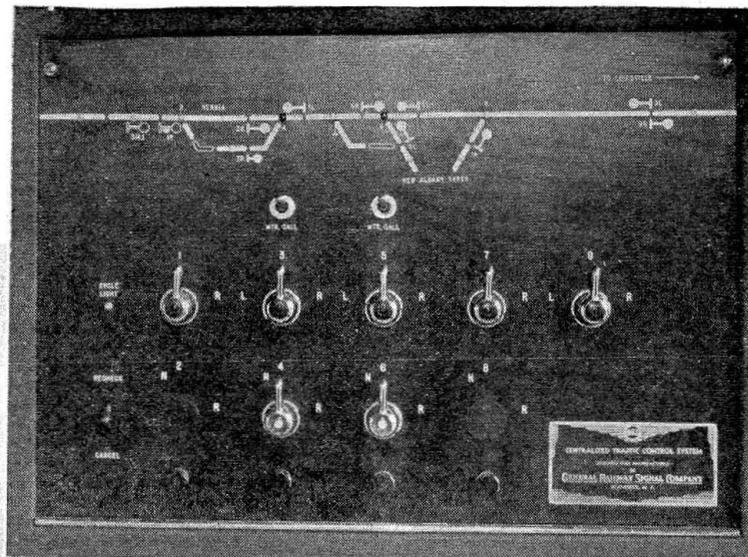
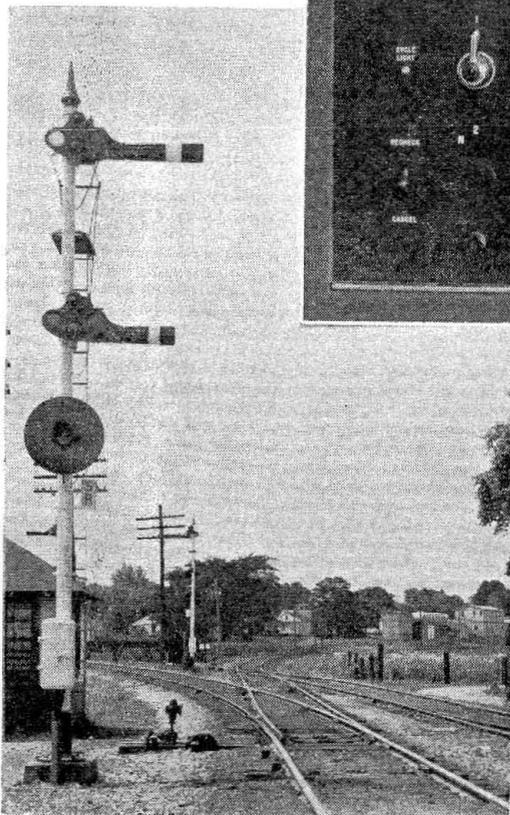


Right—The control panel is located in VI tower

Below—The signal 5R at North Wye has two arms and a switch indicator



# Monon

**Project on 2.5 miles, including two semi-automatic manual blocks, one power switch, two hand-throw switches, one spring switch and 10 controlled signals, saves 20 minutes for each freight train**

THE Chicago, Indiana & Louisville, popularly known as the Monon, has installed remote control signaling on 2.5 miles of single track between New Albany, Ind., and Vernia siding. This project has been effective in saving several minutes for each passenger train and an average of 20 minutes for each freight train, as well as considerable time on numerous switching moves. Many years ago when the Monon terminated at docks in New Albany on the north side of the Ohio river, the main line from the north followed an alignment which is now the north leg of the wye. At a later date when the Kentucky & Indiana Terminal Railway built the bridge from Louisville, Ky., across the Ohio river to New Albany, the Monon built a connecting track from North Wye to the Indiana end of the bridge. The K.&I.T. has various connections and yards in Louisville, and all through trains of the Monon terminate in Louisville. The K.&I.T. bridge is double track and used by trains of the Southern and the Baltimore & Ohio, as well as the C.I.&L. Also by means of gauntlet tracks, at 5-ft. gage, street

cars are operated over this same bridge. At the north end of the bridge, in New Albany, the junction switches for the B.&O., the Southern, the C.I.&L. and the street car line are all included in an electric interlocking known as VI.

#### Why Trains Lost Time Previously

The section of track between VI interlocking and North Wye was constructed through a densely built-up residential section of New Albany. For the first 1,120 ft. the right-of-way is very narrow and winds around between business buildings and industries to a point where it enters Fifteenth street, and then the track is in the middle of this street for 2,400 ft. Through this area the train speeds are limited to 10 m.p.h. North of Beeler street, the railroad has its own right-of-way.

At the time the bridge was built and the connection was constructed between the bridge and North Wye, a manual block was established between VI interlocking and North Wye. Northbound trains were required to

stop at North Wye to report out of the block. All southbound trains were required to stop at North Wye and get the block to proceed. If a train could not be accepted for a through move to VI and on over the bridge, the train had to be held at North Wye because if a train was stopped between North Wye and VI, it would block several street crossings. Having stopped at North Wye, there was always some uncertainty as to how much time would be required for a freight train to pump up the air, get under way and proceed to VI. Therefore, southbound trains were usually held at North Wye until plenty of time was available between other train and street car moves over the bridge. The result, in many instances, was that the southbound freight train lost anywhere from 15 minutes to 45 minutes or more waiting at North Wye. In the meantime, any northbound Monon freight train had to be held in the yards at Louisville. In several instances, through trains would be moved down into the old New Albany yard tracks to get them out of the way of other trains.

# Remote Control Signaling

## Saves Train Time

This required "back-out" moves which caused more delays. A study of the situation led to the decision to install remotely-controlled signaling, and the proposed savings in train delays were so evident that the War Production Board approved the project. Under the new system, train movements are authorized by signal indication without train orders in the territory between VI interlocking and the siding at Vernia. Before leaving Louisville, the northward trains get orders that are effective north of Vernia.

### Project Starts at Signal 9L

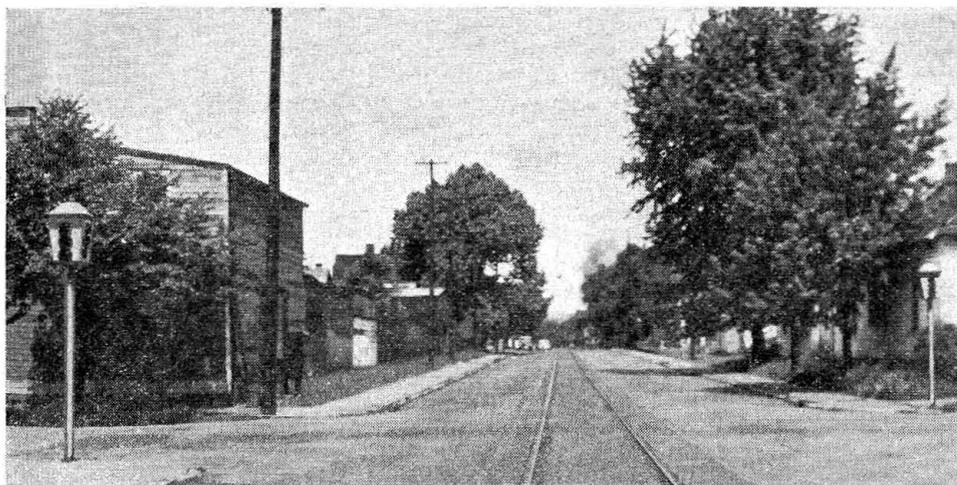
In the previous operating arrangement the operator-leverman at VI interlocking, under the direction of the K.&I. dispatcher, had charge of the manual block between North Wye and VI. Therefore, the control machine for the new signaling is located

terchange tracks to be made without interfering with train movements in the block between 9L and North Wye.

For train movements in either direction, one semi-automatic block extends between this northward signal 9L and southward signal 5R at North Wye. Also signal 7R governs train movement into this block from the south leg of the Wye at South Wye. These signals, 9L, 7R and 5R, normally display the Stop aspect, and the circuits are interconnected so that a Proceed aspect can be displayed on only one. As explained previously, the train speeds are limited by local conditions to 10 m.p.h. in this block. It is desirable, therefore, in numerous instances to allow one train to follow

another, and such practice is safe because of the low speed. For this reason, these three signals, 9L, 7R and 5R, each have a lower "arm" which can be controlled to the 45-deg. position with a yellow light to authorize a permissive following train movement. This permissive aspect cannot be displayed unless the first train entered the block on the authority of a Proceed aspect on the top arm of the same signal on which the permissive aspect is to be given. In other words, the block must have been unoccupied for the first train and the second train must be of the same direction as the first.

In order to secure this sequence, a stick relay is picked up when the first

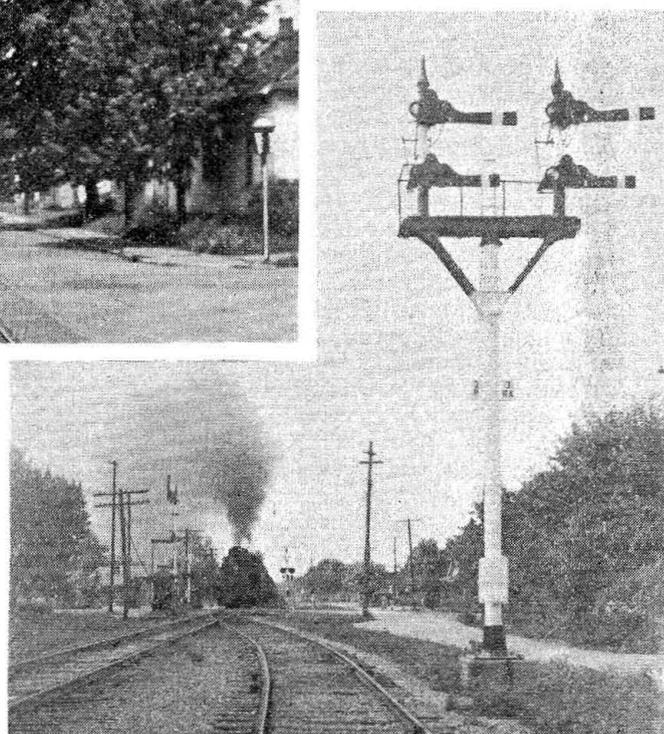


Left—View looking north showing track in the middle of Fifteenth street

in this VI tower and is operated by the same man who previously had control of the manual block. He is now known as the Control Operator.

The first northward semi-automatic, No. 9L, is located 1,247 ft. north of the VI interlocking limits so that northbound Monon passenger trains can make the stop at the New Albany passenger station before entering the block. This area between VI interlocking limits and signal 9L also allows various switching moves on in-

Right—Northbound train passing the new power switch



train enters the block with the signal displaying the Proceed aspect. This stick relay holds up as long as the block is occupied. This permits a permissive aspect on the lower arm for successive trains until the block is unoccupied. In event the lower arm is displaying permissive aspect and the preceding train clears the block before the following train has accepted this indication, the lower arm will assume the stop position and

a track which extends west for a mile or more through the New Albany yards to freight houses and various industries in the western part of New Albany. For the most part these tracks and the two legs of the wye are used only by the switching crew when serving various industries. When a switch engine is to make a move from the north leg of the wye to the main track, the locomotive or leading car is stopped on the short track circuit in

crossings. As a part of the 1945 signaling program, an electric switch machine and semi-automatic signals, controlled from the machine at VI, were installed at the switch at the south end of this siding. This is practically the same as a remote control layout. The southward main track signal 3R or the southward leave siding signal 3RA, when cleared, authorize a train to proceed through the block to signal 5R at North Wye.

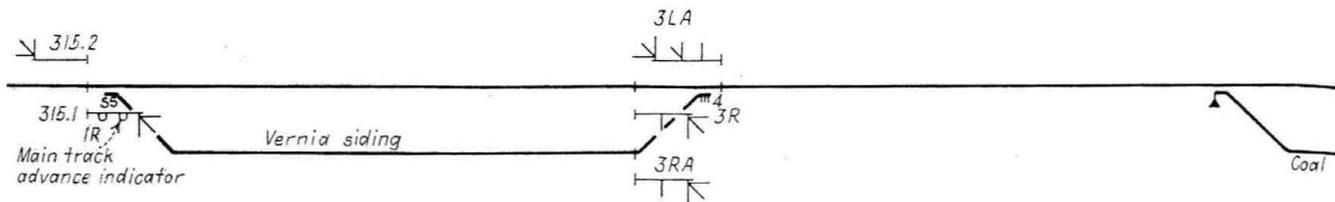


Fig. 1—Left half of track and signal diagram

the top arm will assume the proceed position. The control operator must press the start button each time a signal is to display a permissive or proceed aspect. However, it is not necessary to press the start button to clear the top arm if the block is cleared while the lower arm is displaying permissive aspect.

#### For a Train to Enter the Block From South Wye

When a switch engine on the south leg of the wye is to make a move to the main track, the locomotive or leading car is brought to a stop on the short track circuit, 100 ft. long, in approach to signal 7R. This causes a track occupancy lamp "J" to be lighted on the track diagram on the control machine, and an annunciator bell is sounded. If the train is to be authorized to move into the block, the control operator throws lever 7 to the right which causes the indicator "B" on the mast of signal 7 to be lighted lunar white. This indicator is a normally extinguished single lamp unit in a standard light signal background, as shown in the pictures herewith. The lighting of this indicator authorizes the trainman to throw the hand-operated switch leading from the south leg of the wye to the main track. When the switch has been operated by the trainman the top arm moves to the 45-deg. position with a yellow light, which authorizes the train to pull out onto the main track. After the switch is placed normal, the train proceeds. If such a move is to be made following a preceding train which is still in the block, then the second arm, rather than the top arm, would clear to the 45-deg. position to display a permissive aspect.

The two legs of this wye connect to

approach to signal 5LA. If the train movement is to be made, the Control Operator throws lever 5 to the left, which causes the indicator "B" on signal 5LA to be lighted lunar white. This authorizes the trainman to throw the hand-throw switch leading to the main track. When the switch has been operated the top arm displays a proceed aspect to authorize the train to move out onto the main track.

#### Move to Coal Chute Track

When a switch engine is to make a move from the north leg of the wye to the coal chute track, the switch No. 10 is thrown before the locomotive or leading car enters the short track circuit. Circuits through the switch circuit controller are arranged so that when the locomotive or car enters the approach track circuit no annunciator indication is sent in to the control machine.

When a southbound switching move is to be made from the main track to the north leg of the wye, the locomotive or leading car is stopped on the short track circuit in approach to signal 5R. Then when the control operator throws lever 5 to the right, the indicator B is lighted lunar white to instruct the trainman to throw the switch and clear the main track.

#### At the Vernia Passing Track

The passing siding at Vernia was first constructed with ordinary hand-throw switch stands but a difficulty was that the trains lost too much time when stopping and starting due to trainmen operating these switches when entering or leaving this passing siding.

Furthermore, when making these stops, the trains blocked certain street

Signal 5L at North Wye is the opposing northward signal for this block. Only one of these two signals can be cleared at a time.

As a general rule, when making a meet at Vernia, the northbound train is directed to take siding, thus using the power switch. At the north switch, a spring switch mechanism was installed so that northbound trains can pull out of this siding and proceed without stopping, as trainmen are not required to close a hand-throw switch.

Signal 315.1 is controlled automatically. It normally displays the approach aspect if the track circuits between this signal and 3R are unoccupied and signal 3L is displaying stop. But if signal 3R is displaying 45 deg. or better, then signal 315.1 displays the 90-deg. aspect.

In some special circumstances, it may be desirable to stop a southbound train at the north end of Vernia and direct it to take siding. This is done by controlling the bottom indicator 1R on signal 315.1 to show lunar white and to accomplish this, signal 315.1 must display stop. This indicator consists of a single lamp unit with the lamp normally extinguished.

#### Electric Lock on One Switch

An electric lock was installed on the hand-throw switch which connects the north end of the coal chute track to the main track. When a switch engine on the coal chute track is ready to move out on the main track, the conductor telephones the control operator and if no through train is due, the conductor is given permission to use the switch. In order for the electric lock to be released, the signals, 5L, 5LA, 3R and 3RA, which control movements to-

ward the switch, must all be displaying the Stop aspect, and the block between these signals must be unoccupied.

When a move is to be made from the main track to the north end of the coal chute track, the switch engine or leading car is stopped on a short track circuit just north of the switch, and

lamps which are lighted to indicate track occupancy of the corresponding sections. When a lamp is lighted, a single-stroke bell is sounded. A point of special interest is that the track-occupancy approach annunciator controls include two full automatic blocks north of the north end of Vernia siding. This allows adequate advance

indications from the respective territory to the control machine.

The two signals, 9L and 9R, which are only 1,247 ft. from VI tower, are controlled by direct-wire circuits. Both of these signals are controlled by one two-wire circuit, including one wire and connection to common, which is used also to return an indica-

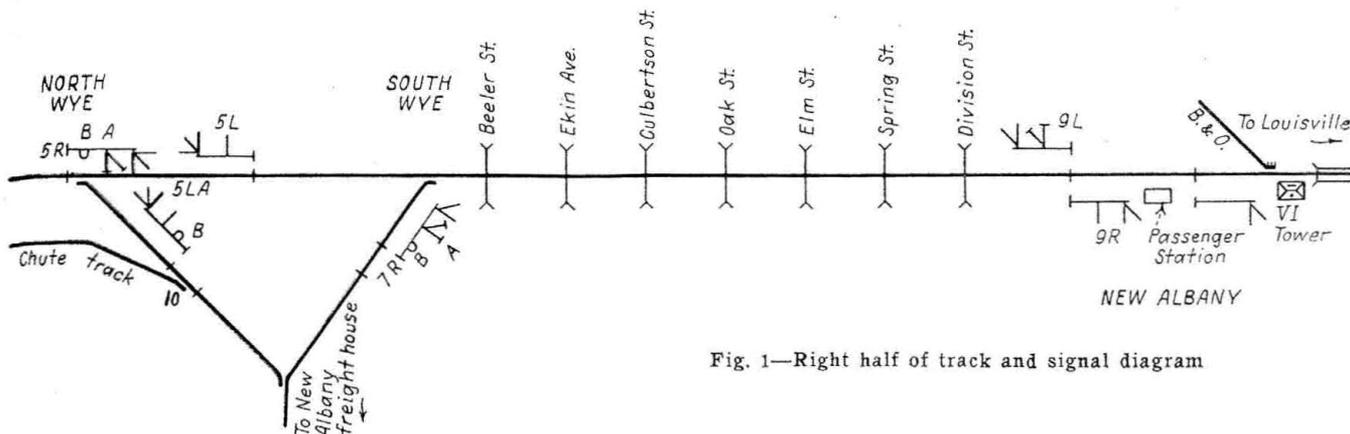


Fig. 1—Right half of track and signal diagram

this releases the electric lock so that the switch can be thrown.

The control machine in the VI tower is of the panel type with miniature levers, as shown in one of the accompanying pictures. The signal levers normally stand in the vertical position to control the signals to the Stop aspect. A lever is thrown to the right to clear a southward signal or to the left to clear the opposing northward signal. When the corresponding signal clears, a small green lamp is lighted in the face of the barrel of the corresponding lever. The switch lever

notice to the control operator concerning the approach of a southbound train so that he can inform the dispatcher and get directions to line up for the train to move on through VI and over the bridge to Louisville without stopping. Thus this extra long annunciator section saves train stops.

**Circuits for Remote Control**

The power switch and signals at the south end of Vernia siding, as well as the signals at North Wye and South Wye are controlled by the

tion to the tower to repeat the Proceed aspect of the signal cleared.

Referring to Fig. 2, the relay 9GZ at the signals is the control relay for signals 9L and 9R. Relay 9GK at the tower controls the signal repeater indicator lamps in the levers.

The two coils of relay 9GZ are connected to form one complete magnetic circuit with a total circuit resistance of 650 ohms. The coils of relay 9GK are 100 ohms resistance each and are connected to form two magnetic circuits, one opposing the other. A 550-ohm resistor in series

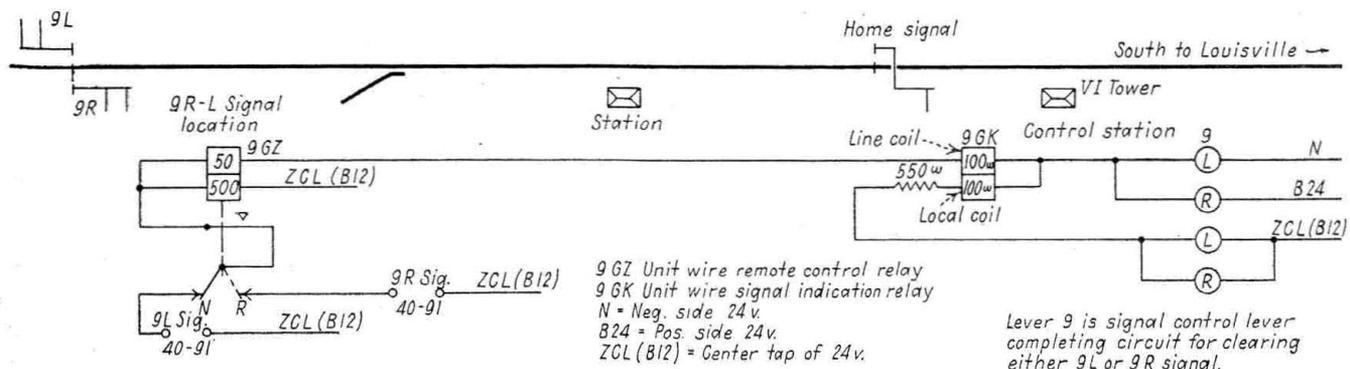


Fig. 2—Diagram of circuits for the control of signals 9R and 9L

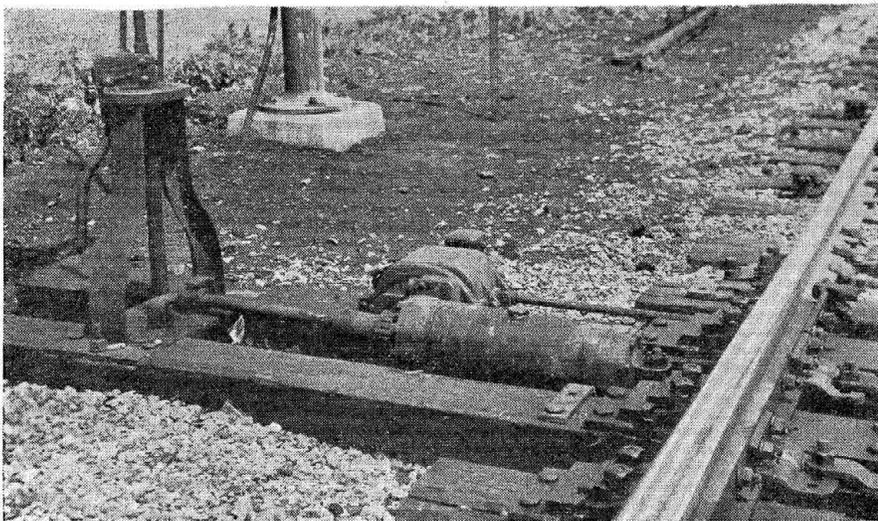
stands in the vertical position to control the power switch to the normal position. This lever is thrown to the right to control the switch to the reverse position. A small yellow lamp in the barrel of the lever is lighted during the time that the switch is out of correspondence with the position of the lever. If the lamp continues to be lighted, the operator knows that the switch is not over and locked.

The illuminated track diagram on the control machine panel has 11

General Railway Signal Company Type-H eight-step line coding system which is operated over two wires between the field locations and the VI tower. One field station, located at North Wye, includes the controls for the signals at that location and at South Wye. A second field station at the south end of Vernia siding includes the controls for the power switch and signals at that location and the operation of the take-siding indicator on signal 315.1. Each of the field stations includes the handling of

with local coil of 9GK relay produces the same number of ampere turns as in the line coil, thus completely neutralizing the two magnetic circuits and preventing relay 9GK from picking up while relay 9GZ will pick up.

When signal 9L or 9R clears, the 500-ohm coil of the 9GZ relay is shunted. This reduces the total resistance of the circuit to 150 ohms, permitting higher amperage to flow, consequently there are more ampere turns in line coil of 9GK relay. This unbalances the opposing magnetic



Spring switch at north end of the Vernia siding

circuit and permits relay 9GK to pick up and close the circuit for the indication light. Line resistance between locations has been disregarded in the explanation, it amounts to approximately 6 ohms.

#### Street Crossing Signals on Fifteenth

For a distance of 2,200 ft., the Monon main track is in the center of Fifteenth street, and in this distance five streets, Spring, Elm, Oak, Culbertson and Ekin, cross Fifteenth street at right angles. All these streets are paved. The train speeds in this area are restricted to 10 m.p.h.

At each of the street crossings there are standard city type "stop and go" color-light signals for the protection and direction of street traffic, as shown in one of the pictures.

When no trains are in the vicinity, these street traffic signals are controlled automatically to direct traffic north and south along Fifteenth street for so many seconds and then east and west for so many seconds.

When a train approaches, the automatic cycle control gives way to track circuit controls which establishes the red for east and west street traffic and the green for north and south on Fifteenth street for one block ahead of the train, and holds this control until the rear of the train passes any given crossing. Then the cycle control again takes effect.

The track circuits and track relays for the control of these street traffic signals are used also to control the line circuits for the signals 9L and 5R, for authorizing train movements.

There is no space available for a pole line along the right-of-way anywhere from VI interlocking north to North Wye, a distance of approximately one mile. Therefore, all signal circuits in this area had to be put in underground cable. The city owns

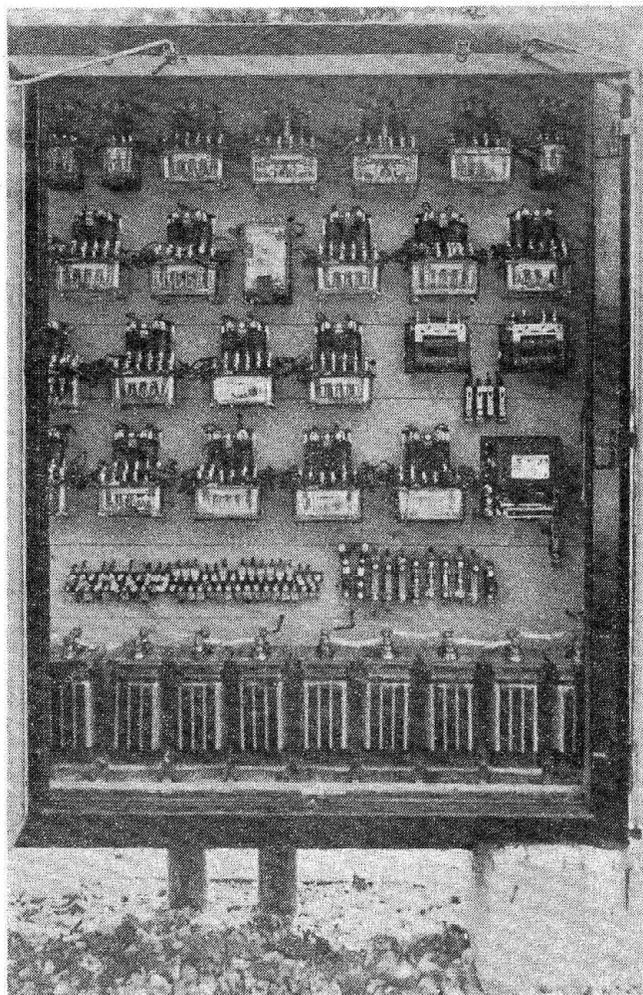
8 ft. between the edge of the sidewalk and the residential lots. Authority was granted to the railroad to install the underground cable in this area, providing the dirt and sod were restored to previous levels. The total length of the trench was 5,441 ft. and goes under 14 paved streets and 10 paved alleys, as well as numerous concrete sidewalks.

At the streets and alleys, old loco-

motive boiler flues were installed for the cable to be pulled through. The cable included two No. 8 and two No. 10 conductors and from 5 to 11 No. 14 conductors. The No. 8 wires are for the 110-volt a-c. power distribution and the No. 10 for the line coding system, while the No. 14 wires are for various local controls.

One reel of 2,000 ft. of 12-conductor cable weighed 8,550 lb. The reel was so large and heavy that no available cable cart would handle it. Therefore, a cable rack was made from old track ties which were bolted together and braced. The reels were handled out to the field locations by means of an automobile wrecker crane. The underground cable is made up with an outer protective covering, including lead sheath, two layers steel tape and jute, and this cable was furnished by the Okonite Company. North of North Wye the circuits are on line wires on the pole line.

This signaling project was planned and installed by the signal forces of the Monon, under the jurisdiction of E. G. Stradling, superintendent of telegraph and signals, and under the supervision of C. R. Williams, supervisor of construction.



Interior of one of the cases at the power switch