes an increase in the number of moves on some of the territory.

Between Jacksonville and M.P. 56, the grade is down and up, ranging up to 0.8 per cent with a maximum of 0.9 per cent so that the average ruling grade is 0.7 per cent in both directions.

Construction practices revised to meet war-time requirements — Primary battery used throughout and iron line wires used on final sections

Between M.P. 56 and M.P. 49, just west of Bluffs, the railroad descends along a creek down to the valley of the Illinois river, this section of 7 miles being mostly on a descending grade ranging between 0.5 and 0.7 per cent, with a short section of 0.8 per cent so that the ruling grade is considered as 0.7 per cent. In this 7 miles, there are 15 curves three of which are between 2 deg. and 3 deg., four are 3 deg., one 3 deg. 45 min., and one 4 deg. Under these circumstances the sighting distances are short.

In the 5 miles between M.P. 49 at Bluffs and M.P. 42 at Valley City, the railroad crosses the wide valley of the Illinois river, the grade being practically level. On the 5 miles between M.P. 42 at Valley City and Griggsville, the railroad ascends along a



Signal on the bridge for directing approaching boats on the Illinois River

In consideration of the fact that the automatic signaling was urgently needed for protection, the management authorized the project with directions to the effect that the design and construction practices be altered as might be required in order to minimize the amounts of strategic materials.

Signals and Controls

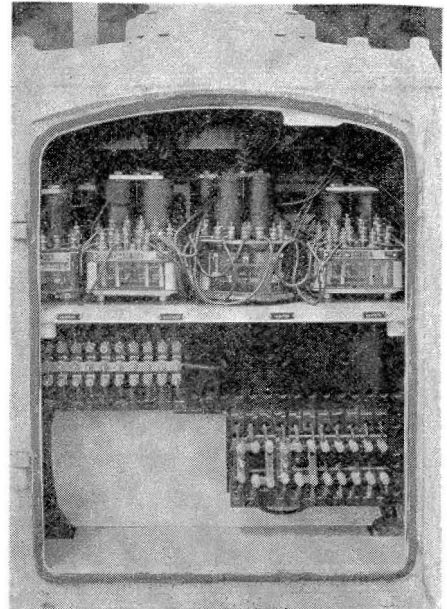
With an exception to be noted later, the signals are the U. S. & S. Co. H-5 searchlight type, in which the mechanism is plug connected. On the final section between Camery Switch and Kinderhook, the five signals required are second-hand semaphores which were installed temporarily to conserve materials for the duration of the war.

The signals are mounted on sectional type pre-cast concrete foundations, each consisting of a bottom disk, a vertical barrel section and a top disk, all bolted together. The mast is the proper length to bring the center of the signal lens 15 ft. 3 in. above the level of the top of the rail, so as to be in direct line with the engineman in the cab of a locomotive.

A double signal head-block location

trains, such as Chapin, Bluffs, Naples, Valley City, Griggsville, Baylis and Barry. Other short sidings, which may be used by work trains or by the local freight train when setting out or picking up cars, are located at Neelys, Maysville, New Salem, Camery Switch and Magner.

The spacing between intermediate signals depends on the overall dis-

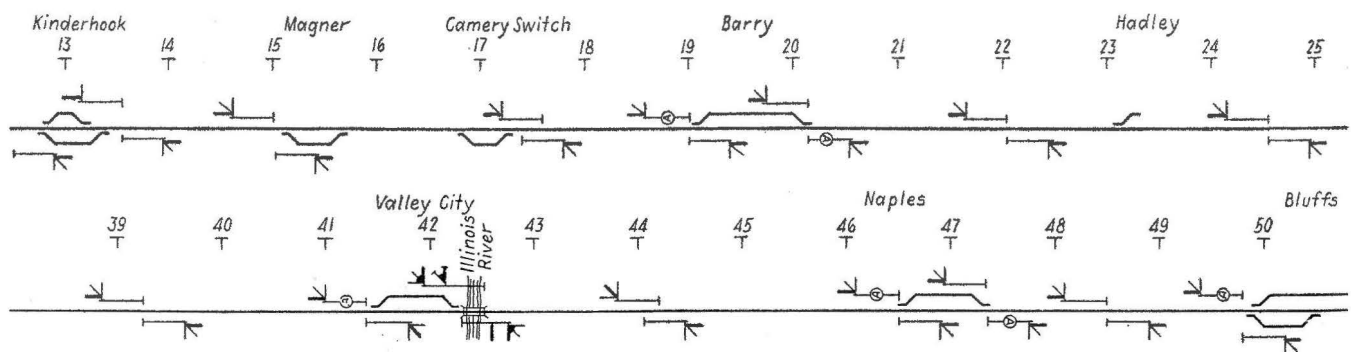


Interior of typical instrument case

creek valley at varying grades most of which is 1.0 per cent or more so that the overall ruling grade is set as 1.5 per cent. In this five miles, there are 12 curves of which three are 3 deg., one 3 deg. 45 min., one 4 deg., one 4 deg. 45 min., and two 5 deg. 15 min. Thus the sighting distances are short.

Between Baylis and M.P. 21, east of Barry, the line is up hill and down. Between Camery Switch and M.P. 21, the grade ascends eastward with a maximum of 1.6 per cent, so that the

tance between two sidings with "A" station departure signals; for example, there are three sets of double locations of intermediate signals between Griggsville and Baylis, the



Track and signal plan of the new automatic block signaling

overall ruling grade is 1.5 per cent, the same as between Valley City and Baylis. The trains are loaded so that a single locomotive is sufficient to handle a train except westbound between Valley City and Baylis, as well as eastbound between Kinderhook and Baylis. Therefore, on these sections a helper locomotive is provided for each train. The movements of these locomotives as light engines down the grades increase the number of moves made daily.

was installed about 10 ft. from each passing track switch. Each station-leaving signal is an absolute signal and is so designated by the absence of a number plate and by a marker consisting of a yellow disk 14 in. in diameter with a raised reflex letter A painted red. This marker is mounted on the mast 7 ft. below the signal unit.

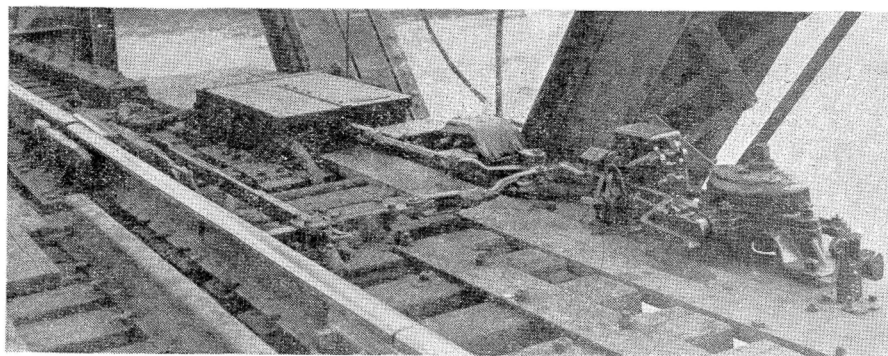
Head-block locations including "A" signals are provided at only the more important sidings which are used for the meeting and passing of through

blocks being approximately two miles in length, plus or minus depending on local conditions to secure the best sighting distance available. These intermediate signals provide protection for the outlying house tracks at Maysville and New Salem.

Features of A.P.B. Control

The signaling is arranged for operation on the absolute permissive block system. The signals are controlled to

Switch stand with electric lock for operating bridge circuit controller and for checking the rail lock



three aspects by polarized line circuits, using one wire in connection with common for controls in one direction and one wire in connection with common for the other direction. The polar line circuits extend to the operating coils of the respective searchlight signal mechanisms, which are rated at 250 ohms. The line circuit to the rear is polarized through contacts in a 350-ohm slow pick-up slow release relay, which in turn is controlled by contacts in the searchlight signal to repeat the yellow and green positions. The use of this repeater relay prevents "flips" of the signal aspects due to the operation of light engines at high speed.

The controls are arranged so that when a train passes an intermediate signal for the opposite direction, that signal continues to display the most restrictive aspect until the train clears the block. Thus if a train stops between stations, it does not have a clear signal to authorize a back-up move.

Switch Position Protection

The switch circuit controllers are the U-5 type, the connecting rods being equipped with ball-and-socket joints at each end. The line control circuits are not broken through contacts in switch circuit controllers.

through a riser pipe and terminate on terminals in a cast-iron junction box located about 2 ft. from the switch circuit controller. Flexible insulated wires extend from the terminals in the junction box to the terminals in the controller, these wires being inclosed in a piece of discarded air hose. This practice minimizes the breakage of wires which may be caused by vibration due to passing trains.

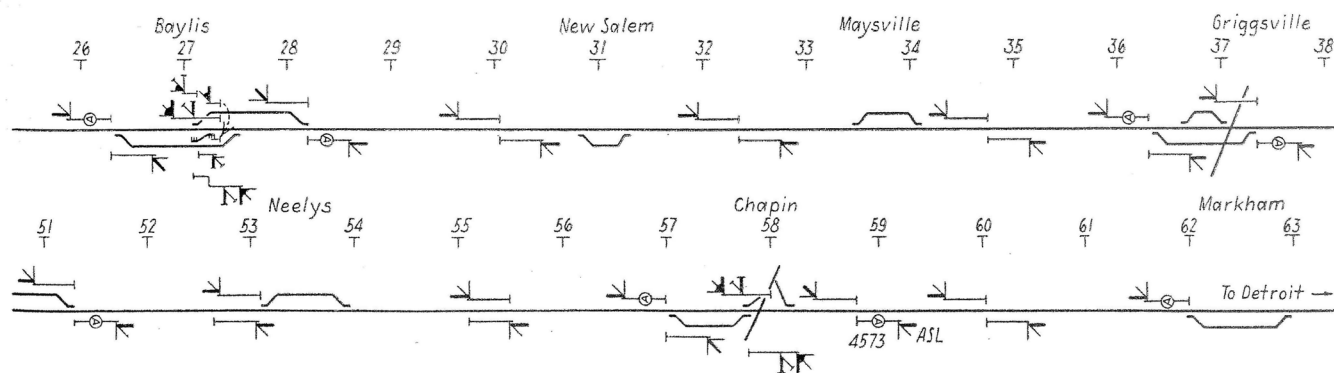
Approach Lighting

The signal lamps are the single-filament type rated at 10 volts, 5 watt, or at 11 volts, 11 watts where deflecting cover glasses are used. Approach lighting is in effect for all signals. Directional lighting control is provided. Signals are lighted on approach from one signal to another, with the exception of station-departure absolute "A" signals which are lighted when a train passes the opposing "A" signal at the next station. For receding movements, the signals are lighted for only

arms were used. These break arms are mounted on a single crossarm, thus saving extra arms, pins and insulators that would be required for double arms.

Automatic signal projects installed on the Wabash during recent years have included an a-c. floating system of power supply with a two-wire a-c. power distribution line circuit, transformers, rectifiers, and storage batteries for feeding line circuits and signals. On the Markham-Kinderhook project, however, the signaling is fed exclusively from primary batteries, thus eliminating the copper line wires for an a-c. power circuit, thereby contributing to the saving of copper for use in the war program.

At each signal there is a set of 16 cells of Edison 500-a.h. primary cells which normally feeds the operating coil of the searchlight signal at that location, as well as the line circuit to the rear and the pole-changer relay. The signal lamp is normally extinguished, but when approach control



between Kinderhook and Markham

Switch position protection is accomplished by series-opening and shunting the track circuit. Because the insulated rail joints at head-block signals are located only 10 ft. from each passing track switch, no extra insulated joints are required to secure this result. Each cut section, where possible, is located near an outlying main-track switch, thereby obviating extra insulated joints.

The underground cables from the rail connections are brought up

one track circuit. The series line approach lighting relays are the DN-22 type.

On 45 miles between Markham and Camery Switch, the three control line wires are No. 10 Copperweld. On the final section of 5 miles between Camery Switch and Kinderhook, the line wires are No. 9 iron. All line wires have double-braid weather-proof covering. At signal and cut-section locations where line control circuit wires dead-end, Ohio-Brass Company break

is in effect, the lamp is lighted from the 16 cells of primary battery.

Each track circuit is fed from a set of three cells of National Carbon 500-a.h. high-voltage primary battery. The rails are bonded with Cadweld bonds.

New Drawbridge Protection

This line of the Wabash crosses the Illinois river at a point about one mile east of Valley City. The swing-
(Continued on page 544)

Automatic Signaling on Wabash

(Continued from page 523).

type drawbridge at this river crossing is operated by electric motors under control of a bridge-tender. Prior to the recent improvements, no signals were in service at this drawbridge, all trains being required to stop short of the draw and proceed on a hand signal from the bridgetender.

As a part of the program, the signaling was carried through this draw-

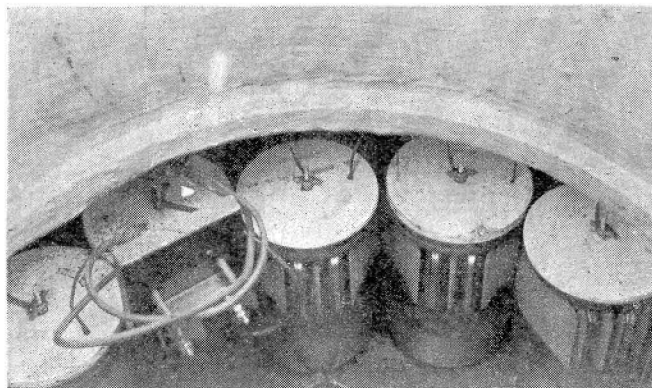
protected by an all-relay interlocking controlled by a miniature lever machine in the ticket office of the passenger station. An interchange track between the two roads is connected to the main lines at switches located outside of home signal limits, as shown on the diagram. Under certain circumstances, an eastbound train, for example, may leave most

crossing, is the eastward "A" absolute signal, the circuits being arranged accordingly. This permits trains, when switching, to occupy the main line between the crossing and signal 4573, without holding the westward "A" signal 4540 at Markham at the Stop aspect.

The second feature is the provision of a second "arm" on each of the Wabash home signals at Chapin. These are searchlight signal units which display either red or yellow, the control circuits being on the call-on non-track circuit control basis so that locomotives can be directed to back down on their own trains.

Signals for Boats

Special signals, made up of units similar to those used in highway-railroad crossing signals, are mounted on each side of the Illinois River bridge, and are directed along the line of navigation approaching the bridge from each direction. When a river boat is approaching, the pilot blows the whistle to call for the bridge to be opened. If circumstances are such that the bridge can be opened promptly, the bridge-tender operates a small switch which causes the two green lamps in the vertical line on the signals to be flashed. On the other hand, if a train is closely approaching, or there is any other reason why the bridge cannot be opened promptly, the



A set of 16 cells of 500-a.h. primary battery is provided at each new signal

bridge layout so that signal protection is provided, and trains can now proceed on the authority of home signals, without the necessity for stopping. The two new home signals are located in approach to the draw as shown on the drawing. At each end of the draw, there is a set of rail-end locks, which is operated by pipe connections to a stand mounted on the bridge deck at the south side of the track. Operation of the lever of the stand operates the rail locks as well as a Stiles drawbridge circuit controller. The lever of the stand is equipped with an electric lock. Neither of the home signals can be cleared unless the levers of both of these stands are in the normal position and locked by the electric lock.

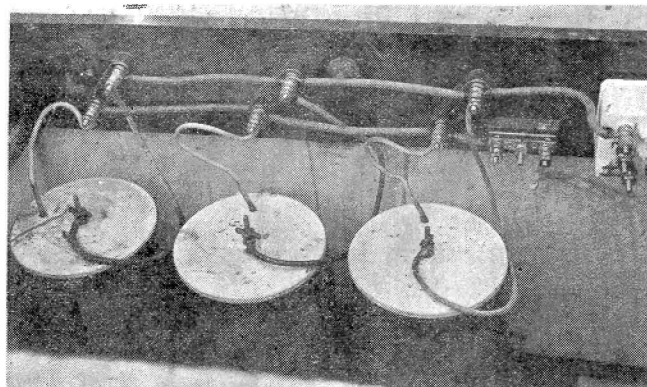
In the bridge-tender's control room there is a desk-lever unit with one lever. This lever, when in the center position, controls both home signals to display the Stop aspect. When the lever is thrown to the right, the westward signal clears, and when thrown to the left, the eastward signal clears. If a proceed aspect is taken away with a train on the approach, a clock-work time release, set at three minutes, must be operated in order to release the lever so that it can be placed normal.

Advance "A" Signal at Interlocking

At Chapin, the Wabash crosses a single-track line of the Chicago, Burlington & Quincy, this crossing being

of its train west of the crossing while the locomotive is moved east of the crossing to set out or pick up cars on the interchange track, and during this period it may be desirable for a

A set of 3 cells of 500-a.h. primary battery feed each of the track circuits



westbound train to keep moving from Markham toward Chapin. The procedure in this instance is that when the switching is finished on the interchange track at Chapin, the locomotive backs down west of the crossing to its train which is either on the passing track or on the main line.

Two Special Features

In order for these various train movements to be made without interference, two special features are provided. Eastbound automatic signal 4573, located 4,779 ft. east of the

bridge-tender operates a small switch which causes the two red lamps in the horizontal line on the signals to be flashed. With this warning, the boat pilot can govern his boat as may be required to avoid crashing the bridge. Normally the lamps in the navigation signals are extinguished.

These new automatic signaling and interlocking changes were planned and installed by the signal forces of the Wabash Railway under the direction of G. A. Rodger, signal engineer, the major items of signaling equipment being furnished by the Union Switch & Signal Company.