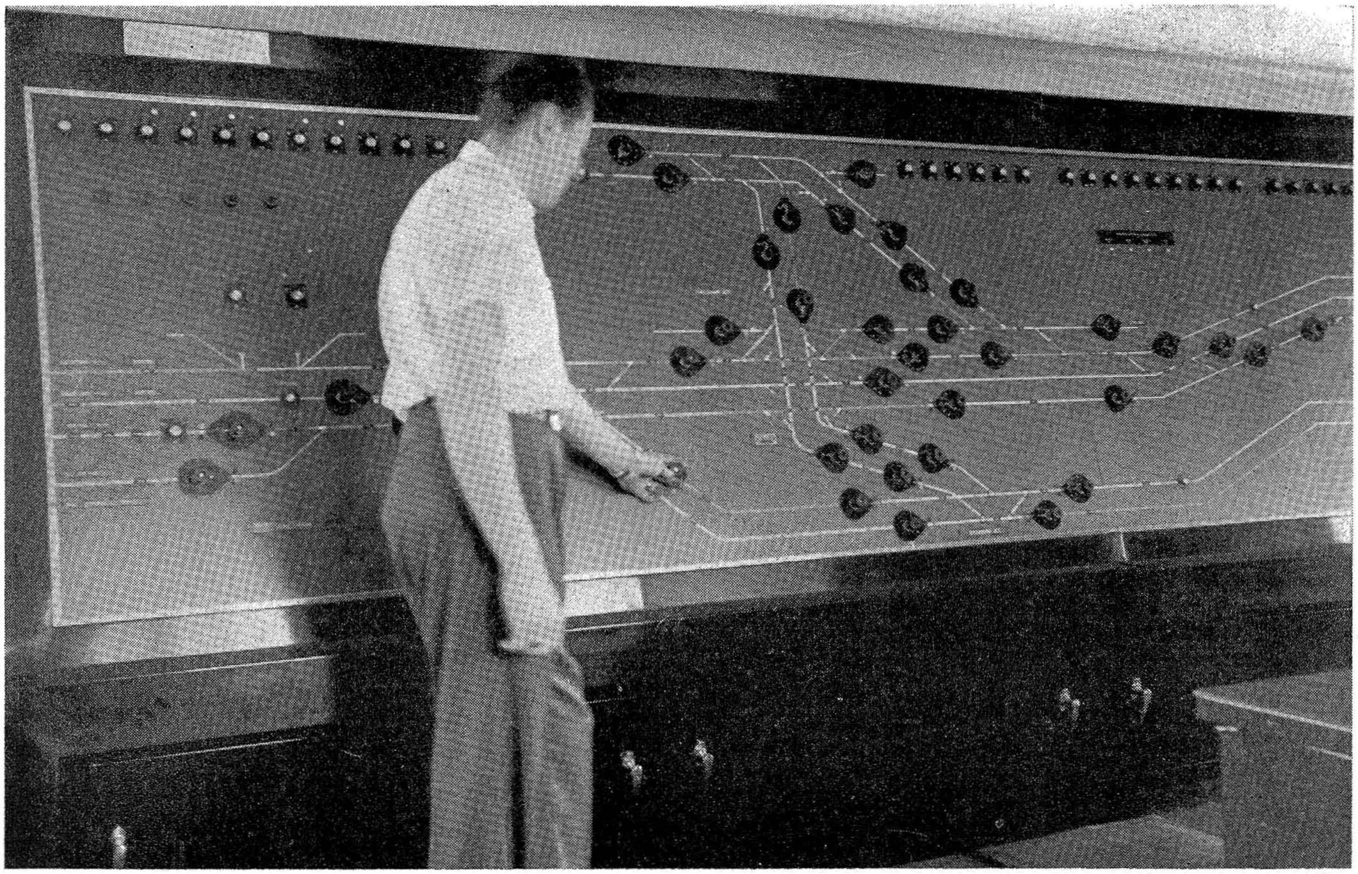


The interlocking machine panel is 6 ft. high and 12 ft. long, each signal being controlled by a black knob, known as the route selector

Route Lever Interlocking on Rock Island

Large electric plant, controlled by all-relay circuits using route-selection keys and sequence switches to control derails, crossovers, switches and the signals

THE ROCK ISLAND has rebuilt the electric interlocking at Gresham, near 89th street and Vincennes avenue, on the south side, in Chicago. Previously this layout was operated by an all-electric interlocking installed in 1906. At various times, in recent years, the original semaphore signals have been replaced with colorlight signals, and the old switch machines have been replaced by modern electric switch machines of conventional type. The control equipment in the new tower is the sequence switch system of interlocking.

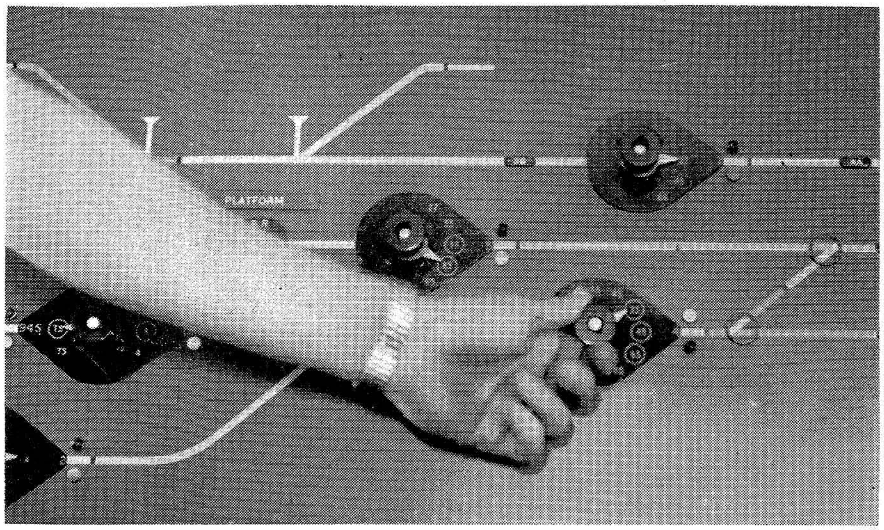
The multiple-track main line of the Rock Island is elevated for the 10 mi. from the Chicago LaSalle Street station to Gresham. From Gresham station, the double-track main line extends south to Blue Island and beyond. Just south of Gresham station, there is a junction with a double-track passenger line extending west to Beverly junction—then south. Also in the interlocking, a double-track line, used by Baltimore & Ohio and Chesapeake & Ohio passenger trains, makes a junction with the suburban line at switches 89 and 90, then extends east across the three-track Rock Island north-and-south main line, and then on east. Various wye connections, switches, crossovers and derails are included in the interlocking, as shown on the plan. The whole plant includes 13 single switches, 9 crossovers, 3 movable-point frogs, 14 derails and 41 home signals, of which 22 are dwarfs and 19 are high signals. Seven of the derails are on main track, each operated by separate switch machines. Two derails, on spurs, are pipe-connected to and operated by the switch machine which operates the corresponding main track switch.

In the 1953 project, the old frame tower, the old interlocking machine, all the old relays and wiring distribution, over the entire plant were removed. A new brick and concrete tower was constructed at the location shown on the plan. New buried and aerial cables were installed.

When starting the project, crossover 69 was moved from a location just east of switch 75 to a new location east of switch 70, and a new power crossover, 91, was added, the signals 92 and 93 being moved to new locations west of the new crossover. Otherwise, the track and signal arrangement is the same as with the previous interlocking.

Traffic Handled

Each day, a total of 20 through passenger trains and 30 suburban passenger trains are operated through Gresham interlocking on the north-and-south main route, via Washington Heights; and 64 suburban trains are operated through the interlocking on the Beverly Hills line. Likewise, about 10 Baltimore & Ohio passenger trains and 7 Chesapeake & Ohio passenger trains are operated on the east-and-west line through the plant. The Rock Island's road freight train terminal is at Blue Island, 6 mi. south of Gresham; therefore, no road freight trains pass through Gresham. However, numerous transfer cuts are operated daily through Gresham, to take inbound freight from Blue Island yard to various freighthouses, stockyards and industries in Chicago; and to return outgoing cars to Blue Island yards. Thus, as a whole, more than 190 moves are made through Gresham interlocking daily. Of importance, also, is the fact that the volume of traffic is in two peaks; inbound in the morning, and outbound in the evening.



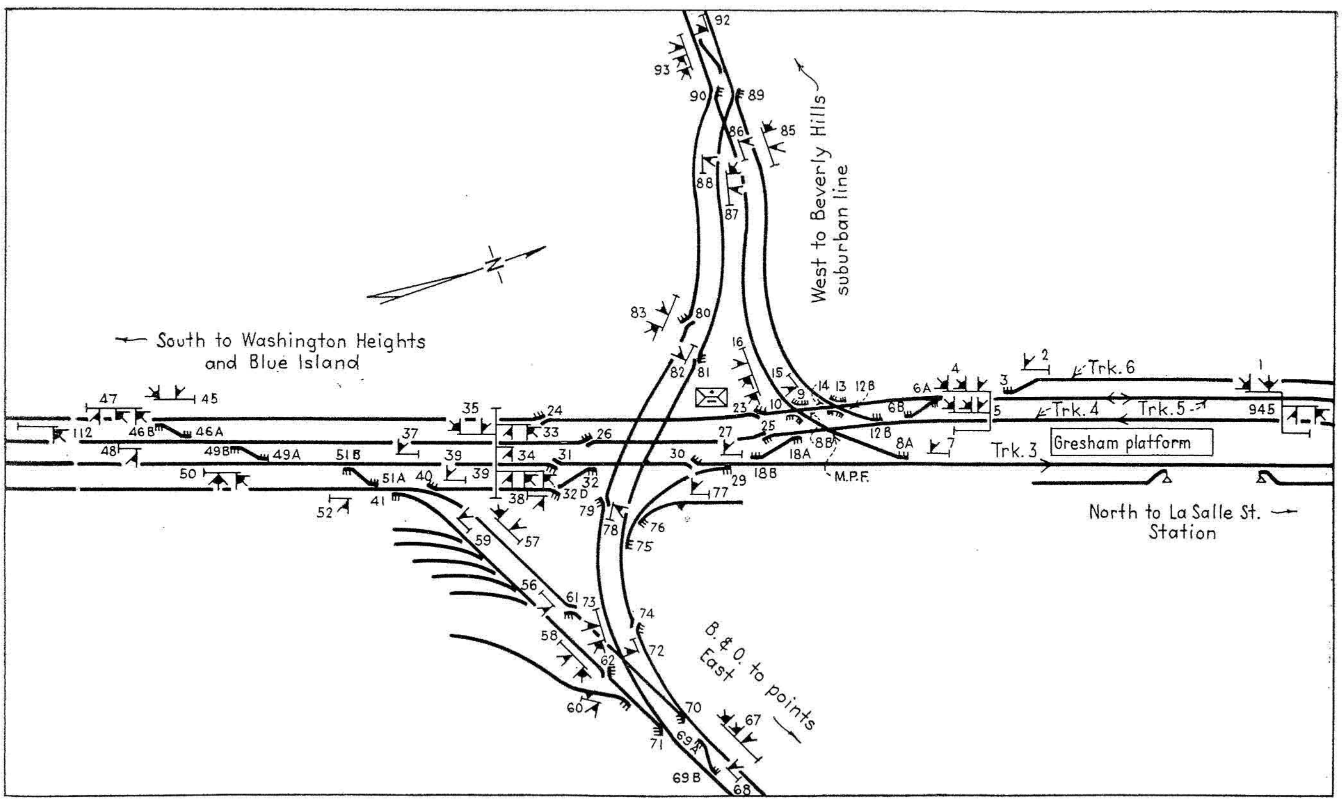
Signal repeater indicator lamps are located adjacent to the point of the escutcheon

Route Control Initiated By One Operation by Towerman

The portion of the interlocking machine panel, to control the present track layout, is 6 ft. high and 12 ft. long. The lower edge of this panel is 28 in. from the floor, and the panel slopes back at an angle of 20 deg. from vertical. On this panel, each track is represented by a painted line 3/16 in. wide, the limits of each track circuit being painted a distinctive color. Duplex track-occupancy indicator lamps are located on the track line, within the limits of the line representing each track circuit. These lamps are lighted when the corresponding track circuit is occupied. Each power switch or derail is represented by an indicator, including two lunar sections. When lined for the "straight" track, the corresponding "straight" section on the panel is lighted, or, when a switch is reversed, the corresponding section is lighted. Thus, the track line-up is shown as a line by these switch indicators.

On each line representing a track, and at the location corresponding to each home signal, there is a device known as a route selector key, which includes a black knob, 1 in. in diameter and 1¼ in. high. The shaft of this knob goes through the panel plate to contacts in a small circuit controller at the rear. On the face of the panel, each route selector key has a stationary black escutcheon plate, the point of which extends in the direction in which the corresponding home signal controls.

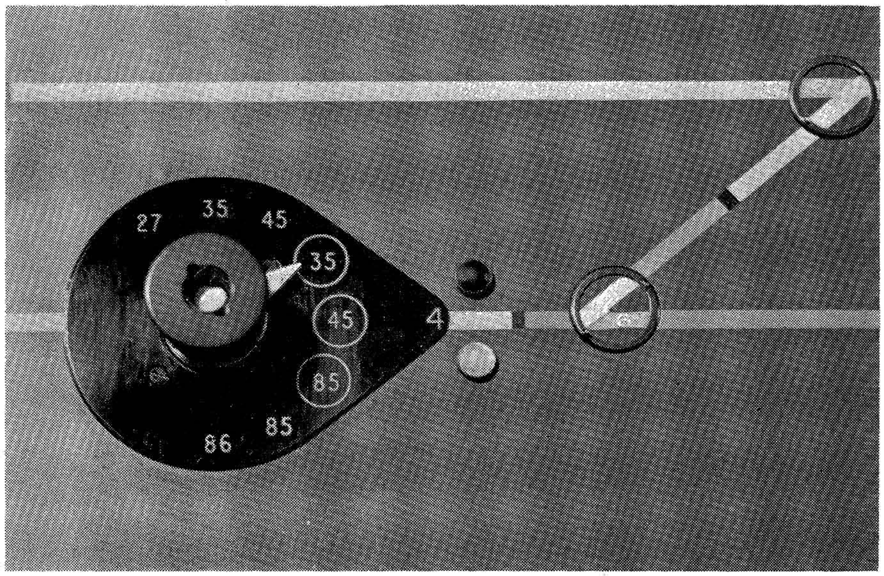
In a circular path, on the escutcheon, are white numbers which correspond with the various routes (exits) which can be entered at the home signal being considered. On



Track and signal plan of Gresham interlocking the lines representing tracks, the exit location of each route is designated by ½-in. white letters such as "WM" (westward main). In most instances, the route is designated by the number of the signal at the exit of that route. If there is no such signal, the route can be designated by the name of the track which is the exit, for example, "EM" for eastbound main or "T6" for track No. 6. For a "call-on" aspect, the pointer must be set at a different position, the high "arm" signal being designated by a circle around the number. Each of 31 of the route selection keys is for the control of one corresponding home signal. Signals 34 and 35, governing in opposite directions on track No. 4, are on the same signal bridge. Therefore, one route selection key is used for control of both these signals. Likewise, one route selection key controls signals 1 and 945 on track No. 5.

The towerman, knowing the home signal at which a train is to enter the interlocking limits, operates the route selection key representing that signal. To do so, he turns the knob, and a small pointed indicator, on the bottom of the knob, points to the number of the route (the exit) being selected. Thus, the controls, with respect to the entrance signal and exit of a route, are established. Then the towerman pushes the knob about ⅜ in. (flush to the panel), and it remains in this position. This final push closes contacts in the circuit previously determined by the rotary selection. These circuits control other devices and relays, which control the switches to line up for the route selected, and then the signal is cleared for that route. The lamp indicator repeats the position of each switch, so that the route is shown, and, when the signal is cleared, a green indicator lamp is lighted adjacent to the point of the escutcheon of the route selection key being discussed.

When the train accepts and passes the signal, the signal aspect changes to Stop; the green signal indicator lamp is extinguished; and the red signal indicator lamp is lighted. Then, or at any time later, the towerman pulls the knob of the route selection key to restore it to its normal position, about ⅜ in. from the face of the escutcheon. Progress of the train through the home signal limits is shown by the track-occupancy indicator lamps on the lines on the panel.



To clear signal 4 to exit 35, pointer is turned to "35" and knob is pushed

The Function of Sequence Switches

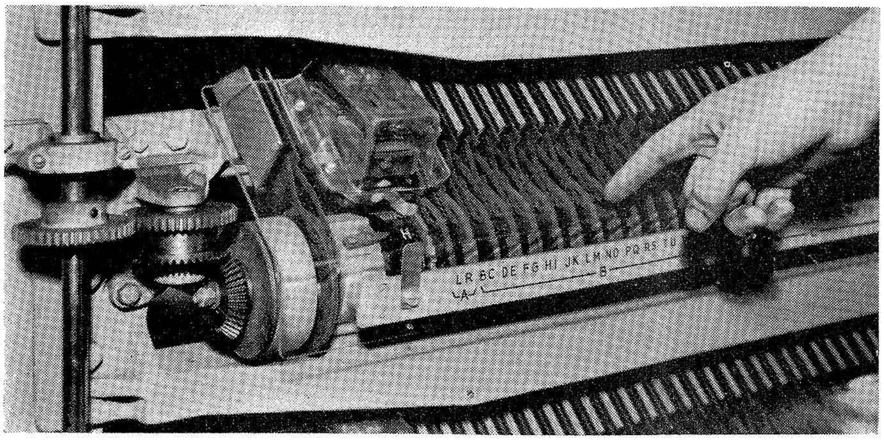
The contacts of the route selection keys, on the panel of the interlocking machine, are used to control relays and other devices, known as sequence switches, which are in metal cabinets on the ground floor of the tower, directly below the interlocking machine on the second floor.

Sequence switches are a form of mechanically operated multiple-contact circuit controllers. One of the sequence switches such as used in the Rock Island interlocking is shown in an accompanying illustration. A ⅝-in. shaft, rotating in ball bearings, extends horizontally across the lower portion of this device. On this shaft, spaced ¾ in. apart, are flat, circular disks of insulating material. These disks are 3 in. in diameter and ⅛ in. thick, and each disk with its two spacing bosses is molded in one piece. The hole through the center of the disk and spacing boss is ⅝ in. square, to fit on the square shaft, and thus the disks must turn with the shaft. Phosphor bronze contact rings are riveted to each side of each insulated disk, these rings being cut into segments, so that they make contact with associated bronze spring brushes only when required. The fixed ends of these brushes, otherwise known as contact fingers, are mounted in fixed insulated blocks in the upper tier (as shown in the illustration). Incoming wires are solder-connected to these contact fingers.

On the left end of the shaft is an electrically operated clutch, which when energized, connects the shaft to a bevel gear which is operated by a corresponding gear on a vertical shaft, driven by a motor not shown in the picture.

The horizontal shaft and contactor disks, of a sequence switch, are normally in the "home" position, and can be rotated and stopped in any one of 11 other positions. Near the

The new tower is of concrete and brick fireproof construction



Man's hand points to contacts in typical sequence switch

left end of the shaft of each sequence switch, there is a special metal disk 3/16 in. thick and 3 in. in diameter. On the circumference of this disk are 12 notches, to correspond with the 12 rotary positions of the shaft. One notch is marked as the "home" position. Each of the remaining 11 notches is marked by the number designating the route controlled when the sequence switch is in that position.

Normally, a sequence switch is in the home position, being held there by the latch of the lock. When the towerman initiates the control for a route, by setting and pushing a route selection key on the control machine (as previously explained), the necessary circuits are automatically checked, and then, on the proper sequence switch, the lock coil is energized to raise the latch from the notch. Then the clutch is energized, and a motor (to be explained later) drives the vertical shaft which is geared to the sequence switch shaft to turn it to the route position called for by the towerman. Then the sequence switch stops, and the lock is released to drop in the notch and thus prevent further turning. Contacts closed and opened on the various disks of the sequence switch, indirectly control the switch machines to line up the route called for, and then to clear the signal.

Number of Sequence Switches

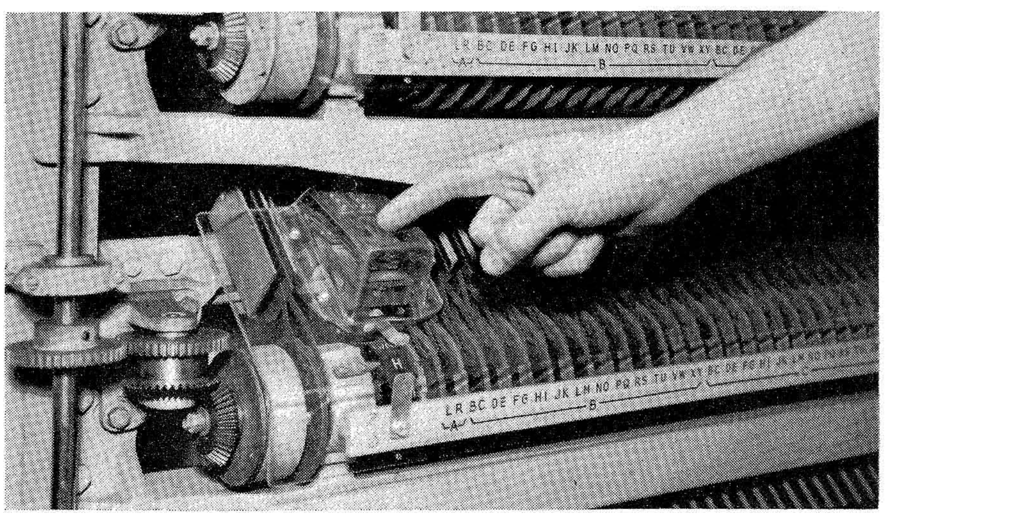
One sequence switch can control several conflicting routes, up to a total of 11. The interlocking between these routes is thus obtained mechanically, because such a switch can be in only one position at a time. For this same reason, non-conflicting routes, which are to be lined up simultaneously, must be controlled by different sequence switches. For example, routes A and B do not conflict, but both these routes conflict with route C. Routes A and B must be on different sequence switches, so that they can be set up simultaneously. Route C can be controlled from the same sequence switch as either A or B. If route C is controlled by the same sequence switch that controls route A, then electric circuits between contacts in the two sequence switches are connected to obtain circuit locking between B and C. Thus, route relays are not required.

The 41 home signals can be cleared for a total of 32 track circuit controlled routes, and for 117 additional non-track circuit controlled call-ons. In a route that is divided into sections, to permit sectional route release of the electric locking, each section must be on a separate sequence switch to permit each such sequence switch to return to normal and, thereby release its section, independent of the remaining sections. Taking all factors into consideration, a total of 25 sequence switches were required at this plant.

The operation of each sequence switch is controlled and checked by a group of special relays in a transparent plastic cover mounted at the left end of its respective sequence switch. One of these relays controls the operation of the motor which drives the sequence switch to the position called for. A second relay controls the operation of the motor to return the sequence switch to its home position. A third relay is known as the proving relay. When its sequence switch has been driven to the route position called for, the corresponding proving relay is energized by a circuit which continuously proves that: (a) the sequence switch is in a position corresponding to the route selection key operated by the towerman; (b) the sequence switch is stationary in the route position and locked in that position: (c) the interlocking conditions which permitted the sequence switch to be driven to the route position are still intact. Thus, when the route has been established, and the proving relay energized, any change to open the circuit will release the proving relay, which will put the necessary signal to red. If sufficient contacts are not available in any of the three relays mentioned above, repeater relays are used.

The sequence switches, along with the attached electric locks, proving relays and driving motors, are enclosed in sheet metal dustproof cases, that are located on the ground floor of the tower. This equipment and the control machine on the floor above constitute what is known as the sequence switch interlocking control system, as here installed, designed and manufactured by the Standard Telephones and Cables, Ltd., London, England, distributed by Federal Telephones & Radio Corporation, both affiliates of International Telephone & Telegraph Corporation, New York.

When a train accepts and passes a signal, and the signal has returned to the Stop aspect, then the tower-

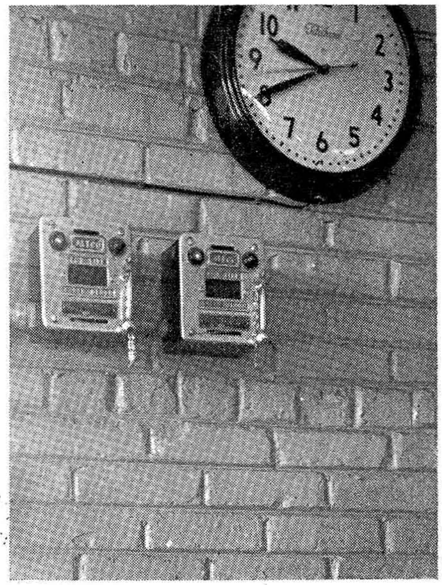


Man's hand points to transparent cover over lock

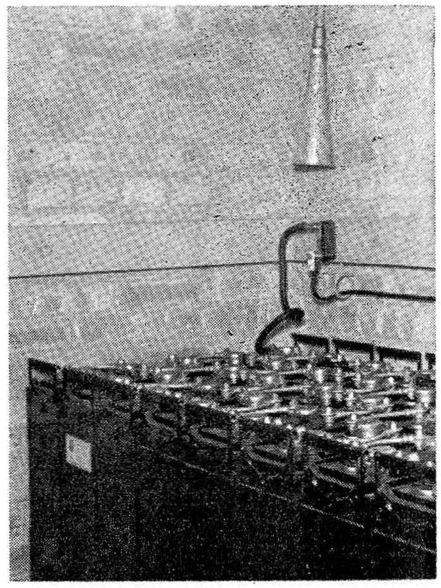
man pulls the knob of the route selection key for that signal, so that the knob is restored to its normal position, ⅜ in. from the escutcheon plate. Then, when the rear of the train clears the home signal limits, or each respective section of the sectional route release, the corresponding sequence switch is automatically rotated to return it to its "home" position.

The circuits through contacts in sequence switches do not go outside the tower. They go from the sequence switches to the operating coils of plug-in d.c. relays of conventional design, that are mounted in a rack on the ground floor of the tower. One such relay corresponds with the controls for each signal "arm," and one such relay for the control of each power switch or crossover. Also, this rack includes relays to repeat the positions of switches, the aspects of signals, and to repeat track circuit relays. Some of the relays in these circuits enter into the controls for the operation of the sequence switches, as previously discussed.

Tanks to supply carbon dioxide



Extinguisher indicators and control



Extinguisher discharge funnel over the battery

Independent Control of Switches

When tests are being made, it is necessary to control each switch or crossover independently and apart from the route selection keys. Therefore, in the upper left corner of the panel of the control machine, there is a row of small control keys, one for each power-operated single switch and crossover. Normally, each of these keys is in the center position with the arrow pointing up, so that control by the route selection keys is in effect. If the maintainer is to work on a switch, the towerman turns the corresponding individual key to the right to cause the switch to operate to the reverse position, or he turns the key to the left to operate the switch to the normal position. When the testing is finished, the towerman returns the individual key to its center position, thus returning the system to control by the route selection switches.

All circuits are operated by direct current, supplied by batteries. The 110-volt d.c. switch machines are fed from a set of 90 Edison storage cells, rated at 240 a.h. The 50-volt sequence switch motors are fed by a set of 40 Edison storage cells, rated at 40 a.h. Each track circuit is fed by one Edison storage cell.

All circuits going out from the tower are in buried cable. From the railroad crossing south along the main line the circuits are in aerial cable on messenger run on concrete posts. In the remainder of the interlocking the circuits are in buried cable. Most of this cable was made by The Kerite Company. The control circuits in the tower are No. 16 wire with rubber insulation and Thermoplastic flame-proof covering, made by the United States Rubber Co.

Automatic Chemical Fire Extinguisher

The interior of the new tower is protected by a chemical fire extinguisher system, which normally is controlled automatically, but which can be controlled manually. The system is fed from a bank of four tanks of carbon dioxide, each rated at 50 lb. capacity. In case of fire, this gas is fed from the tanks, through control valves and pipes to discharge nozzles located at various places in the building. The system automatically selects for operation in any of three groups. Group A includes the relay room, wire chaseways and inside of interlocking machine. Group B includes maintainers room and the battery room, and Group C includes boiler room. Small devices, known as spot fire detectors, are located at various places in the rooms in the wire chaseways and inside the interlocking machine. Each detector consists of a circuit controller which is operated by a thermostat. If the temperature surrounding a spot fire detector rises quickly, or if a smoldering fire holds the temperature only slightly above normal for several minutes, the detector closes a circuit, which automatically selects and operates an electric valve that releases gas from the tanks to the pipes leading to outlets located in the respective group locations such as in Group A. At the same time, a pressure operated relay closes circuits that sound a buzzer, and lights an indication lamp in the operating room, where the leverman can see it.

The leverman and the maintainer investigate the fire, and take further action as required. In the meantime or at any other time, if the maintainer or the leverman see evidence of smoke or fire inside the tower, they can step to a set of special control boxes, and actuate special handles which will turn on the gas to feed to any one of the three groups. This chemical fire extinguisher system was furnished by the American-La France Foamite Corp., Elmira, N.Y.

This interlocking was planned and constructed by signal department forces of the Rock Island, under the direction of C. M. Bishop, signal engineer.