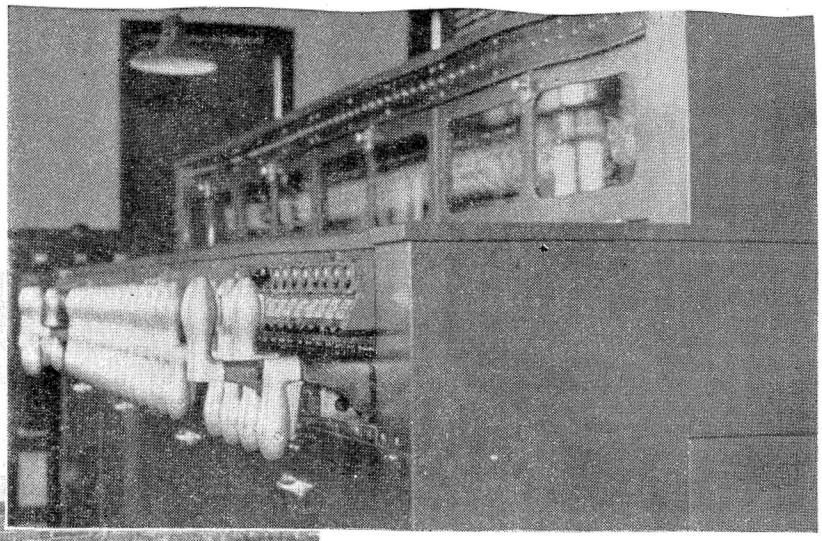
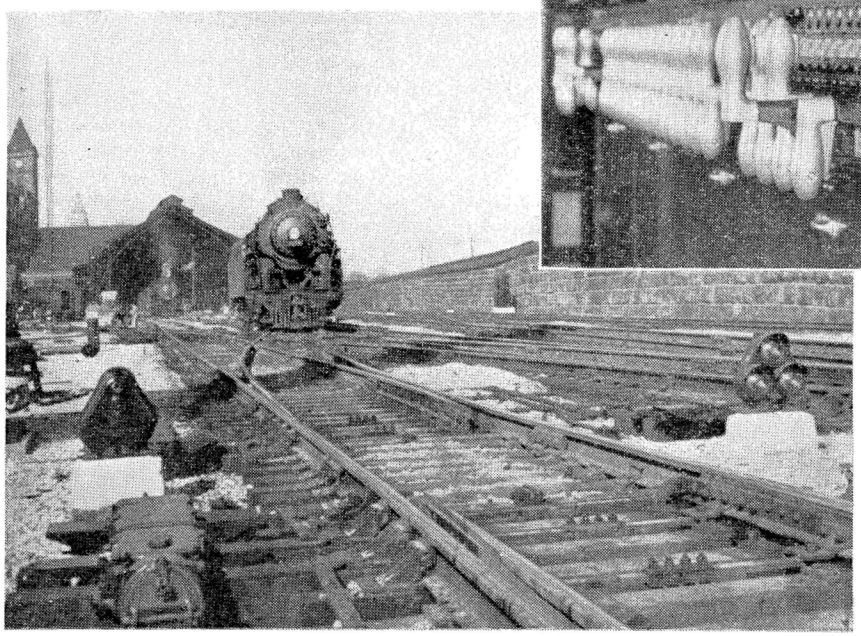
Right—Interlocking machine with indication lamps to repeat operation of the cross-protection relays. Below—View of track layout looking north toward the passenger station





Special circuits reduce the quantities of insulated wire and cable required—Fireproof wiring construction in the tower

Electric Interlocking Installed on I. C.

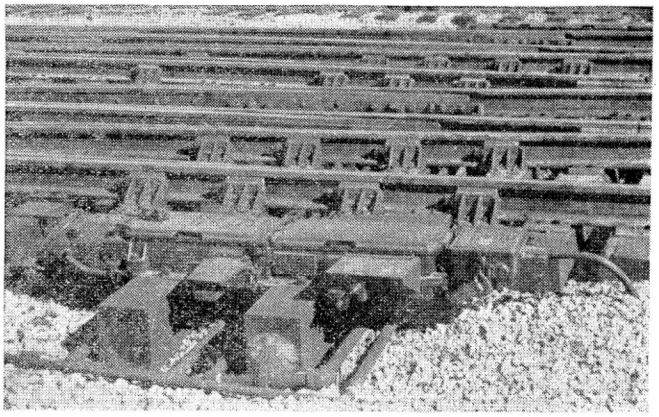
At a location known as Weldon, at the south end of the track layout of the passenger station in Chicago, the Illinois Central has recently installed an electric interlocking to replace a mechanical plant which had been in service at this location since 1892. The Chicago Terminal improvement program of the Illinois Central, started in 1920, included plans for a new passenger terminal. For this reason, the track layout and interlocking at Weldon were not modernized as part of the extensive improvements made in the years 1920 to 1930. In the meantime, the plans for the new station did not materialize.

The old interlocking at Weldon included detector bar protection, no track circuits being in service. The installation of insulated joints for track circuits in the old track layout would have required numerous track changes. As a consequence, the old track layout and mechanical interlocking at Weldon were continued in service far beyond their normal life. Prior to our entry into the war, plans had been prepared and materials purchased to install a new interlocking at Weldon. This work was halted by the War Production Board. After the old plant had been inspected in detail by representatives of the Bureau of Safety, Interstate Commerce Commission, the War Production Board authorized the Illinois Central to proceed with construction. The project as a whole involved not only the new interlocking but also new rail and ties, as well as new ballast, a complete underground drainage system for the area and steam piping under all the switches to prevent snow and ice from obstructing operations.

A part of the project was to lengthen the station tracks and platforms to hold longer trains without hanging over to foul the interlocking limits. This result was accomplished in part by relocating some of the switches and crossovers farther south. Also by using dwarf signals instead of high signals on bridges, each signal could be located so as to utilize every foot of track up to the clearance point.

Type of Interlocking Used

The new tower, as shown in one of the accompanying illustrations, is three stories high, and of brick construction. The interlocking machine is on the top floor, the relays on the second floor and the battery and maintainers' headquarters on the ground level floor. The interlocking machine is the General Railway Signal Company unit-lever type, using dynamic indication with individual polar relays for cross protection. On the front of the upper sec-



Power switch layout with steam pipes for melting heavy snow

tion of the case for the interlocking machine there is a row of small indication lamps, each of which is controlled through a back contact of a correspondng cross-protection relay so that the lamp is lighted if its polar relay kicks out. Lamps of this nature have been used for years on other similar interlockings on the Illinois Central and have proved to be worth while as an aid in locating trouble quickly.

Type of Interlocking Machine

The interlocking machine has a 64-lever frame including 28 levers for switches and 21 levers for signals, thus totaling 49 working levers. A separate lever, equipped with a separate electric lever lock, is provided for each single switch of each crossover, and each switch machine of the three double slip switch layouts. The conventional forms of lever lamps are provided. Lever lamps on signal levers are two-unit type. One unit with white light indicates when the signal is clear. The other unit with red light indicates when the signal is at Stop. These lamps are lighted only when signal lever is reversed. An illuminated track diagram, mounted over the interlocking machine, includes lamps which are lighted when the corresponding sections of track are occupied.

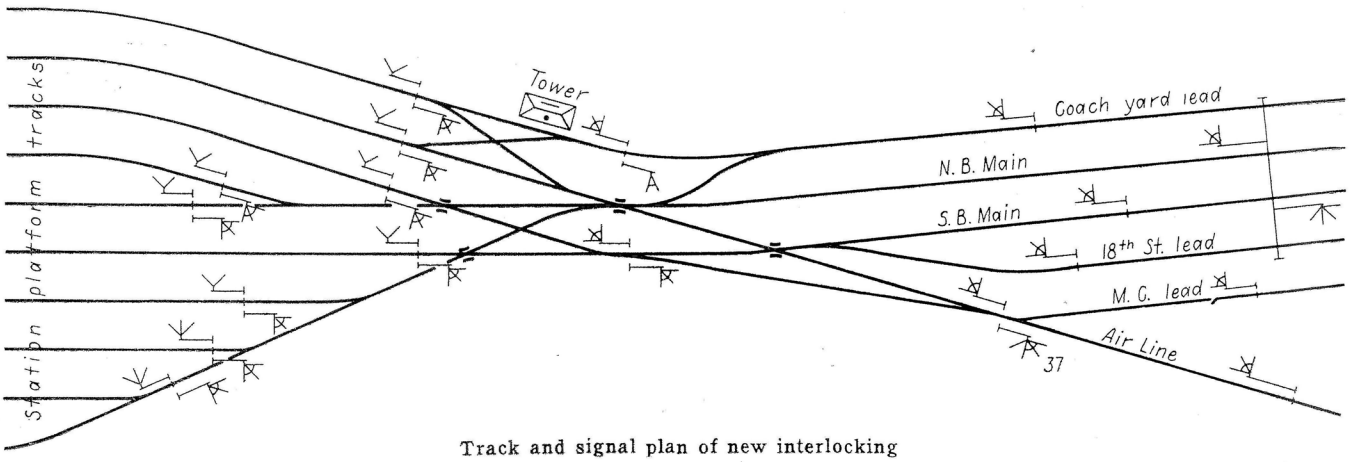
New Features of WP Circuits

A three-position switch-repeater relay is provided to repeat each single switch as well as each switch of a crossover. A new idea included in this plant is the use of the regular switch control wires to provide the energy to feed each switch repeater circuit. This saves the wires otherwise used to extend low-voltage energy to each switch, and other advantages are that a check is provided concerning the corresponding positions of the lever and the switch.

The accompanying diagram shows the circuit. Standard construction includes a three-pole single-throw knife switch mounted in the terminal box on the end of each switch machine. The changes to feed the WP circuit are as follows: A wire is run from the line side terminal of the incoming RW switch control wire to contact 3 on the D side of the point detector; a wire is run from the line side terminal of the incoming CW switch control wire through a 300-ohm resistor to contact 4 on the D side of the point detector; and a third wire is run from the line side terminal of the incoming NW switch control wire to contact 5 on the C side of the point detector.

With these connections, the NW wire feeds positive energy to the normal side of the normal WP circuit controller, and the switch reverse RW wire feeds positive energy to the WP circuit controller. In this manner, a check is made of the position of the lever, and the position of the switch, because the WP relay will not be energized unless the position of the lever corresponds with that of the switch. The WP relay will not pick up if the switch machine is cranked over, the lever not being moved.

With previous arrangements, it was necessary to break signal control circuits through band contacts on switch levers, corresponding to the WP relay circuit passed through, in order to check the lever position with that of the switch. With the new circuit, the signal circuit checks over the WP relay contacts. Thus no switch lever checks are needed in the signal controls, which eliminates chances for trouble and considerable wiring between relay rack and interlocking machine.



Track and signal plan of new interlocking

With the new circuit, if the WP contacts in the point detector do not operate properly, a short circuit may be thrown on the 110-volt switch operating battery. For this reason a 300-ohm resistor is used in the circuit at the switch machine, and a 6,000-ohm resistor is used in each WP relay circuit at the tower. These resistors would prevent excessive discharge in case of a short circuit.

Automatic and Emergency Releases

The release of approach and route locking is effected automatically by the use of thermal time-element relays. As applied to the northbound main track and on the route leading to the line to the west, the releases

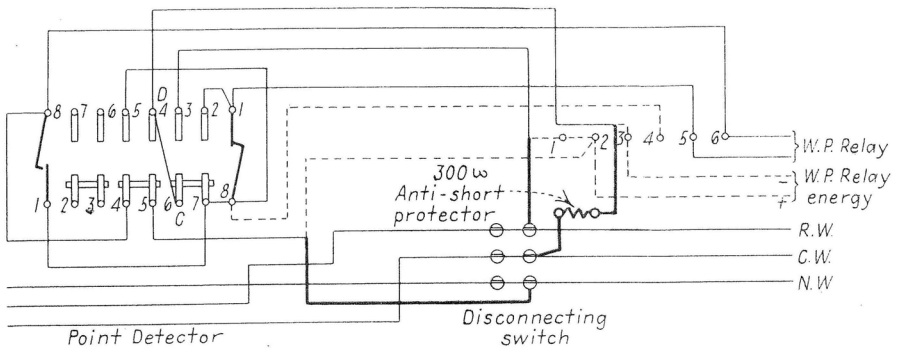
include a full cycle, i.e., the heating and the cooling of the thermal element. On all other moves, the signal lever is released as soon as the element heats. The release time is 15 seconds for slow-speed routes and 77 seconds for high-speed routes.

In combination with a jack box, one clockwork time release serves for the emergency release for the entire plant. The jack board is mounted in a sheet-metal box, the door of which is normally closed and locked with a lead seal. If a track circuit is occupied by a work train or if a track circuit fails, the leverman breaks the lead seal and opens the box. Then he moves the plug from its normal jack to the jack marked to correspond with the track circuit which is out of service. Then the time release is operated, which then effects a release for the levers involved. The plug must be restored to its normal jack in order for the signal over the route to be cleared. This special box and time release are located on a board near the north end of the interlocking machine.

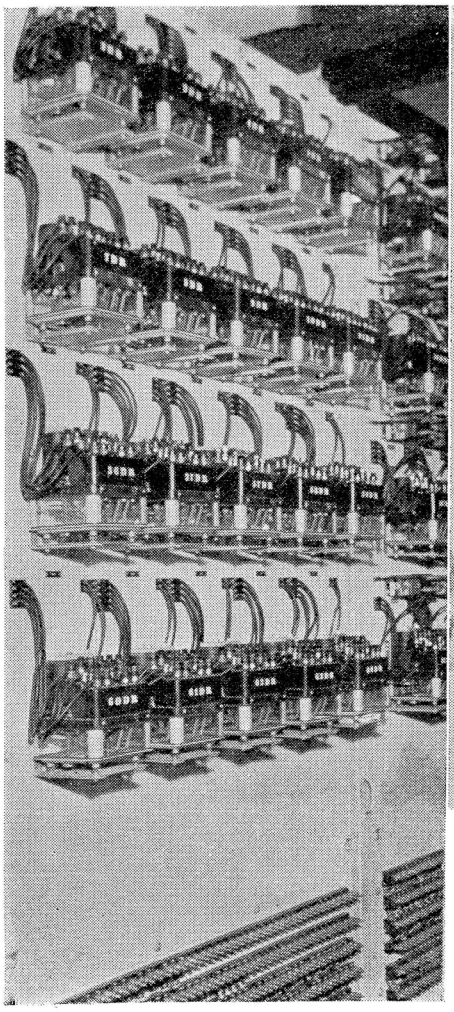
All of the relays for the entire plant are located on the second floor of the tower, thereby facilitating inspection as well as replacements in case of trouble. The track circuits are the a-c. type, the transformers and current limiting devices for feeding these circuits, and also the relays, are all in the tower. These relays are the two-position vane type. The track circuit wires from the tower to the rail connections are No. 14. A 2.5-ohm adjustable resistor is connected in the feed to the rails, and a 10-ohm resistor is connected in series with the relay end.

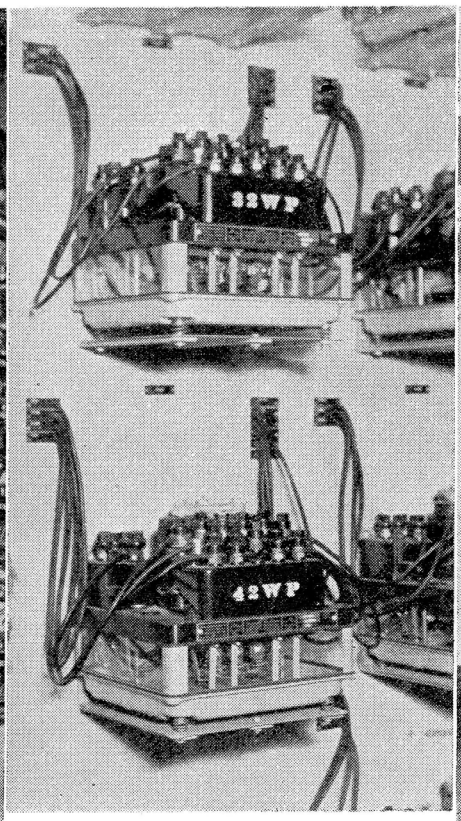
All relays other than track relays are the conventional d-c. type, operating on approximately 12 volts d-c. The relays are of the shelf type, each being spring mounted on an individual shelf, bolted to panels of asbestos board which are ¾ in. thick, 4 ft. wide and 8 ft. high. Plug couplers are provided so that any relay can be replaced quickly. Insulating nuts are used on the terminals on the plug couplers in order to prevent accidental short circuits.

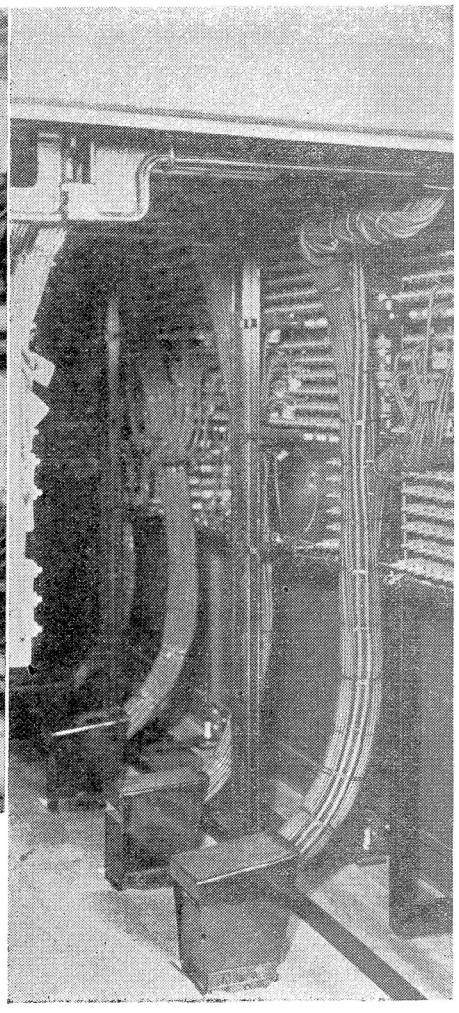
The wires from the terminals on the plug couplers extend through individual holes in the asbestos board, then down the rear of the panel and out through another hole to a bakelite based terminal mounted on the lower part of the panel. Other wires



Connections removed shown dashed and new connections shown heavy

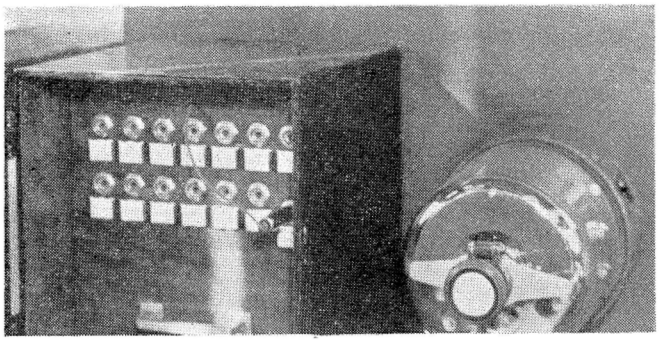






Left—Asbestos relay panel. Above—Plug couplers on relays. Right—Fireproof wiring in the interlocking machine

from these terminals extend the circuits to other terminal boards or to the interlocking machine on the floor above. A point of interest is that both sides of each of the d-c. and a-c.



In combination with a jack box, a clockwork release serves for the entire plant

bus feeds are connected to each panel, thus facilitating tests.

Each of the 4-ft. by 8-ft. asbestos panels is all one piece, and is bolted to upright steel channels which are 1½ in. by 4 in. Adjacent panel boards are spaced 4 in. apart, so that the sides of the 4 in. channels, together with sheet-metal plates, front and back, form a 4-in. by 4-in. vertical duct for wires.

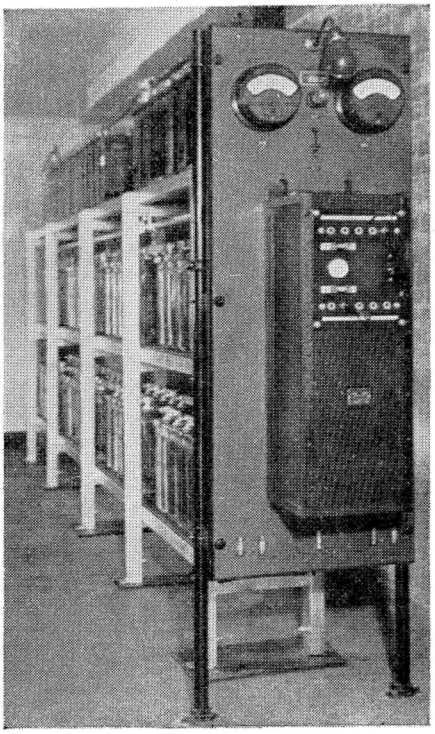
The concrete floor at ground level includes a duct running north and south the length of the building. An opening from this duct extends up through the floor into a sheet-metal cabinet in which are mounted terminals for all wires entering the tower as well as those extending from this cabinet to all places in the tower. All wiring between this cabinet and the terminals on the relay racks on the second floor, as well as on up to the interlocking machine on the third floor, are in sheet-metal ducts, made up in standard length sections and bolted together with ¼-in. stove bolts. As additional fire prevention protection, all these runs are Rockbestos A.V.C. fireproof signal wire.

The 110-volt battery for operating the switch machines consists of 56 cells of 120-a.h. Gould storage battery, and the low-voltage control circuits are fed from a set of 6 cells of the same type battery rated at 160 a.h. These batteries are on a rack made of 2½ in. plank on a frame made of second-hand angle iron.

One-Rail Track Circuits

On account of the complications in track layouts including three double slip switches, the adoption of single-rail track circuits not only simplified the installation of insulated rail joints but also made it practicable to place the ends of track circuits to the best advantage without cutting too many rails. In any given track circuit, one rail is isolated by insulated joints, but the other rail is connected to run wild in common with other similar rails for other track circuits. Staggered polarity of adjacent track circuits is provided.

The switch machines are the model-5A with 110-volt d-c. motor. These machines include point-detectors and lock rod protection. The switch layouts include 1-in. by 8-in. insulated gage plates and adjustable rail braces. On two ties, the plates extend and are attached to the switch machine thus preventing lost motion.



Storage battery and charging panel

As shown in one of the views, a cast iron junction box, 12 in. square and 5 in. deep, is attached to one end of each switch machine. This box includes terminals as well as a three-pole single-throw knife switch which is connected in the switch operating circuit, so that the machine can be cut dead by opening the knife switch. The underground cable coming into this box is brought up from the ground at an angle and then through a cable clamp which forms a part of the entrance to the box.

A network of pipes was installed in the spaces between ties under each switch layout. In winter when snow starts to fall, live steam from the station heating plant is turned into these pipes under the switches to melt the snow. As soon as possible, a fire is built under an auxiliary boiler, and when steam from this boiler is available, the switch heating load is connected to this second boiler.

The signals are color-light dwarfs, each signal having three lamps, red, yellow and green, arranged as a triangle. These signals are equipped with 10-volt 18-watt lamps, which are normally burned at about 9 volts at the lamp.

Three standard aspects, red for Stop, yellow for Approach and green for Clear, are displayed on most of the signals. In addition to these three aspects, one of the signals, No. 37, displays the Restricting aspect, red-over-yellow. In order to have the two lamps in a vertical row on such signals, the signal case as a whole is mounted so that the red and yellow units are in a vertical row at the left, with the green unit to the right.

Automatic Signals Leading Into Station

Within the limits of this Weldon interlocking, inbound trains are routed to various tracks in the passenger station. Especially in stormy weather, the enginemen of arriving trains cannot see through the smoke and steam in the train shed to determine whether the track to which they are being routed is unoccupied. In order to provide such information, so that trains can pull in promptly if the track is clear, a two-aspect dwarf signal was installed for each station track.

These signals are controlled automatically by track circuits. When the track circuit controlling a signal is unoccupied, that signal displays a single yellow aspect. When the track circuit is occupied, the signal displays a Restricting aspect, red-over-yellow.

This interlocking was planned and installed by the signal department forces of the Illinois Central. The relays, relay panels and signals were furnished by the Union Switch & Signal Company, and the remainder of the apparatus such as switch machines and interlocking machine, were furnished by the General Railway Signal Company.