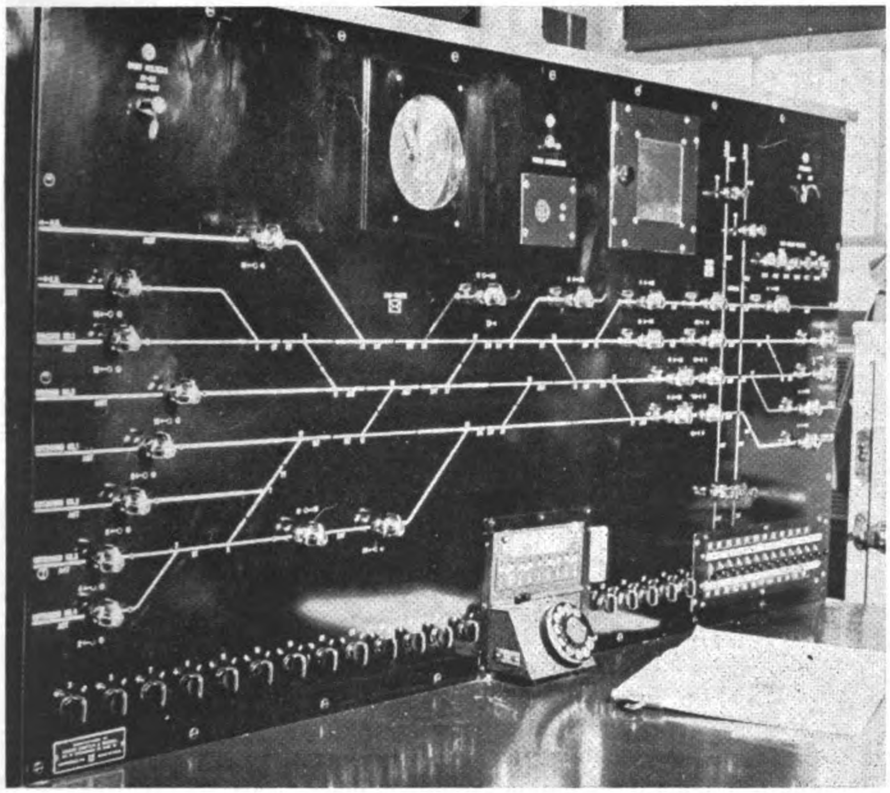
Railway Signaling and Communications



Emergency control is a feature of this plant. If switches are lined but the signal will not clear, train stops at signal, then leverman breaks the lead seal on emergency lever, which he throws, thus holding all signals at Stop. Then he can flag that train through. After this lever has been placed normal, all other routes can then be lined.

Relay Interlocking Saves Time . . .

at Yard Entrances

Belt Railway of Chicago installs new route-type interlocking which includes switches at east end of Clearing yard and a crossing of the double-track mainline of the Grand Trunk Western with four Belt tracks

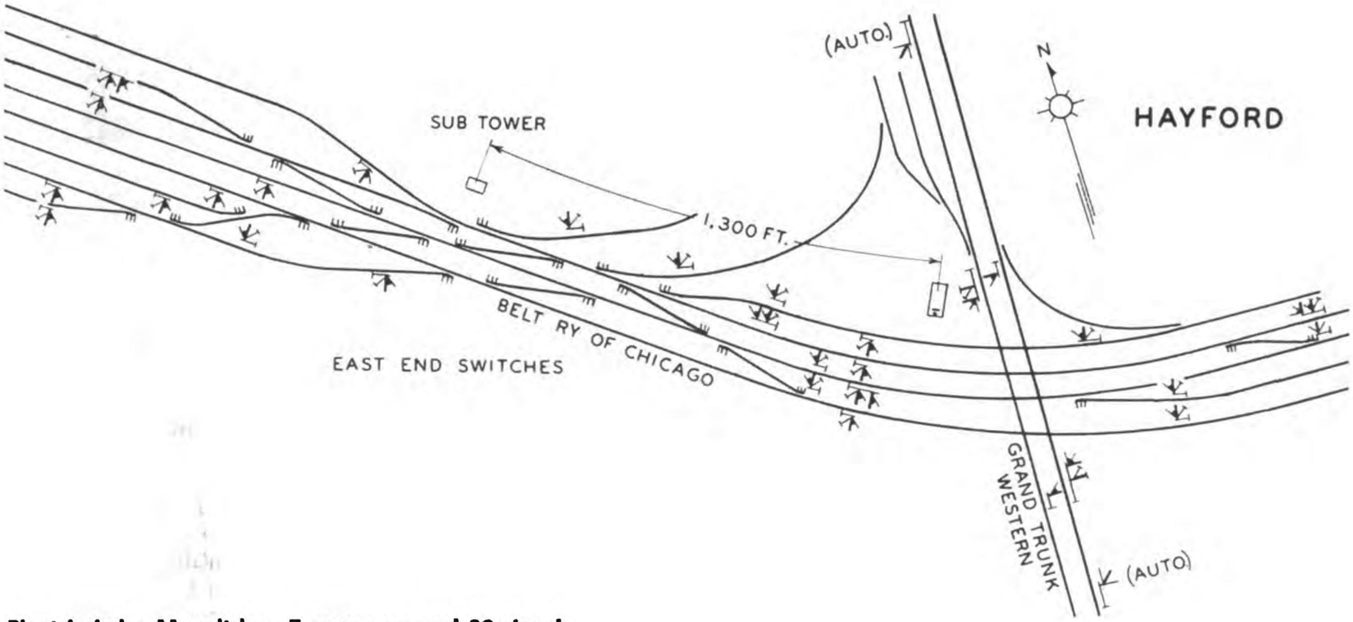
CONSIDERABLE DELAY HAS BEEN ELIMINATED and train movements expedited since the Belt Railway's new interlocking has been in service at the east end of Clearing yard on Chicago's southwest side. These switches were formerly operated by switch tenders. Just east of these switches, a double-track mainline of the GTW crosses the BRC. The signal protection at the crossing was controlled by a table interlocker. Approximately 120 trains daily move through the plant on Belt Railway tracks, these being trains of eight other railroads: C&O, C&EI, ERIE, IC, MONON, PRR, RI and WAB. About 30-40 trains daily are operated on the GTW, some of which move over connections onto BRC tracks to enter Clearing yard.

A yard track indicator is located near the east end switches. The humpmaster at Clearing calls the interlocking operator and tells him the track numbers for approaching trains. The operator then selects the number on the yard track indicator dial (telephone dial). As a quick check that he has the correct number, a red lamp is lighted for the tens' digits (10, 20, 30, etc.) and a white indication lamp is lighted for the units' digits (1, 2, 3, etc.). He cancels the indication by pressing a button.

The new interlocking plant consists of 7 crossovers, 11 turnout switches and 29 searchlight signals, all controlled from a route-type control machine in a new one-story concrete block tower at the GTW crossing. The switch machines are the A-5 electro-pneumatic type, and the turnouts are No. 9 and No. 12. Because trains on the Belt Railway are entering or leaving the yard while using this interlocking, all train speeds are limited to 20 mph. Thus dwarf signals are used for the home signals. This avoided the use of expensive signal bridges over three tracks or four tracks. Aspects displayed by the dwarf signals are: red, yellow (movement over a switch or crossover reversed), green (movement over a switch or crossover normal), and lunar white (call-on to enter an occupied block). On the GTW, where train speeds on the main tracks are 45 mph, high signals are used for normal direction.

Route Lined by Pressing Two Buttons

The interlocking machine panel has ¼ in. lines representing the tracks, various track circuit sections being colored red, yellow and blue, the contrasting colors showing distinctly against the black background panel. A signal knob is at



Plant includes 11 switches, 7 crossovers and 29 signals

each location on the diagram corresponding to an entrance or an exit of the interlocking. To line a route, the operator presses the knob corresponding to the signal where the train is to enter the interlocking. When he does this, a red light adjacent to this knob is lighted, and amber lamps are lighted adjacent to signal knobs at all available exits from this entrance. Oblong white lamps in the various routes (track sections) are lighted to show the positions of switches. Next the operator presses the knob at the signal where the train is to leave the interlocking. When the route is lined, the amber lamp at the exit will be extinguished and the red lamp at the entrance signal will change to green, indicating that the signal has been cleared. The oblong white switch-position indicators will remain lighted along the route lined. All other switch-position indication lamps are extinguished. Any controlled signal within the route lined will also be cleared automatically, and is so indicated by the green indication lamp which is lighted adjacent to the signal knob.

When the train accepts and passes the entering signal, its green indication lamp is extinguished. As the train enters each track section, a red oblong track occupancy section lamp is lighted. This interlocking has sectional route release locking. If the operator desires to cancel a route, once he has set it up, he pulls out each signal knob, and the red indication lamps flash 45 times per minute to indicate that the signal is in "time." At the expiration of 3 minutes, the red lamps at the signal knobs are extinguished.

Call-on Lets Trains Close Up

Because of the numerous train movements in and out of the yard, and because they are made at 20 mph, the call-on aspect was provided for signals, whereby trains could close up when entering the yard. To control a signal to display the call-on aspect, the operator must turn the signal knob before he pushes it. This controls the signal to display the lunar white aspect, permitting a train to enter an occupied block. Once a signal has been cleared to the call-on aspect (lunar white), it will progressively clear to less restricting aspects upon departure of the preceding train. When a train has accepted the call-on aspect and passed the signal, the operator must pull and turn the signal knob to return it to normal operation.

To provide the operator with sufficient time to clear the plant and line a route over the crossing for an approaching GTW train, a "second approach" indication was provided. When a GTW train is approximately 10,000 ft. from the crossing, a single-stroke gong sounds, and the red indication lamps in the GTW approach section of the track diagram begins flashing 45 times per minute. When the GTW train passes the distant signal, approximately 5,000 ft. from the plant, the gong again sounds and the flashing-red lamp burns steady.

A microphone and loudspeaker are mounted in the face of the control panel, and a separate row of toggle switches can cut the interlocking operator into several telephone, dispatchers' and talk-back circuits. Other controls on the panel include release keys for the trap circuits at the GTW crossing; toggle switches for the electric snow melters on the switches, switch levers for manual control of the switches during maintenance and emergencies.

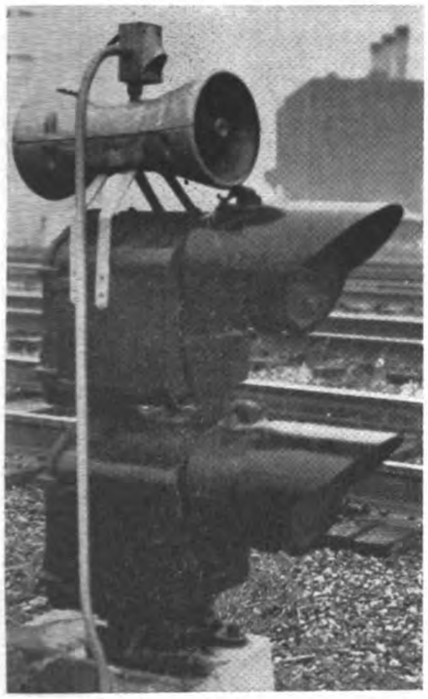
Emergency Operation

A feature of this interlocking is the emergency control, which includes a special emergency lever and circuits. If the switches have been lined up for an approaching train, but the signal will not clear due to some failure of a circuit, the train arrives and stops at the signal. Then the leverman breaks a lead seal on the emergency lever, and turns this lever. This lights a red warning lamp over this lever, and circuits are effected so that all signals are held at Stop; the route relays and route locking relays are de-energized, thus locking all switches in the position where they are. Therefore, the leverman cannot move a switch or clear any signal, thus preventing setting up a conflicting route. Then, after making a check to see that the switches are in the position for the route to be used, the train is flagged through the plant. When the emergency lever is restored to original position, the plant is restored to normal operation, with the exception of the route that has been affected by the failure. Until such time that the failure is corrected, the emergency lever must be used for each movement over that route.

The leverman is required, by rule, to report each instance in which the wire and lead seal, on the emergency lever, is broken. Also, this lever is connected to an electrically operated counter, mounted inside the machine case, which registers the number of times that the emergency lever is operated.

Talk-Backs Save Time for Departing Trains

As part of this interlocking installation, several talk-back loudspeakers were installed throughout the plant. Some of them are mounted on pipe masts, and where clearances are restricted, other speakers are mounted atop the searchlight dwarf signals. When a train is ready to leave the yard, the crew foreman goes to the nearest talk-back, and presses a button to signal the interlocking operator, who answers by stepping on his foot-switch and speaking toward his microphone which is mounted in the face of the interlocking control machine panel. The yard crew foreman says that he is ready to pull out, and the operator can line up a route for the departing train, knowing that the train will accept the signal as soon as it clears. Switch crews have found the talk-back system to be time savers, in that they can let the leverman know where they want to go, without having to walk to the tower. Communication equipment was furnished by the R. W. Neill Company.



Loudspeaker on dwarf

Commercial power for the entire interlocking including the control machine is supplied from three lines: normal power from one source, and standby power from two other separate lines. When the normal power fails, transfer switches automatically switch the load to one of the standby lines.

Interlocking is Direct Wire Control

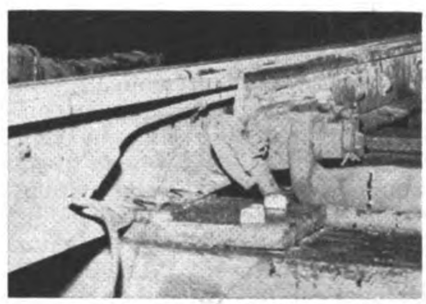
Non-vital circuits are in Ankoseal telephone type cable made up of 50 and 75 pair wire. The vital circuits such as controls, are made up of 5 to 19 conductor No. 14 wire, Hazard cable. All signal, communication and power wire and cable is directly buried in trenches alongside the air lines. Where wires, cable and air lines go under track, they are in 8-in steel pipe.

All wires and cables are brought in underground to the two towers into metal chases in the relay rooms. These floor chases, at the terminal board bases, have metal hinged covers. All slack in the cable is in these chases, rather than being distributed along the line. The cables are color coded for easy identification. For example, red is for wires from relay racks to the teminal board; brown is for inter-wire between relay racks; yellow is for wire between relay racks and the control machine; and green is for switch control wires. Individual wires between relay racks is black. Wire chases between racks and terminal boards are of No. 14 steel, painted with two coats of a high voltage insulating paint. Fiber insulated bushings are used at all entrances where wire leaves the floor chases and enter the terminal boards, and where this wire leaves the terminal boards to enter overhead chases which carry it to relay racks and the control machine. These chases were made for the Belt Railway by the DuBois Engineering Co., Hammond, Ind., which also furnished the transfer equipment for automatic power transfer and individual control switches for the electric snow melters.

All relays are the plug-in type, being rack mounted in groupings in numerical sequence according to track circuits. Thus a grouping begins with the track relay, the track repeater, and working through the switch and signal relays. This again, makes for easier maintenance. A special relay rack and terminal board, in the sub-tower building relay room, enables the maintainer to test relays individually. Usually the route selection relays are in the interlocking control machine but in this project they are rack-mounted in separate cases in the relay room. Thus they are in a dust-free case and are easily accessible for testing and maintenance. All battery in this project is Edison B6H nickel-iron storage.

Air lines are Byers' wrought iron heavy duty pipe, main lines being 2 in., with branch lines down to ½ in. to an individual switch. Air line pipe was covered with a double wrap of Tapecoat asphalt tape. The tape is wrapped around the pipe and then heated, causing it to flow, thus forming continuous asphalt covering. Three pairs of air compressors were installed to provide air at 55-70 psi for the switches. Each compressor operates on 440 volts a.c. and is rated at 9.2 cu ft. per minute. If the pipe line pressure falls to 55 psi, one compressor cuts in and 30 seconds later the other compressor cuts in. Both are cut out when air line pressure reaches 70 psi.

A separate commercial 144-kw power line was constructed for the electric snow melters. These General Electric heaters are rated at 200 watts per ft., a total of 6,000 watts being used at each switch. The heating rods are mounted on the web of the gage side of the stock rails. Each switch heater has its own thermal breaker, and in the sub-tower individual controls are located for each switch heater for test purposes.



Heater rod along web of rail

This installation was made by railroad forces under the supervision of Harry W. Dunn, signal and electrical engineer, Belt Railway of Chicago; the field force was directed by J. W. Benham, signal and electrical supervisor. The engineering and design of signal equipment was performed by the Union Switch & Signal Division of Westinghouse Air Brake Co.