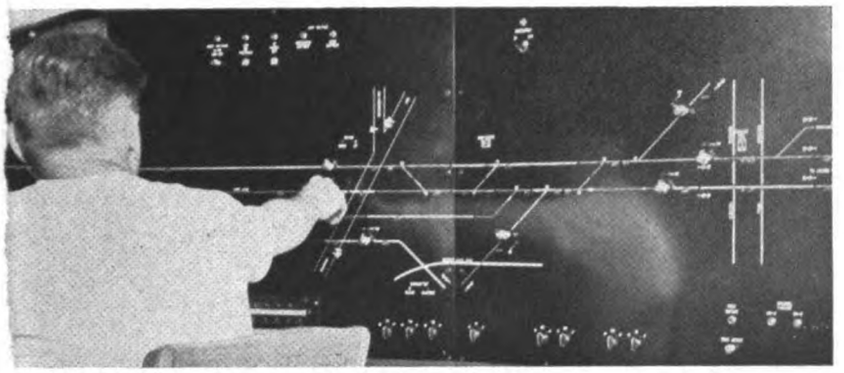


Railway Signaling and Communications

December 1958

New interlocking, known as Western avenue, is controlled from a panel that is a new wing on the existing control machine at Hayford tower on the Belt Railway

ıterlocking Saves Time and Money

. . . for the Belt Railway of Chicago

Route-type interlocking installed where Belt Railway connections are made to yards of the Wabash and the Chesapeake & Ohio, as well as a wye track to the Baltimore & Ohio Chicago Terminal. Known as Western avenue interlocking, it is controlled from a machine at Hayford tower about 7,000 ft west at Clearing Yard

SAVINGS OF 20 MINUTES PER TRAIN for each of the 240 trains daily are being realized as a result of installing new power switches and controlled signals at Western avenue on The Belt Railway Company of Chicago, in the southwest part of the city. The five crossovers and three single switches in this plant were formerly hand-thrown by switch tenders, who gave hand signals to direct train moves. At the Columbus avenue grade crossing (see plan), new flashing-light signals and automatic short arm gates were installed. This crossing, which also includes Maplewood avenue, meeting Columbus avenue at the railway tracks, was formerly protected by manually controlled flashing-light signals and watchmen. Controls of home signals governing train movements over the highway crossing are interlocked with the controls of the crossing protection equipment, as will be explained later.

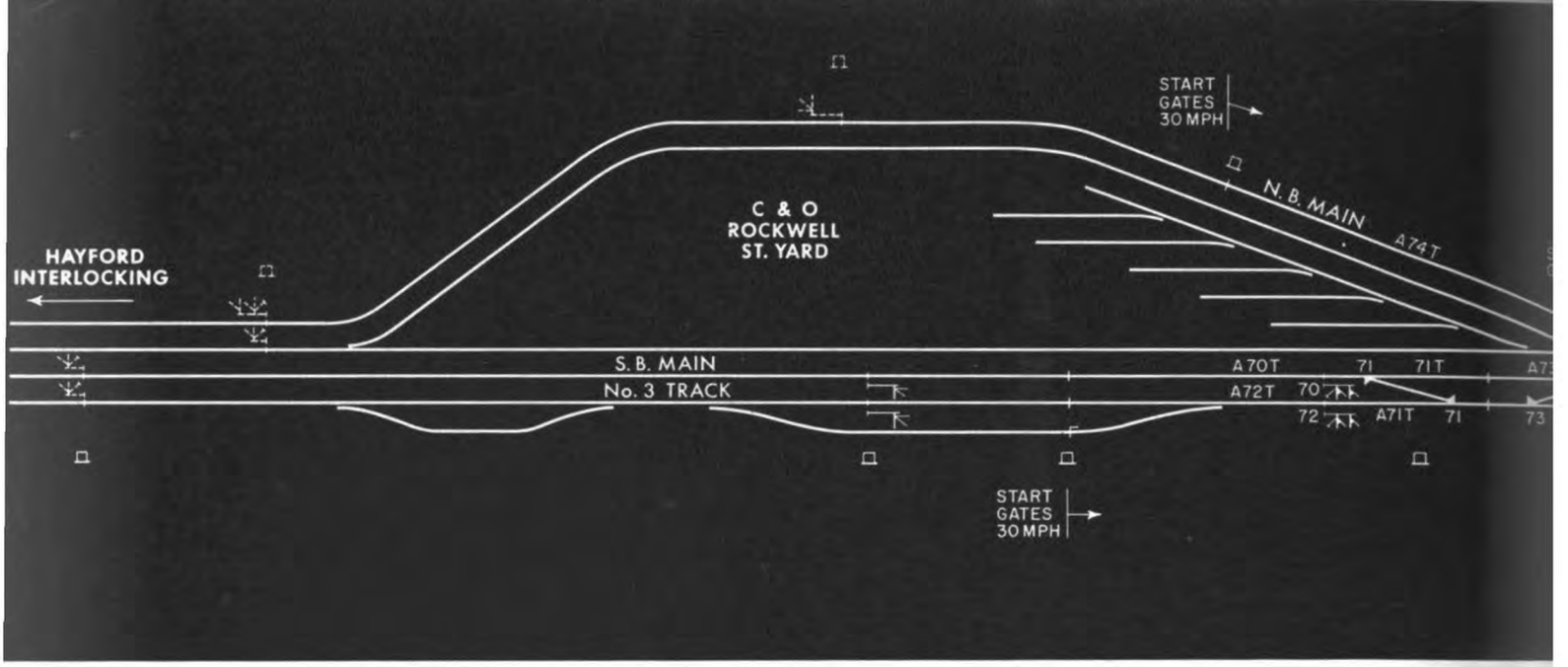
Known as Western avenue interlocking, the new plant handles trains of eight other railroads: C&O, C&EI, CRI&P, Erie, IC, Monon, Pennsylvania and Wabash. Maximum permissible speed through the interlocking is 20 mph. Nine H-5 searchlight dwarf signals direct train moves. Aspects displayed are: red, yellow (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). The A-5 electropneumatic switch machines are equipped with GE electric snow melters. Turnouts are No. 9 and No. 12.

Code Control from Hayford

Western avenue interlocking is about 7,000 ft east of Hayford tower. Because of the distance involved, the new plant is controlled by a US&S 516A code system operating over five line wires. This code system sends 25 controls and receives 50 indications concurrently per second. A new wing section was added to the present Hayford route type control machine for the new interlocking. To simplify manipulation and conform to the existing control machine operation, the operator need only push two signal pushbuttons to line a route for a train. No pressing of a code start button is required.

Pressing the pushbutton in the track diagram corresponding to the signal where the train enters the interlocking, causes an indication lamp associated with that signal to be lighted red. Amber route exit indication lights are lighted adjacent to the signal pushbuttons at all available exits from this entrance. Next, the operator presses the pushbutton at the signal where the train is to leave the interlocking. This causes a corresponding amber route indication light to be lighted adjacent to the entrance signal pushbutton to denote that the route has been selected. At this same time the other route exit indication lights for the routes that were available but not selected are extinguished. White oblong lights in the track diagram, which shows switch position, will flash during the time the switches are in transit. When the switches reach the position called for and the route is lined and locked these lamps will burn steady. The switch indication lamps in conjunction with the entrance and exit route indication lamps provide an illuminated path of the route lined. When the signal clears the indication lamp for the signal changes from red to green.

When the train accepts and passes the entering signal, its green indication lamp is extinguished, showing the signal has been automatically canceled. As the train enters each track section, a red oblong track occupancy section lamp is lighted. If the leverman desires to cancel a route manually,



once he has set it up, he pulls out each signal pushbutton in the route. The red signal indication lamps will flash 45 times per minute to indicate that the route is time locked. At the expiration of three minutes, the red lamps at the signal pushbuttons are extinguished, indicating the route has been released. The interlocking circuits also provide sectional route locking. This expedites the manipulation of the control machine by allowing a train to release the locking as it clears each section of the route.

Because of numerous train moves made into and out of the C&O yard and over the two leads to Landers yard on the Wabash, the call-on aspect is provided whereby trains entering these yards can close up, enabling them to clear the main line more quickly. To control a signal to display the call-on aspect, the operator must turn the signal pushbutton before he pushes it. This controls the signal to display the lunar white aspect, permitting a train to enter an occupied block. When a train has accepted the call-on aspect and passed the signal, the operator must pull and turn the signal pushbutton to return it to normal operation. A special feature of the call-on allows the aspect, once displayed, to progressively clear to less restrictive aspects—when the train ahead of the signal departs from its control limits.

In order to obtain reverse signaling with traffic control, reversible coded track circuits were installed on the north and south main tracks and on No. 3 track between Hayford interlocking and the Western avenue plant, some 6,000 ft. To expedite movements between these two interlockings, an automatic signal is also used on each track to govern moves in the normal direction of traffic. The codes used for signal control are: 75 for the yellow aspect, 180 for green, and no code for red. Track circuits are approximately 2,500 ft long.

The track relay used at each end of the reversible circuits is a style CD-F code following with tuned contacts, thus eliminating the need for a decoding transformer.

Talk-Back Speakers Save Time

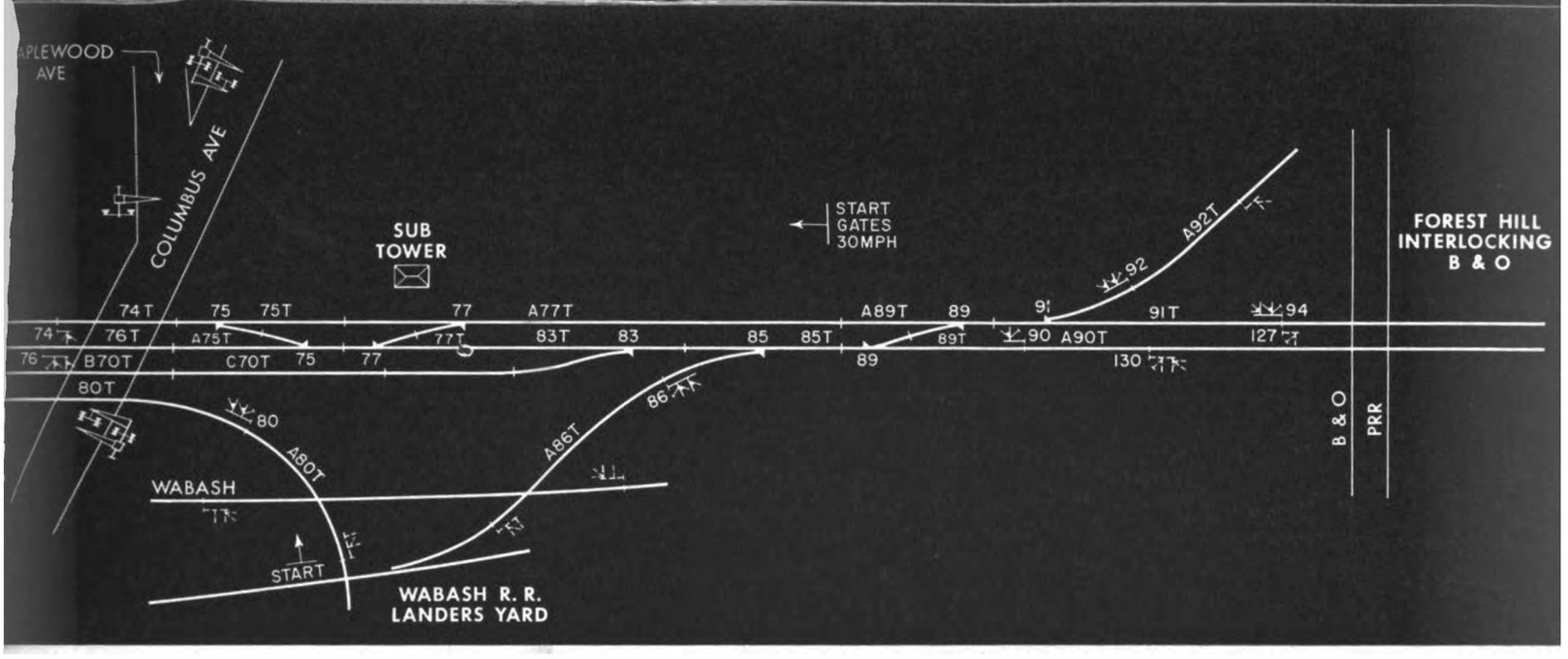
Talk-back speakers play an important part in expediting train moves and saving time in this Western avenue interlocking. Speakers, mounted back to back, are on top of some interlocking dwarf signals. Where clearances will permit, a pair of speakers is mounted on a small pedestal near the dwarf signal, and in some instances near switches where crews will normally stop. A talk-back speaker is also mounted on the end of a relay rack in the sub-tower building, which contains the relays and code control equipment for this Western avenue plant.

Circuits from these speakers are run to the Hayford tower where each speaker wire pair terminates. A key and indication lamp on the control machine are for each speaker circuit. Thus the Hayford operator has instantaneous communications with train crews and the signal maintainer as well. This has been particularly helpful when the maintainer is checking switches, as he can use a nearby speaker to ask the operator to throw a switch. Such instant calling was recently helpful in minimizing damage due to an overheated journal. The supervisor, when down at the sub-tower, saw a hot box on a passing westbound train. He used the talk-back in the relay room to call the Hayford operator and tell him about the hot box. The operator was able to set a signal to Stop at the Hayford plant. When the train crew called in, he told them of the hot box, which they were able to repack. The talk-back speakers, amplifiers and associated equipment were furnished by R. W. Neill Co.

Non-vital circuits, including the talk-back speaker circuits, the code line and the telephone circuit to the sub-tower at Western avenue, are in Ankoseal telephone-type cable, made up of 35-pair wires. The 1 to 37-conductor cables containing the vital control circuits were furnished by The Okonite Company and The Kerite Company. The communication and power cable is run aerially between Hayford and the Western avenue sub-tower. At the Western avenue plant, the cables are 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: Hayford and the sub-tower at Western avenue.

Room To Work In

The Western avenue sub-tower is 30 ft wide and 100 ft long. An advantage of this size is that relay racks can be 4 ft apart, giving the



maintainer plenty of room in which to work. The chase at the Western avenue sub-tower runs in a 2-ft square duct in the floor the entire length of the building. Thus, cable can be brought in from either end, which provided quite a saving, compared to a building with only one cable entrance. As a fire prevention measure, the cables in this sub-tower chase are covered with engine sand. Flat metal covers over the chaseway are approximately 3 ft long, so they are easily removable for access to the cable. All slack in the cable is played out in the chaseway.

The relays are the plug-in type, being rack mounted in groups, 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 makes for easier maintenance. A special relay rack and terminal board in the sub-tower relay room enables the maintainer to test relays individually.

Code line and operating battery, as well as the battery for all the controls, are Edison nickel-iron, alkaline A6H, rated at 240 a.h. This battery is charged through a two-rate charge control relay. When the relay is on low charge, an annunciator bell is sounded in the Hayford tower, so that the operator may inform the maintainer.

Gates Improve Grade Crossing Protection

To reduce delays to vehicular traffic and improve the protection, automatic short arm gates were installed at the Columbus avenue crossing with the Belt Railway. The protection equipment is track circuit controlled in the conventional manner. Indication lamps on the control machine panel at Hayford tower show when gates are either down or up.

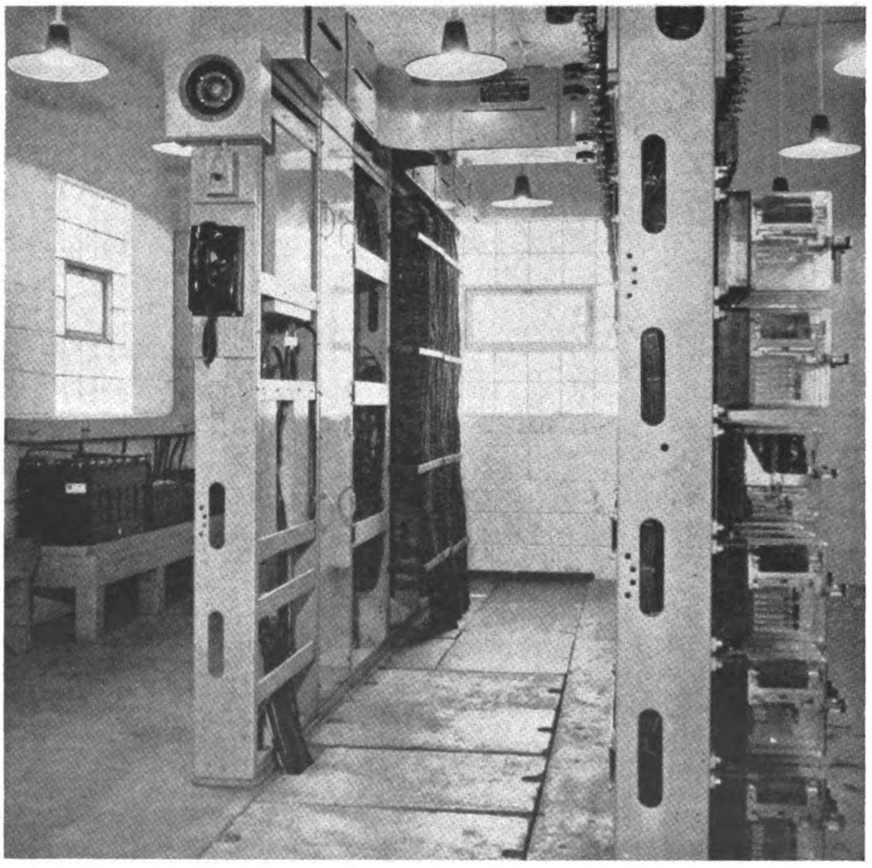
At Western avenue interlocking, the following signals lie within the approaches to Columbus avenue street crossing, 70, 72, 74, 76, 80. Signals 70 and 72 were considered to be back far enough that gates are not required to be down to permit these signals to clear. Crossing protection is not effective in the rear of these signals unless the signal is cleared (and, of course, the approach is occupied).

With a train on track section A76T approaching signal 76, the crossing protection is not effective until a code is sent to clear signal 76 by reversing 76RRP. With 76RRP reversed, 76ASR drops to

See Figure 1 (next page)

lock the route selected. When A76T track section is occupied with 76ASR de-energized, relay YLXMR

See Figure 2 (next page)



Talk-back speaker in sub-tower relay room connects to Hayford tower operator

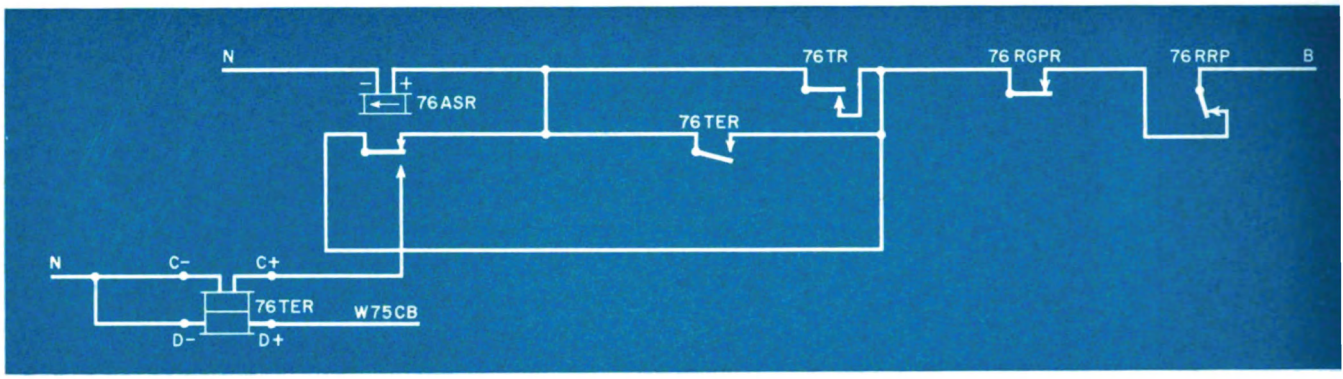


FIGURE 1—Circuits for approach and time locking relays

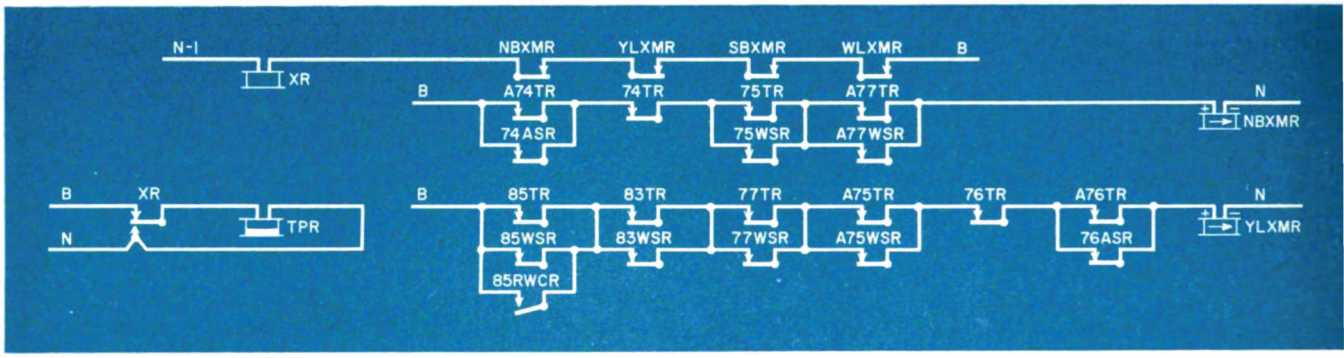


FIGURE 2—Highway crossing circuits

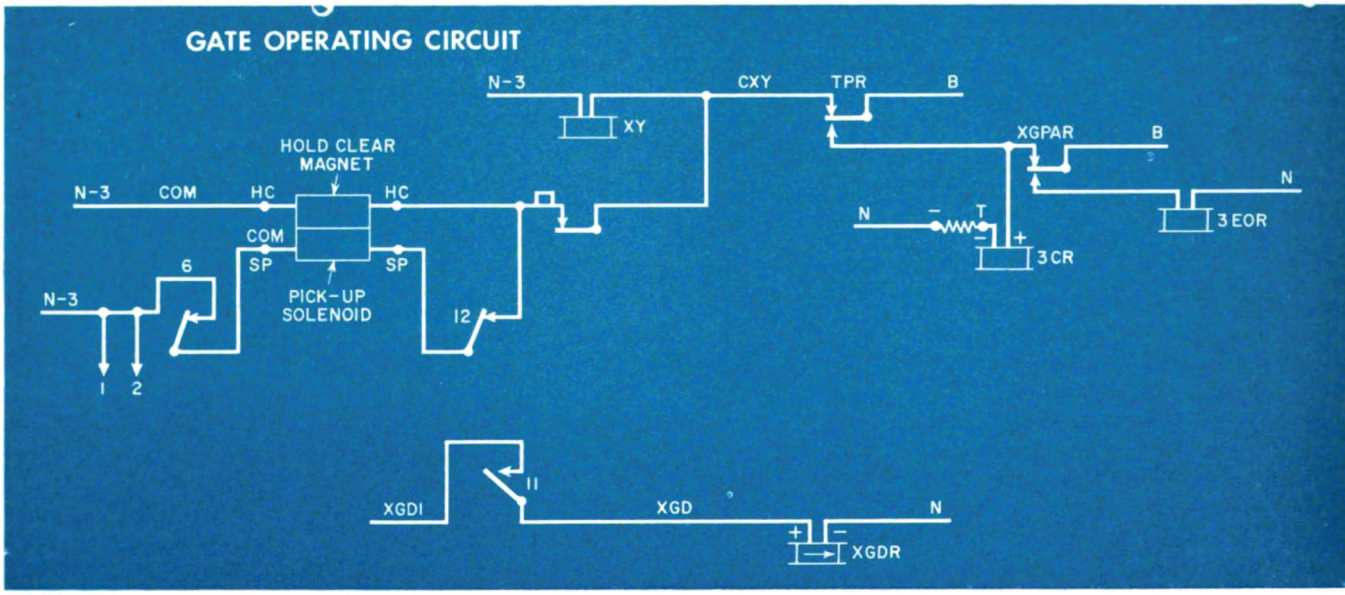


FIGURE 3—Gate operating circuit

Contact Number	Contact Closed		Contact Use
	Gate Going Up	Gate Going Down	
1	40°-50°/85°-90°	90°-85°/50°-40°	Arc Supressor Cont.
2	0°-10°	10°-0°	Final Down Snub
6	80°-90°	90°-80°	Solenoid Control
11*	0°-10°	10°-0°	GDP Relay Control
12	0°-90°	80°-0°	Solenoid Cutout

*Operating cam for circuit controller contact No. 11 must be adjusted to conform with above tabulation. (Adjustment from factory is 80-90)

Notes regarding contact numbers as shown on gate operating circuit plan

is de-energized. Relay YLXMR de
energized drops XR, XR drops
TPR, and TPR de-energized opens
control of "hold-clear" magnets on
gates. With all gates horizontal the

See Figure 3 (above)

XGDR "gates-down" relay picks up
allowing 76BPR to pick up, and

See Figure 4 (top next page)

76BPR up allows signal 76A to
clear. Signal 76 can display a call

See Figure 5 (next page)

on (76A red, 76B energized) with

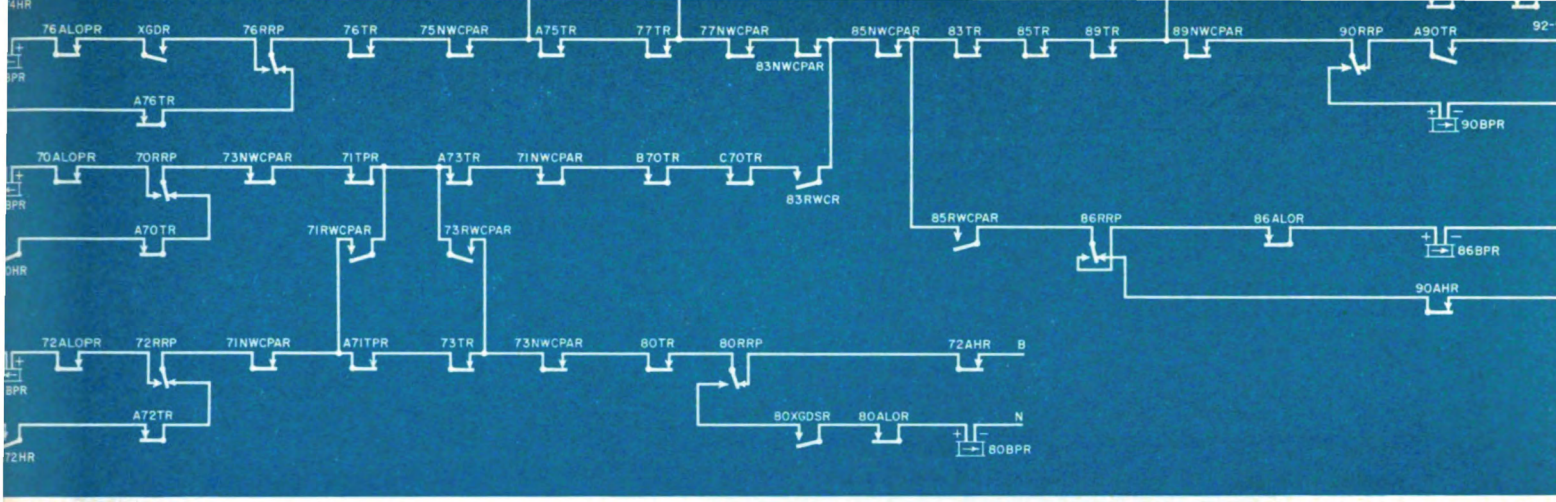


FIGURE 4—UR interlocking circuits

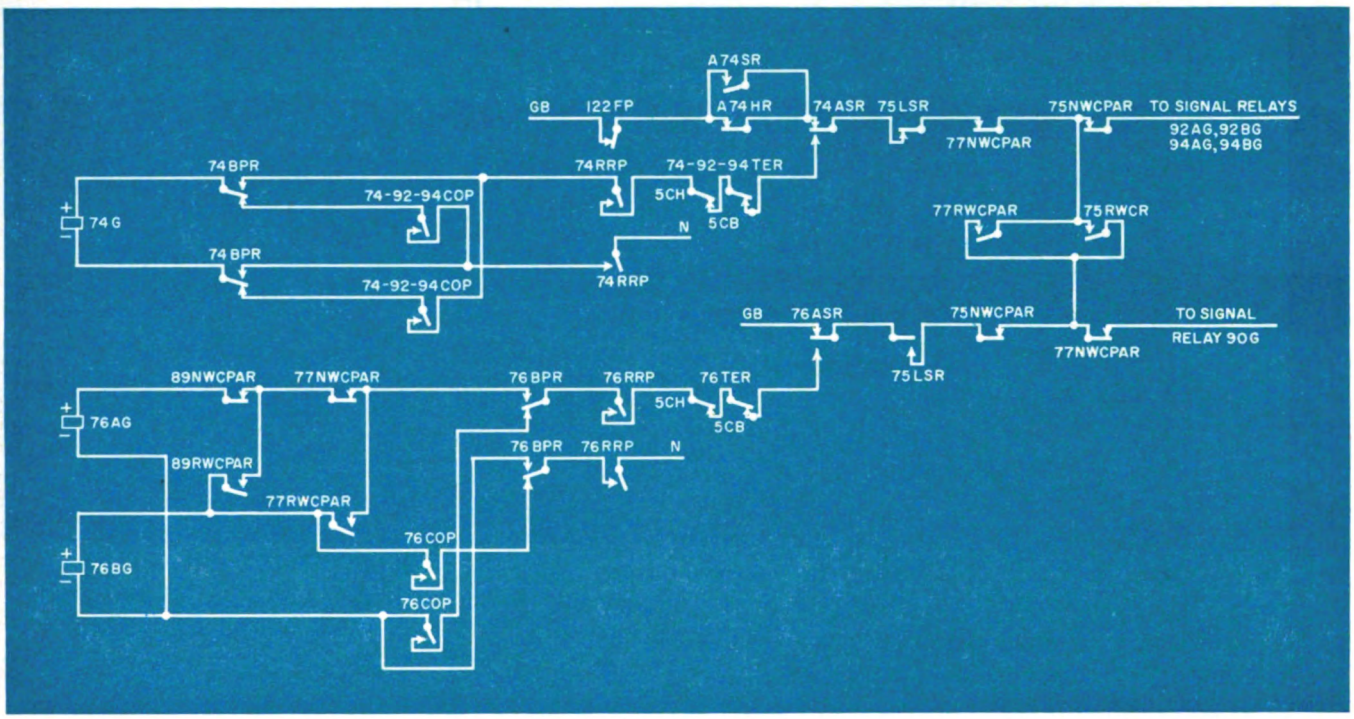
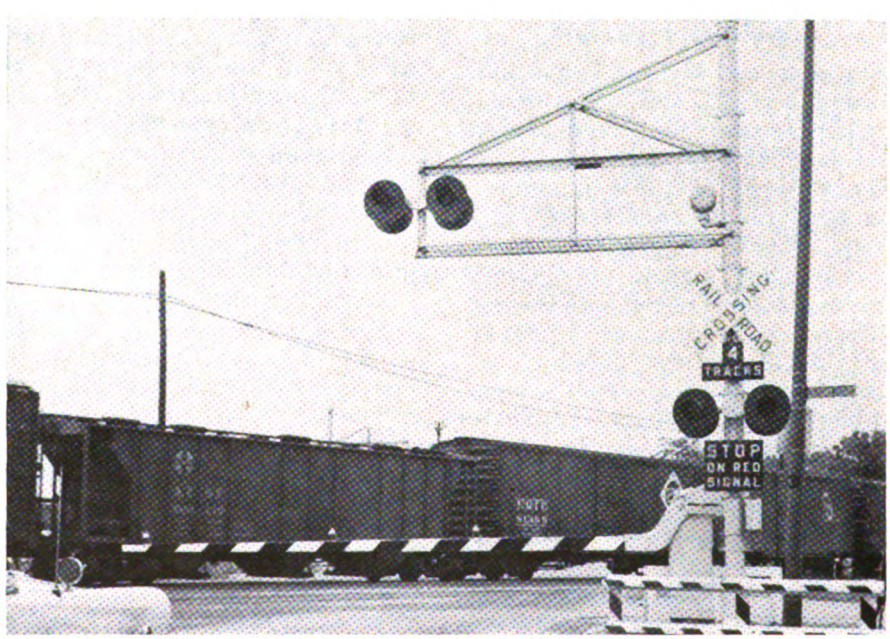


FIGURE 5—Signal control circuits

out checking that gates are down, but crossing protection would be initiated when 76ASR dropped during the clearing of the call-on.

With a train on track section A80T approaching signal 80, crossing protection would be initiated when 80ASR dropped following receipt of a code to clear signal 80 by reversing 80RRP. Signal 80 would not clear until gates were horizontal. This is similar to action described for signal 76.

Should the operator send a code to clear signal 80 with approach track A80T unoccupied, the reversal of 80RRP would pick up



Columbus avenue gates are tied in with dwarf signal controls so that signal can not clear until gates are down if train is on highway crossing approach circuit

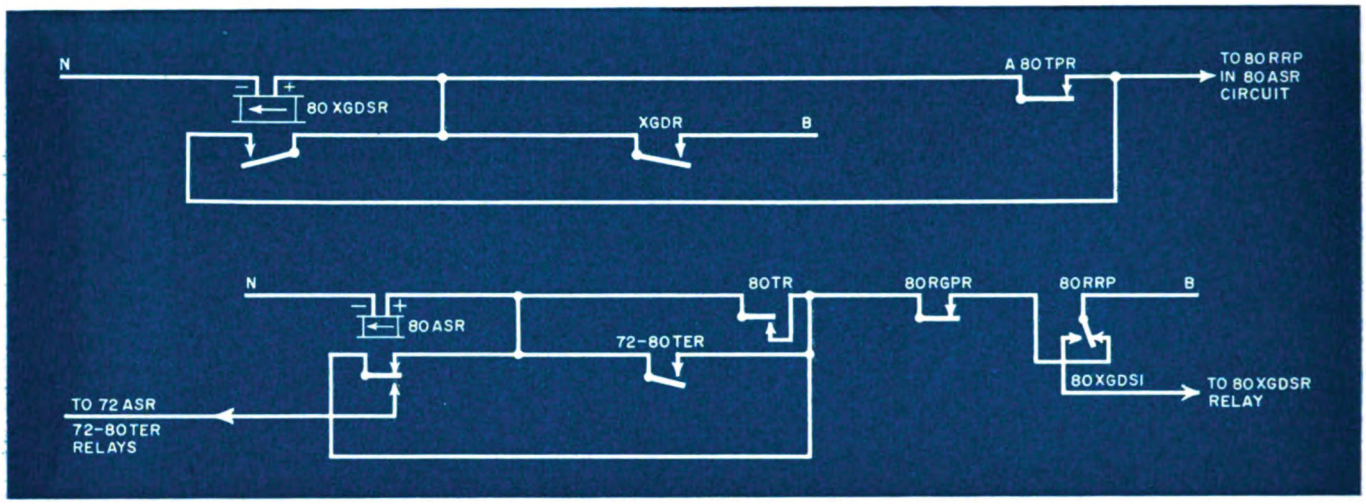


FIGURE 6—Control circuits including approach and time locking relays for signal 80

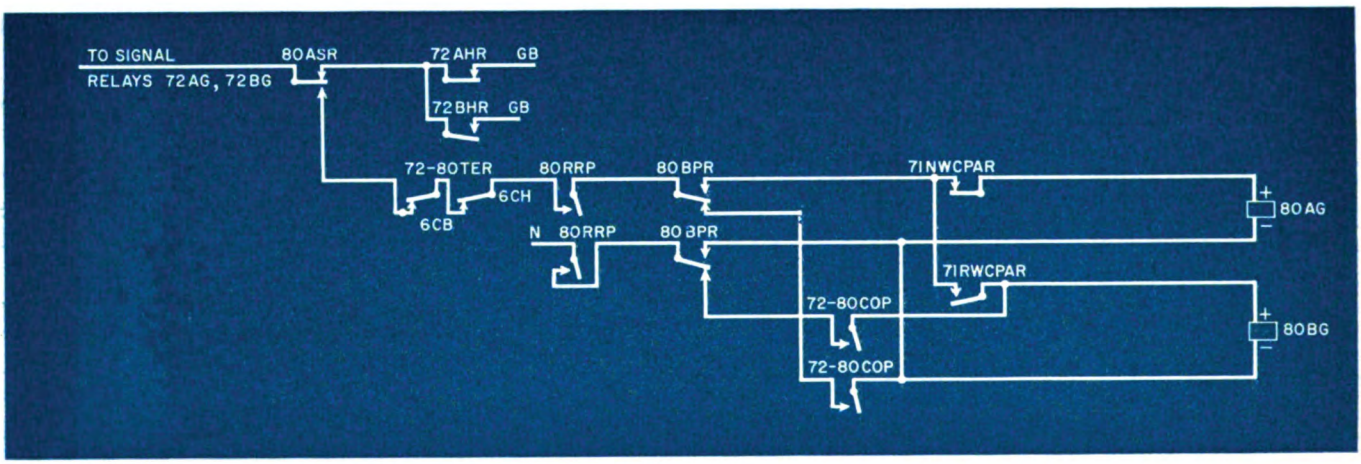


FIGURE 7—Control circuits for signal 80

80XGDS relay. Relay 80XGDS
See Figure 6 (top of page)
energized will allow 80BPR to pick up and 80BPR up will allow signal
See Figure 4 (preceding page)
80A to clear. In this instance cross-
See Figue 7 (above)
ing protection will not begin until a train occupies A80T. As with signal 76, a call-on may be displayed on signal 80 without checking gates down. Signal 74 is tied in with the crossing protection in exactly the same manner as signal 80 is.

All home signals at Western avenue are one or two-arm dwarfs. The normal proceed aspect for one-arm signals is yellow (track circuit controlled) and for call-on is lunar white (non-track circuit controlled). The normal proceed aspects for two-arm signals are Y over R and R over Y (both track circuit controlled) and lunar white (non-track circuit controlled) for call-on.

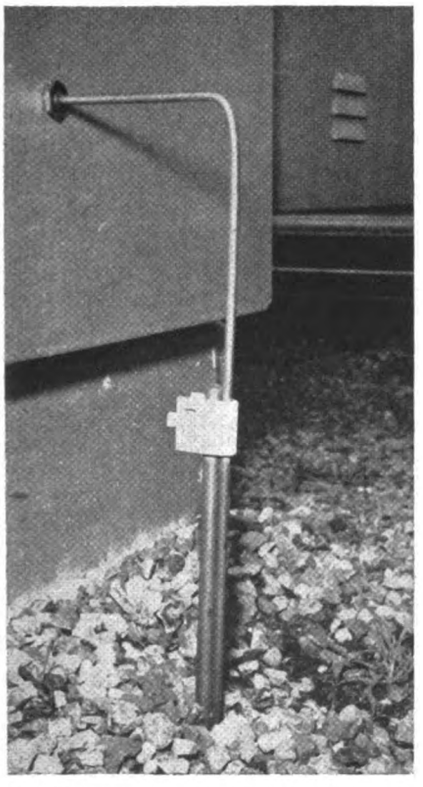
For the straight route, the control of signal 76 runs through track sections 76T, A75T, 77T, 83T, 85T, 89T and A90T. While any of these are occupied and it is desired to allow a second train to follow, the call-on aspect would be displayed by operator coding out signal 76 clear and 76 call-on. Should the first train vacate the above track sections, the 76BPR would pick up
See Figure 4 (preceding page)
when the track relays are all picked up. The 76BPR up will de-energize signal 76B and energize signal 76A,
See Figure 5 (preceding page)
providing a track circuit controlled Y over R aspect if, of course, the second train has not yet passed signal 76. The 76BPR picking up will also kick call-on relay 76COP back to normal.

The crossing protection equipment was furnished by the Griswold Signal Co. The automatic gates have a swivel base, which facilitates maintenance, in that the maintainer can lower the gate and swing it around parallel with the highway. Thus he can change out a gate arm or light bulbs and not be in the path of vehicular traffic. If the a.c. fails, a PN 150-P power transfer relay switches the gate lighting circuit to battery. The gate motors are fed from ten cells of Edison 240-a.h. battery.

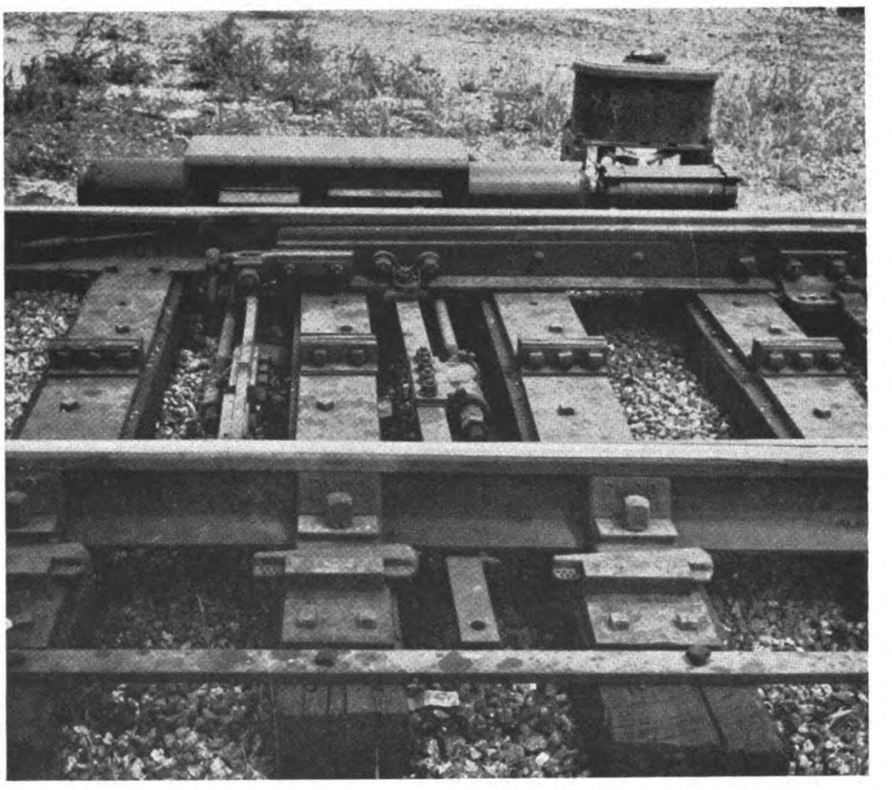
A. C. Into Cases

Commercial power is supplied for the Western avenue interlocking, and 110-volt a.c. is run to all relay cases, including the cases at automatic signals between Hayford and Western avenue. To facilitate maintenance, lights and duplex outlets are provided in all relay cases.

The bottom of each case is covered with a rubber mat. This is a precaution in the event that a wire should drop in the case, so it will not short out or ground any of the signal circuits. Also, the rubber mat is handy in that it keeps batteries in place, and as one maintainer re-



Each instrument case is grounded



Electro-pneumatic switch machines are type A-5. Air is furnished at 55 to 70 psi

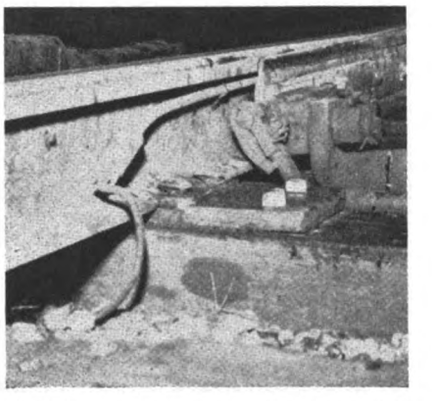
marked, "It's good to keep any spilled alkaline from eating into the metal case floor." All cases are grounded with a 3/8-in. diameter copper "Fire Alarm" rod, which is bolted to the case, and thence bolted to a 5/8-in. by 8-ft Copperweld ground rod.

Air Compressors Operate 15 Min per Hour

Four air compressors were installed to provide air at 55 to 70 psi for the A-5 electro-pneumatic switches. Each compressor operates at 440 volt a.c. and is rated at 9.2 cu ft per minute. Normally two compressors will operate from each of two pressure switches; one switch covers approximately 55 to 70 psi, and the other switch covers approximately 45 to 60 psi. 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 the air line pressure reaches 70 psi. Normally two compressors operate approximately 15 minutes each hour. However, if the air pressure should fall to 45 psi, then a standby pair of compressors will also cut in. When the standby cuts in, an annunciator bell is sounded in the Hayford tower to inform the operator, so he can call the maintainer. A switching arrangement is provided so that from one to four compressors can be operated by either pressure switch. The air reservoir tank at the sub-tower is outside, behind the building. A valve and air line are connected to this tank, so that if the compressors inside the building should fail, a portable compressor can be rolled up next to this tank and its supply line connected to the air line. The valve can then be opened and the portable compressor may be used to maintain the proper pressure. The air lines are 2-in. diameter Byers wrought iron, heavy duty pipe, 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 a continuous asphalt covering.

Electric Snow Melters

A separate commercial 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 rail. Each switch heater has its own thermal breaker, and in the sub-tower individual controls are located for each switch heater for test purposes. The heaters are controlled by the operator in the Hayford tower, using the 516A code system. Indications on the panel tell him when the melters are on or off.



Electric snow melter, mounted along web of rail, is rated at 200 watts per foot

This interlocking was installed by railroad forces under the supervision of Harry W. Dunn, Signal and Electrical Engineer, The Belt Railway Company of Chicago. The field force was directed by J. W. Benham, Signal and Electrical Supervisor. Signal equipment was furnished by the Union Switch & Signal Division of Westinghouse Air Brake Co.