

View showing the leverman at the new Model 14 interlocking machine at Bellevue

operated by train crew members.

Traffic varies, but during the season when coal is being moved to lake ports, approximately 100 trains are operated daily through Bellevue. The Nickel Plate has 6 passenger trains and 40 to 46 freights, the Pennsylvania about 26 freights, the Wheeling about 20, and the New York Central has two local trains each way daily. Counting all trains and crossings, approximately 80,000 train stops were required each year. These stops caused serious delays to trains, as well as damage to cars and lading. Also while trains were being stopped and started, they blocked the street crossings in Bellevue. These various handicaps were overcome by installing the interlocking.

Track Layout Simplified

When planning the new facilities, the track layout was simplified. In order to reduce the number of crossing frogs and eliminate the M.P.F. crossings, an arrangement was made whereby the Pennsylvania trains use the tracks of the Nickel Plate for a short distance, the single switches No. 5 and 17, as well as crossover No. 9, being installed so that Pennsylvania trains cross the Nickel Plate via turnouts and crossovers rather than via the previous movable-point frog. This change also eliminated the fixed frogs at crossings of the previous Pennsylvania track with the tracks of the N.Y.C. and the W. & L.E. The N.Y.C. spur, which previously crossed

the double-track N.K.P. and the single-track Pennsylvania, was cut to deadend each side, thus eliminating three more fixed crossings.

As applied to the revised track layout, the interlocking is arranged as shown in the plan to include 2 power-operated crossovers, 4 power-operated single switches, and 4 hand-operated switches with electric locks, 10 dwarf signals, 8 high home signals, and 2 manual-block high signals. The switches and signals are controlled from the interlocking machine in the new tower at the location shown on the plan. Train movements are directed and protected by interlocking home signals and, therefore, trains move through without stopping which facilitates operations decidedly, as compared with previous operations.

The switch machines are the type M2 for operation on 110 volts d.c. As a means of preventing frost trouble, a 65-watt, 110-volt a.c. heating element was installed in the circuit controller compartment of each switch machine. Each motor commutator is equipped with a defroster. The power switch layouts are on the Nickel Plate tracks, and are constructed according to standards of that railroad. Adjustable rail braces are used on these plates. The interlocking signals on

the Pennsylvania are the position-light type; on the Nickel Plate and New York Central, the color-light type; and on the Wheeling, the search-light type.

Interlocking Machine

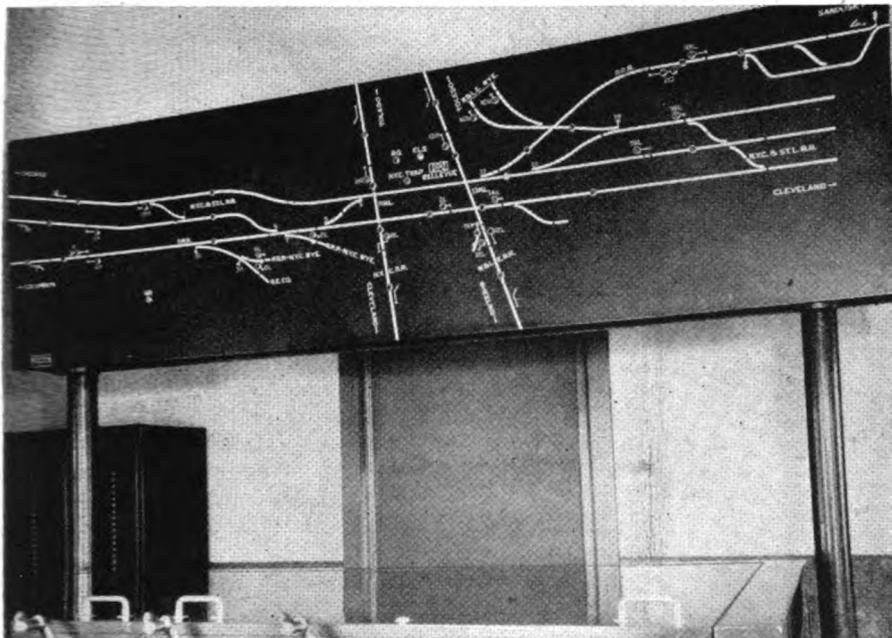
The signal layout, type of building and machine were agreed to by all of the railroads involved. The construction of the plant within home signal limits including the tower building was performed by Pennsylvania signal and carpenter forces. All other work outside the home signals was performed by the forces of the individual railroads on their tracks.

The interlocking machine is of the Model 14 type, including the conventional arrangement of electric lever locks and mechanical locking between levers. It has 6 levers to control 2 power-operated crossovers and 4 power-operated single switches, 3 levers to control electric locks on 4 hand-operated switches inside home signal limits, and 6 levers to control 18 home signals. Two additional levers control 2 manual-block signals on the Pennsylvania.

The illuminated track and signal diagram has lamps which are lighted when corresponding sections of track are occupied by trains. The symbol for each signal has a lamp which is lighted when the corresponding signal displays a proceed aspect. The indication lamps are mounted in a row below the interlocking machine levers. When no track circuits are occupied to prevent the clearing of a signal, the "R" and/or the "L" indication lamps below the lever are lighted. The indication lamps under the switch levers show when the electric locking is re-



The switch machines at Bellevue are the type M2, operating on 110 volts d.c.



Illuminated track and signal diagram mounted above the interlocking machine

leased so that the towerman can throw the levers promptly, thereby permitting him to change routes as soon as possible.

The electric lock on signal lever 18 is controlled by a special circuit so that when having cleared southward home signal 18LA on the Pennsylvania, the lever cannot be returned to the normal position until the train shunts the track circuit beyond the Wheeling crossing. This protects the Pennsylvania train by preventing the clearing of signals 16RA, 16RB or 16L for a move on the W. & L.E. wye interchange track.

Also Push a Button

For a diverging-route movement, such as clearing signal 2R for a train movement over switch 7 reversed into the N.K.P.-N.Y.C. wye, the lever must be thrown, and also a button below the lever must be pushed. Also as applying to the clearing of Pennsylvania home signal 6R for a diverging move into the G.E. track, the P.R.R.-N.Y.C. wye or the N.K.P.-N.Y.C. wye, the leverman must position the levers and also push the button below the signal lever. This extra operation of pushing the button prevents the leverman from lining up such a route inadvertently.

Shelf-type relays, with plug couplers are used throughout the new interlocking

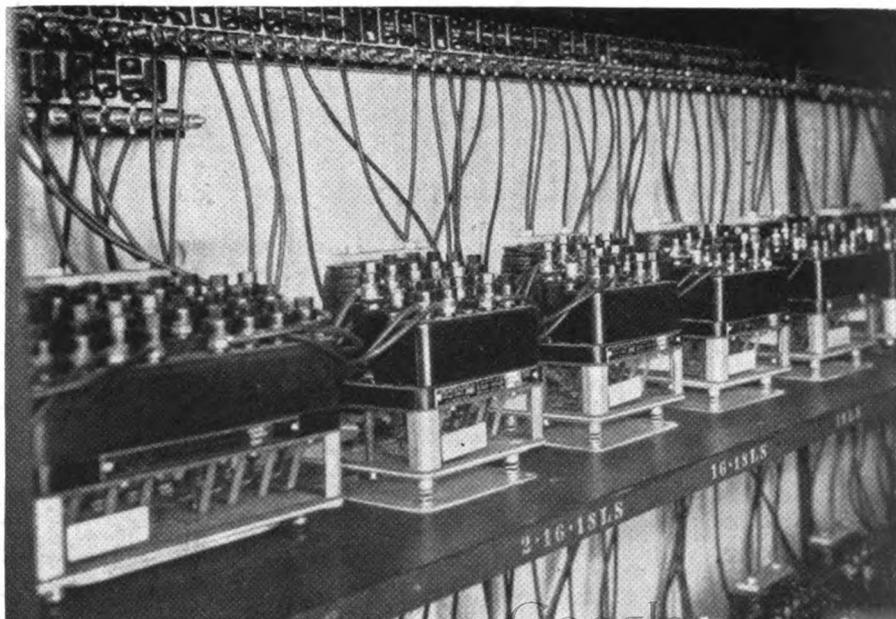
Approach locking or time locking is provided in connection with all signals, and conventional clock-work time releases are used to measure the time interval. Dwarfs are released in 1 min. The Pennsylvania high signals are released in 3 min. 21 sec. Signal 2R on the Nickel Plate is released in 5 min. 15 sec. The releases are normally run down, and when releasing a signal, the clock-work release must first be wound by hand to the fully wound position, as is indicated by a lamp on the track diagram panel. Then the release runs down automatically. When the short time, for example 1 min., has elapsed, one lamp on the panel is lighted, and when the full time has elapsed, a second lamp is lighted. These indication lamps are an aid to the leverman in knowing exactly when penalty time has elapsed.

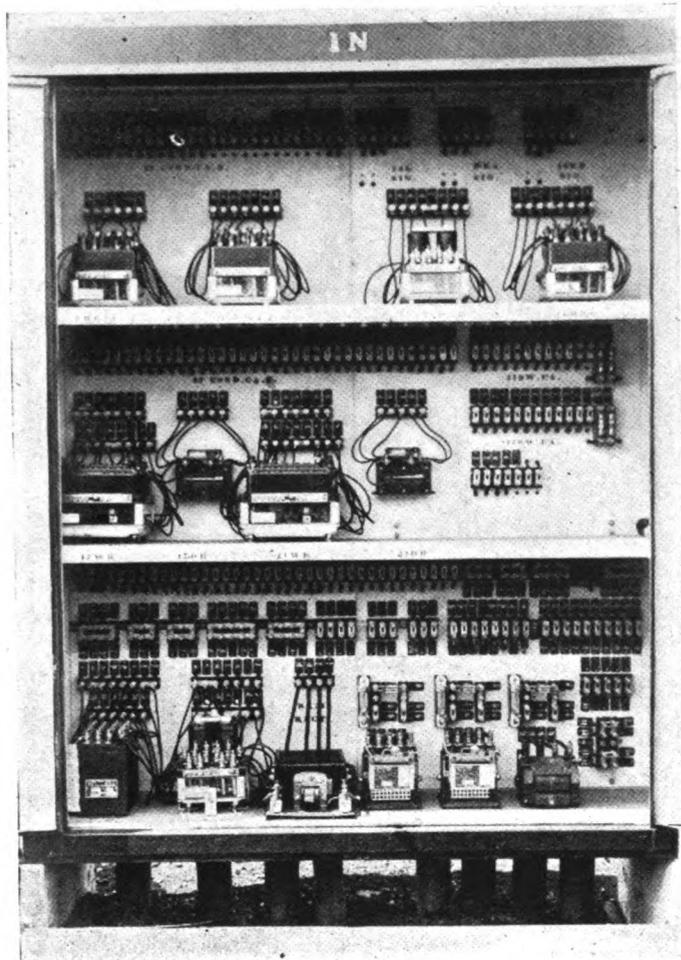
On the New York Central the dead

section through the crossing is longer than the minimum allowed by N.Y.C. standards, and, therefore, a trap circuit arrangement is used. If the trap circuit operation sequence is interfered with by improper operation, such as shunting the middle track circuit with a claw bar accidentally, the trap can be restored to normal by operating a special clock-work time release, which is set to operate in 1 min. A light on the track diagram panel indicates when release must be operated.

Control of Manual Block Signals

The Pennsylvania uses manual block on their line, the northward manual block signal 20 being opposite the southward home signal 18L, and the southward block signal 4 being opposite northward home signal 6R. The manual-block signal 20 is controlled by lever 20 and manual-block signal 4 by lever 4. These levers operate to three positions. The normal position is to the left to control the signal to display the Stop aspect, being thrown to the center to display the Permissive aspect and to the right to display the Clear aspect. When throwing one of these levers from the normal position, it can be thrown, as one operation, only as far as the center position which controls the corresponding signal to display the Per-





The relays and other equipment at home signal locations are housed in large sheet metal instrument cases

missive aspect. Then in order to throw the lever to the R position to cause the signal to display the Clear aspect, the thumb catch must be released, and a special segment on the arc under the lever must be slid by hand to the left, releasing the lever so that it can be thrown to full R position. This special device prevents the leverman from inadvertently displaying a Clear aspect when only a Permissive aspect was intended.

Flashing-Yellow Train-Order Aspect

Flashing-yellow train-order signal aspects are used on the home signals on the Pennsylvania and the Wheeling. Each such signal consists of a single lamp unit mounted on the mast below the regular signal head. Each such unit is a single lamp body the same as used in position light signals, except that the lens is yellow. The train-order lamp is normally dark. To display the flashing yellow aspect, when train orders are to be picked up

Telegraph and telephone panel (left) and special interlocking push buttons (right) on operator's desk

at the tower, the route must be set up and the home signal in Stop position. These train-order signals are controlled by a special panel, as shown in one of the accompanying pictures. Each train-order signal is controlled by a toggle lever which is thrown to the "up" position to operate the signal. A small lamp above the lever is flashed to indicate that the signal is operating.

Plug-Couplers for Relay

Shelf-type relays, with plug-couplers are used throughout this new interlocking. The track relays are the DN11 type, rated at 4 ohms. The

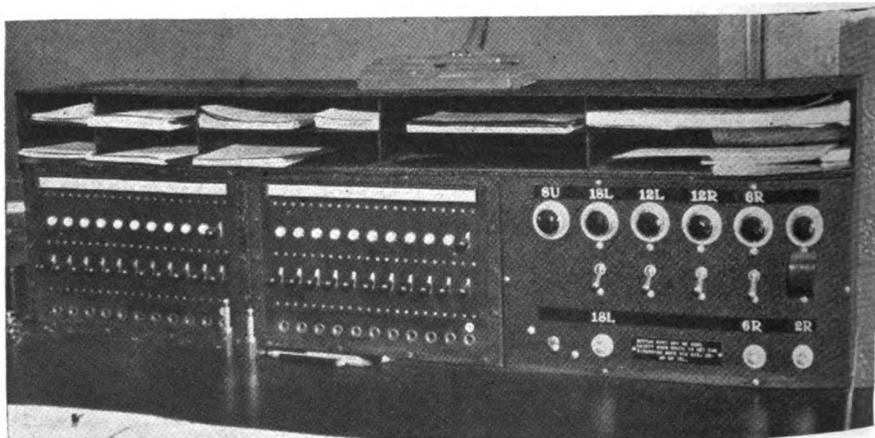
switch-repeater relays are the DP17 type, rated at 400 ohms. The signal-repeater and other line relays are the DN11 type, rated 1,000 ohms. Switch control relays are DP25 with magnetic blow out contact. The relays for controlling indication lamps on the machine and track diagram are the L10 type, rated at 750 ohms. A type FN16 flasher relay operates the flashing-light highway crossing signals at Monroe street, and a type NF flasher relay operates the train-order signals.

A separate room, 14 ft. by 16 ft. on the ground floor of the tower is for housing the relays and other similar equipment. The relays are on shelves made of sheet-iron with angle-iron uprights. Each shelf is 14 in. deep, 19 in. high and 5 ft. long. Each of four such racks has six shelves. The board at the rear of the shelves is asbestos, $\frac{1}{2}$ in. thick. Terminals are mounted on these boards, and wires extend through individual holes to the rear. The jumpers between the terminals and the posts on the plug-couplers are No. 16 flexible insulated wire.

Also in the relay room is a panel for testing for grounds on circuits. By means of rotary switches and knife switches, the meter can be connected to take reading for grounds on both the positive and negative sides of each battery.

Power Supply

The circuits on the plant are fed from storage batteries which are charged through rectifiers from a 110-volt a.c. supply. The switch machines are fed from a set of 55 cells of 120-a.h. battery. Six cells rated at 240 a.h. feed the flashing-light crossing signals at Monroe street. Six cells rated at 180 a.h. feed the local plant indication circuits. Each track circuit is fed by one 150-a.h. cell. At each position-light signal location there is a 6-cell 180-a.h. battery which feeds local circuits and acts as stand-by for the signal lamps, which are fed normally from a.c. At the color-light signal locations there is a 4-cell, 180-a.h. battery which



acts as a stand-by for the signal lamps which are fed normally from a.c.

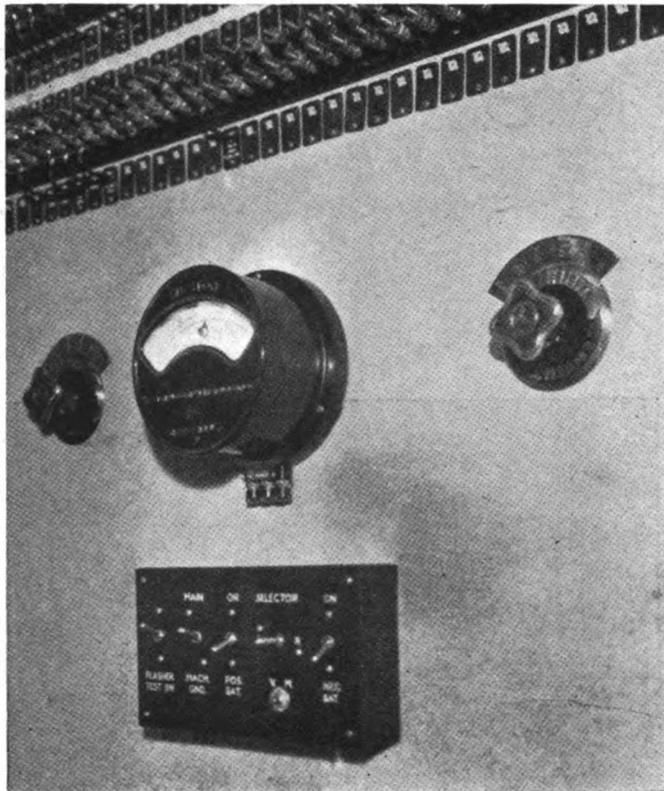
Within home signal limits, the circuits are in underground parkway cable, except for a few hundred feet of aerial cable at the south end. Two wires in a four-conductor No. 4 cable, carry the 110-volt d.c. for the operation of the switch machines and the other two wires in this cable carry the 110-volt a.c. power to the outside cases and the signal locations. The signal lighting circuits from cases to the signals are No. 9 wire, and the track circuit connections are No. 9. The control circuits are No. 14 wire.

At home signals the relays are housed in large sheet-metal cases. The backboards in these cases for mounting terminals are made of asbestos board $\frac{1}{2}$ in. thick, with holes for wires to go to the rear where there is a space about 4 in. deep. Access to this wire space is gained by removing sheet-metal panels at the rear of the case.

Communication Facilities

The communication circuits are carried to the tower in underground cables which terminate on protectors in terminal boxes on the wall on the ground floor of the building. Inside cables carry these circuits to the test panel equipment on the second floor. This panel consists of two relay racks, 7 ft. high, 20 $\frac{1}{2}$ in. wide, selectors, apparatus cabinet, sub-cycle ringer, Morse test set and telephone test set. The test telephone has individual battery and generator so that in case of failure of the regular telephone equipment or power, communications may

Ground tester mounted on panel at the new interlocking

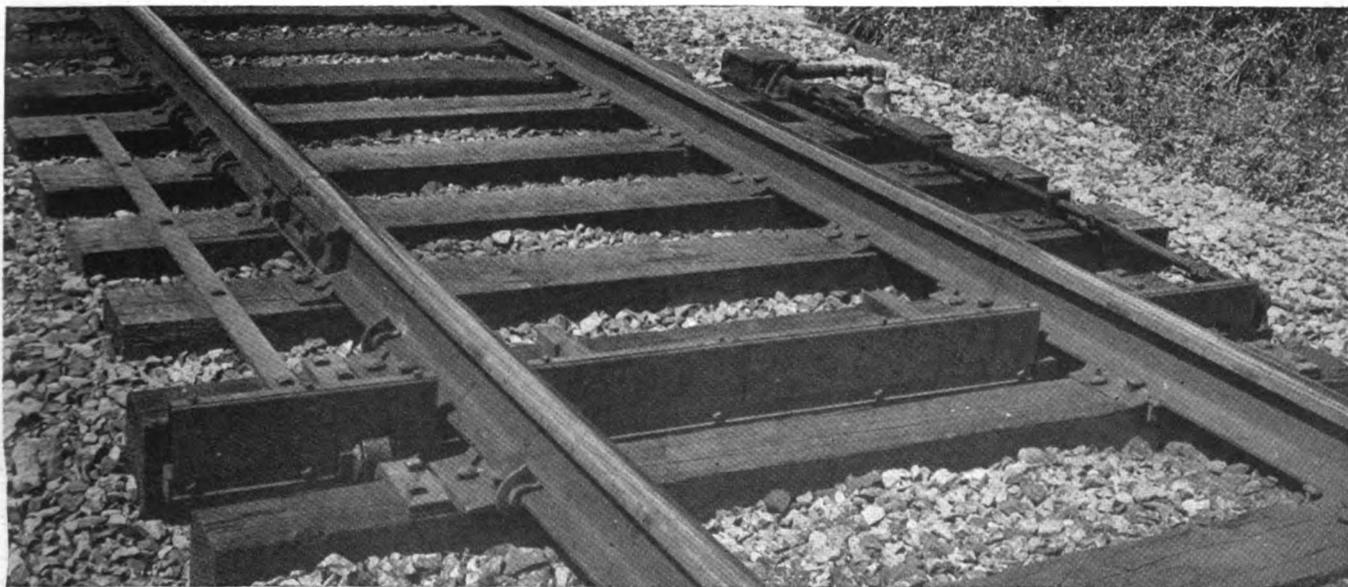


be maintained by use of the test phone.

A 20-line lamp and key telephone concentration unit was installed with the apparatus cabinet, containing ring-up and stick relays, being mounted on the relay racks, and the two units containing lamps, keys and patch jacks being located on the operator's table. In order that the railroad employees may talk on railroad lines without disturbing the test panel equipment and without taking the

operator's position, a hang-up telephone for their use is mounted on the end of the operator's table.

The Morse resonator, extra telephone and operator's telephone are powered by a CAB-4 selenium rectifier and battery unit. A 4-cell tray of storage battery with a dry-disk rectifier are used to furnish power at 6 volts d.c. for operation of the telephone concentration unit relays and lights.



This dragging equipment detector, on the Boston & Maine, is a new type which is directional and self-restoring