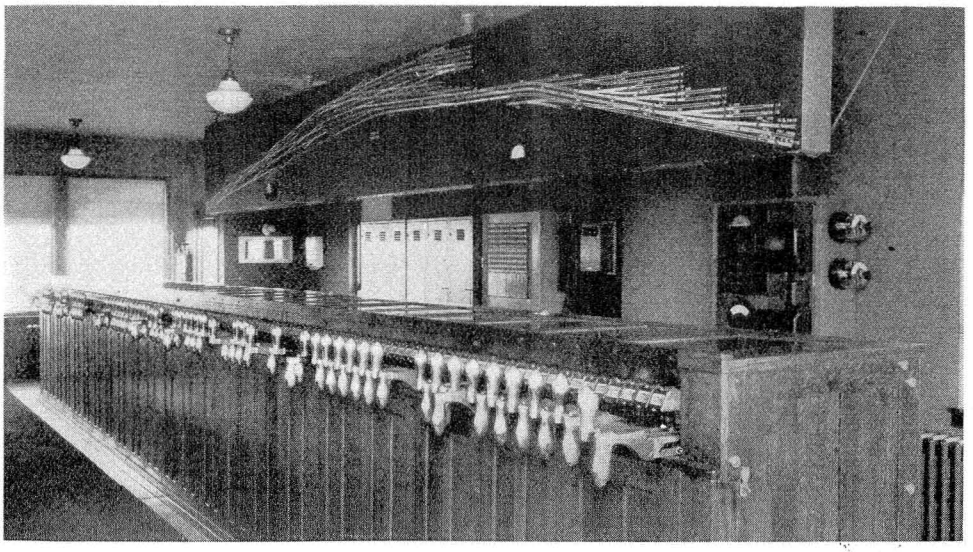


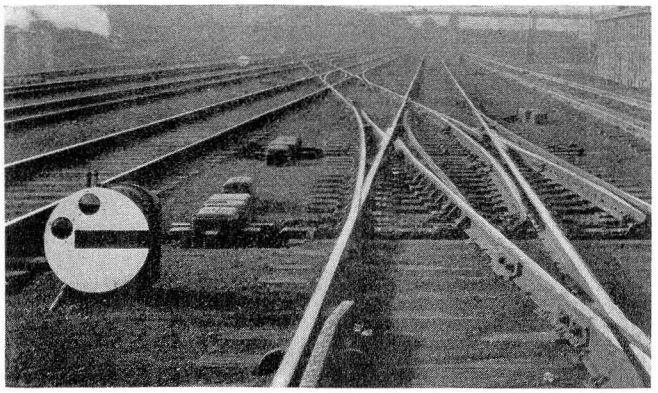
A view in Tower B

Three Large Interlockings Installed by Union Pacific at Omaha

Construction of illuminated track diagrams, relay cabinet and indication-failure detector are some of special features

THREE large interlocking plants are features of the new station and track layout of the Omaha Union station recently completed by the Union Pacific at Omaha. The old station, which was replaced by a modern structure providing every facility for the handling of passengers, express, baggage and mail, was opened to the public by President C. R. Gray on January 15. The station occupies the site of the old Union Pacific station, erected in the late nineties, and was built for the accommodation of the same railways (excepting the Chicago Great Western) that used the old terminal, namely, the Chicago & North Western, the Chicago, Milwaukee, St. Paul & Pacific, the Chicago, Rock Island & Pacific, the Illinois Central, the Missouri Pacific, the Union Pacific and the Wabash. A total of 82 regular trains start or terminate their runs or pass through this station daily.

As a part of the improvements, new station tracks were added, making a total of 15 through tracks, in addition to several stub tracks used for loading and unloading mail and express, for setting out dining cars at the commissary, and for setting out sleeping and business cars.



The use of dwarf signals saved track space

The old layout included two interlockings; Tower A, with an 88-lever General Railway Signal Company Model 2 unit-type electric interlocking, handled the switches and signals at the east end of the station tracks; while Tower B, with the same size and type of machine, handled the west end.

As numerous switches and signals were added to each end of the station track layout and other track changes were made farther west of the station, additional interlocking facilities were required. New brick and concrete towers were built for each of the plants. All of the towers are interconnected with check locking.

The machine from old Tower A was moved to the new Tower B and connected with the machine from old Tower B to make one 176-lever machine with 139 working levers. As both machines were of the unit type, enclosed in oak cases, the re-assembled machine has the appearance of new equipment, as all parts were overhauled and cleaned, the lever handles plated with cadmium-nickel, and the case re-varnished. The machine in Tower B comprises:

56	levers	for 56	signals.
47	"	" 47	switches.
18	"	" 18	ends of slips.
11	"	" 11	movable-point frogs.
1	"	" 2	switch locks.
6	"	" 6	check locks.
37	spare spaces.		
40	track sections.		

A new 136-lever General Railway Signal Company unit-type electric interlocking machine, with 121 working levers, was installed in the new Tower A. The signals and switch machines in the old plants were re-conditioned and used in the new track layout, and new General Railway Signal Company Model 5A switch machines and

Model 2A dwarf signals were installed for the remainder of the switches and signals. The machine in Tower A comprises:

43 levers for 43 signals.
37 " " 37 switches.
24 " " 24 ends of slips.
12 " " 12 movable-point frogs.
4 " " 4 check locks.
16 spare spaces.
29 track sections.

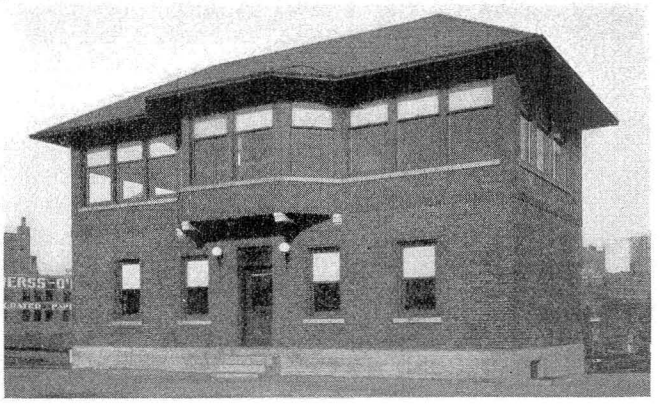
The new Tower C, located at Twentieth street, just west of Tower B, is equipped with a new Union Switch & Signal Company Type F machine with 32 levers and 7 spare spaces, which operates 34 switch machines and 26 signals, the switch machines being Type M-2 and the signals, both dwarf and top-pole, being Type T-2. The machine in Tower C comprises:

11 levers for 22 signals.
14 " " 12 switches.
3 derails.
6 double-slip switches with movable-point frogs.
4 " " check locks (1. 2. 3. 4.)
31 " working.
8 spare spaces (30, 32, 34, 35, 36, 37, 38, 39)
2 spare levers (15-22)
19 track sections.

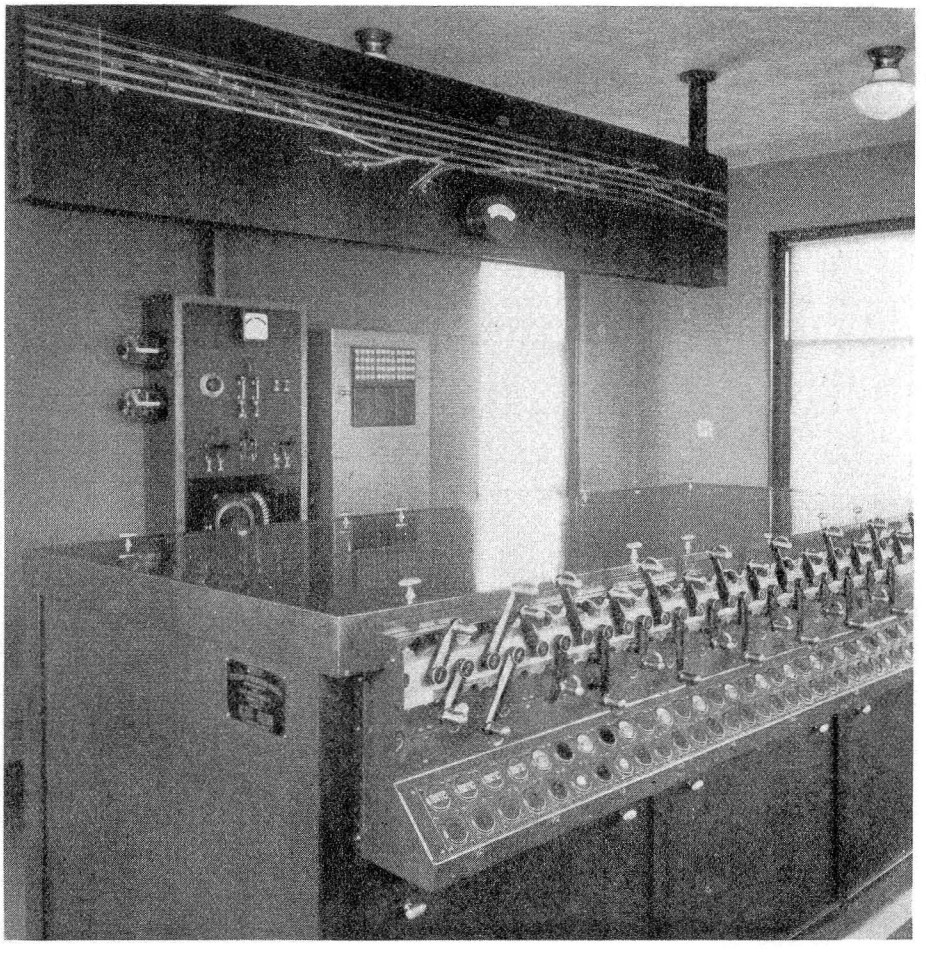
Wire Distribution

The wiring between the towers and switches and signals is all underground, using single conductors. The wires to the signals, annunciators, check-locks, etc. are No. 14; to the switches, No. 10, and the common is No. 0. Each conductor has 5/64-in. Kerite insulation with tape and braid. These wires are run in Orangeburg fibre conduit, as many as 45 wires being pulled in one run of conduit. Each wire in the run terminates on a board in a manhole. In making the duct runs, a row of conduit is laid on a bed of concrete four inches thick, conduits being spaced three inches apart; four inches of concrete is then poured on the top and sides. Where runs extend under tracks or through filled ground, reinforcing rods are used. In order to afford drainage, the conduits are sloped toward the manholes. The manholes, spaced 250 ft. apart, are made of concrete, the inside dimensions being 3 ft. by 4 ft. by 5 ft. A collapsible metal form was used in making manholes.

A 1½-in. galvanized-iron pipe extends from the nearest junction box to each switch or signal, and rubber hose runs from the end of the pipe to the wire inlet on the signal or switch machine. The pipe is painted with Bitumastic paint to prevent corrosion.



New towers were built at each of the three points

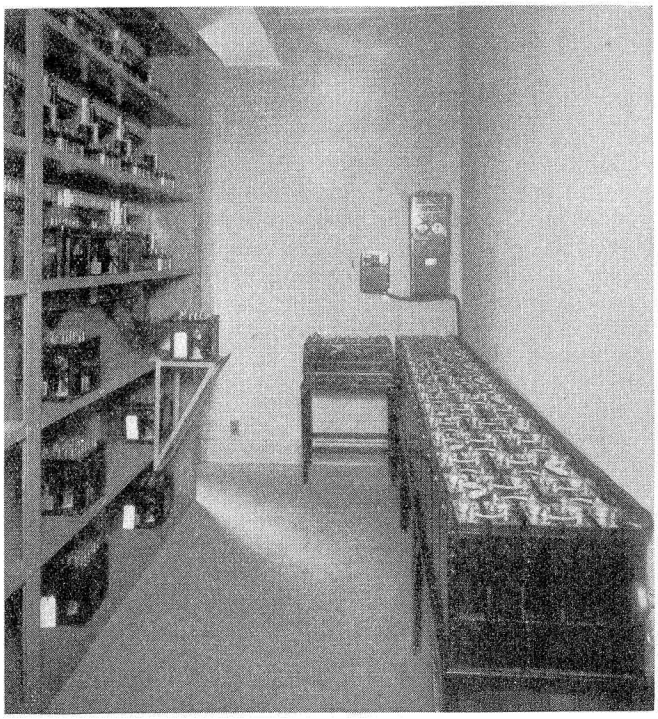


The illuminated diagram and machine in Tower C

All track circuits are operated on alternating current, and the relays are in the tower. The track leads between the tower and tracks are No. 10 single conductor run in conduit to junction boxes, and from there to the rail in wood trunking buried 18 in. below the rails. The joint between the single wire and bond wires is placed in a trunking riser which is filled with Negrite asphaltum. The track circuits are bonded with O'Balloy welded bonds.

Power Supply

The switches and signals are operated on 110 volts, direct current. At Tower A the main battery consists of 80 cells of Edison Type A-4 150-a.h. nickel-steel battery



At right—Storage battery in Tower-C. At left—Relay rack—note portable relay inspection stand

and a lock battery of 14 Edison Type B-4 cells. At Tower B the main battery consists of 56 cells of Exide E-11 200-a.h. battery and a lock battery of 6 Exide EMGO-9 cells. The main battery at Tower C consists of 80 Edison Type A-4 150-a.h. cells with a lock battery of 14 Edison Type B-4 cells. All batteries are charged by Union copper-oxide rectifiers.

The signal lights are normally operated on a-c. but are cut over to the main batteries in case of a failure of the a-c. power supply. The lever locks on the G. R. S. machines are operated on low-voltage alternating current, with a cut-over relay to change automatically to direct current in case of a failure of the a-c. supply.

Illuminated Track Diagrams

The illuminated track diagrams at Towers A and B, which were made by the construction forces on the ground, include several unique features. The faces of the diagrams were made of ⅛-in. sheet steel with a frame work of 1½-in. angle-iron, the frame being welded. In preparing the face of the diagram, a primer coat was applied first, and then a coat of Duco surfacer, after which the entire face was given a coat of putty-glaze, which left it smooth, and then two coats of Duco metal surface were applied, which gives a dull black finish and prevents reflection of light, which might interfere with the reading of the indication lights.

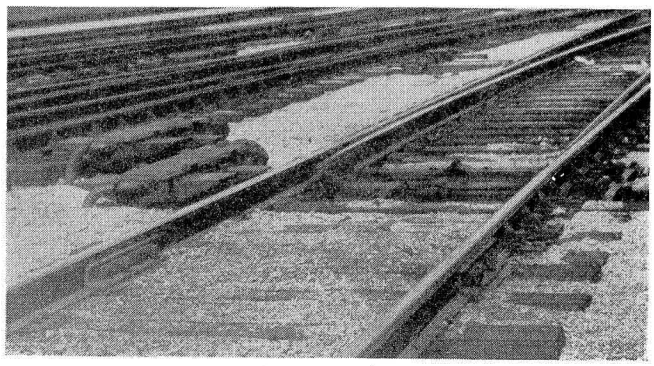
To apply the track layout on the diagram, a layer of DeVilbis masking paper was applied to the face, and a sketch of the tracks was pasted over it. Then, using a sharp knife, the track outlines were cut through to the Duco surface, and the small strips of masking paper, about 1/16-in. wide, which represent the rails, were lifted from the face, leaving the masking paper covering the remainder of the diagram.

Three coats of white Duco are then applied where the strips have been lifted, and, when dry, the remainder of the masking paper was lifted, leaving the entire track layout in white on the dull black background.

Using a standard pattern, the masking paper was cut out to represent the signals, and these pieces were applied at the proper locations and the white Duco applied over these masks. Signals and switch numbers were cut in masking paper with an Ideal stencil-cutting machine using a 7/16-in. die. After these numbers were applied at their proper places, white Duco was applied over these pieces. When this dried, the pieces were lifted and the coloring of the different circuits was then painted in, free-hand. The final operation was to drill 11/16-in. holes in the face, for the application of Raco track-model lamps for the various circuits, the number of lights used in each circuit varying from two to six. The diagrams are suspended from the ceiling, the bottom of the chart being 6 ft. 6 in. from the floor.

Indication-Failure Detector

A special feature on the diagram is three lights placed in the center of the face for an "indication failure" detector and lock-release indicator. In order to check the dynamic-indication current, two polarized relays were connected in the indication common circuit in series multiple, one relay operating on four amperes and one on one ampere. When the current is sufficient, both relays pick up, and battery is applied through both front contacts to a green light in the face of the diagram, so that the light flashes for every proper indication. If the current should be weak, the four-ampere relay fails to pick up but the one-ampere relay does, and battery is applied through the front contact of the one-ampere relay and the back of the four-ampere relay to a red light on the diagram, so that a poor indication causes a red flash. A single stroke bell also is cut in multiple with the red light, giving an audible, as well as a visible, indication.



Power switch machine at Tower-B

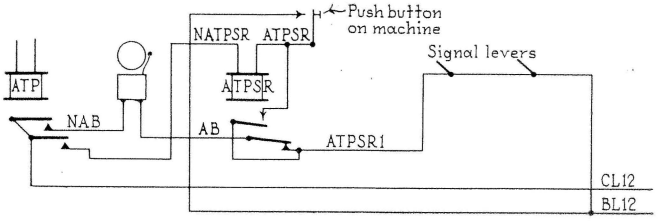
A complete indication failure gives no warning, the device being solely to catch the trouble before it becomes a failure.

Dial-Type Release Switch

Unique lever-lock and approach release were constructed in all three towers as a means of reducing the cost of the apparatus and of simplifying operations. Two accompanying pictures show the front and rear of

one of these dial-type emergency releases, which is mounted with the operating boards.

When necessary to release a lever or an approach-lock stick relay, the leverman turns the contactor, with the dial pointer, to the proper contact as marked for the lever or relay involved in the operation at the time. He must then close the door of the release cabinet, which action, through a contact operated by the door, connects the corresponding lock or relay with a clock-work time release, which is then operated. He then returns to the machine and, at the end of the time-release period, the yellow light on the diagram lights, at which time the release may be operated. The light remains lighted for the 20-sec. period, during which time the release may be used.

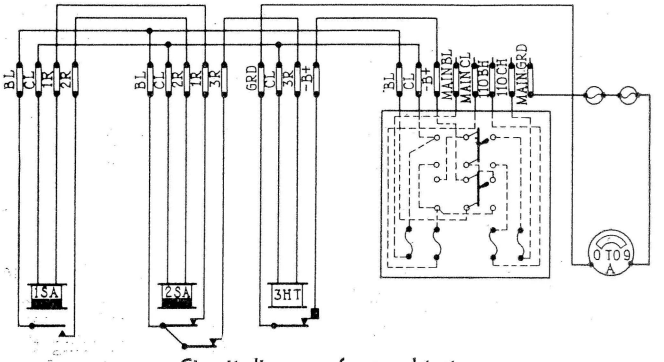


Circuit for annunciator

Annunciator circuits were designed with push buttons and stick relays so that the bell can be stopped by using the push button, as shown in the annunciator-circuit sketch.

Ground Testers

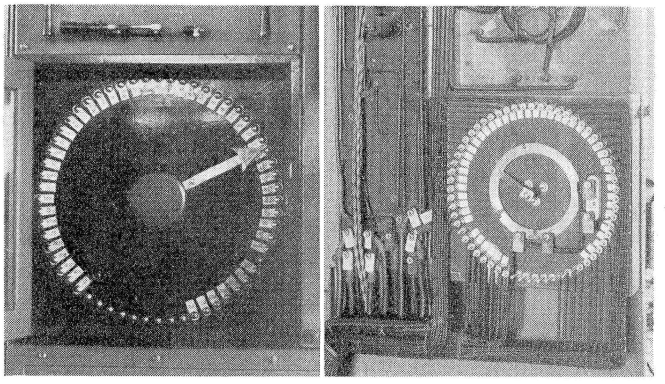
Ground testers were provided as permanent equipment for Towers A and B. Two 500-ohm slow-acting and 1,000-ohm "high voltage" relays are so connected that relay 1SA (slow-acting) is controlled through a front contact of relay 2SA (slow-acting), and 2SA is controlled through a back contact of 1SA. Relay 3H (1,000-ohm) is connected through a front contact of 2SA so that when the device is used, relay 3H operates about 60 times a minute. When a negative ground is known to exist, positive battery is connected through relay 3H and a 100-watt lamp or other resistance to cut the current to about one ampere. With the circuit being made and broken 60 times a minute, the ground is easily located by using a small compass to follow along the various wires. When a point is passed where the fluctuations of the needle cease, an inspection of terminals and apparatus readily discloses the cause of the ground. When the ground current is less than one ampere, no resistance is placed in the circuit, and an exploring coil, which partly encloses the wire, is used instead of a compass. The procedure is the same in the case of a positive ground, excepting that negative battery is connected through the relay. The test may be made on both main- and lock-battery circuits.



Circuit diagram of ground tester

Relay Racks

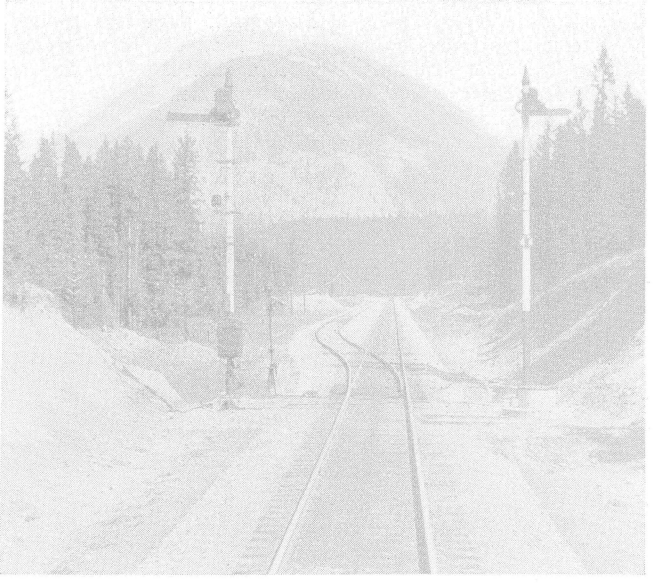
Relay racks in the relay room of each tower are constructed of 1½-in. angle-iron with shelves of No. 12 gage sheet-iron. The shelves are about 20 in. high and 14 in. deep. The cabinets are placed back to back with a runway about 2 ft. wide between them. The wires pass through the backs of the cabinets to porcelain based terminals, the terminal straps being stenciled to identify the wires. Fibre tags are tacked on the back of the cabinet at each wire opening so that wires can be identified from the back as well as from the front. The opening between the cabinets is from one end only, the whole giving the appearance of one cabinet.



Front and rear of dial for releases

The relay cabinet at each tower is placed directly under the interlocking machine and all wires from the main terminal board, which is in the basement, running through the cabinet and to the machine, are in metal chases or conduits. No doors were used on the cabinets, the installation being in a separate room which is kept locked. The jumpers from the terminals to the relay are long enough to permit moving the relay out on to a portable stand for testing and inspecting. This portable stand is made of welded angle-iron and is designed to hook over the shelf edge.

These plants were installed by the regular signal department forces of the Union Pacific.



On the Canadian Pacific in British Columbia