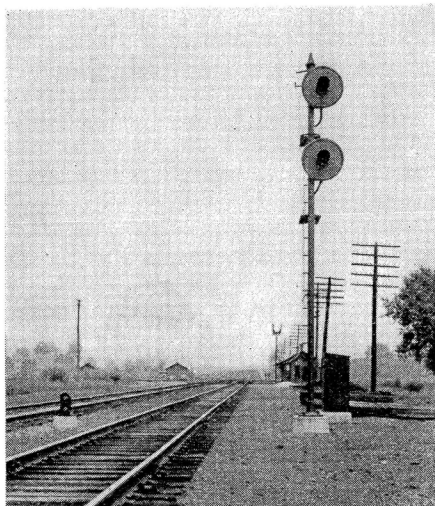


Western Indiana Installs



Northward home signal on Western Indiana

THE CHICAGO & WESTERN INDIANA has installed an all-relay interlocking, including color-light signals for directing train movements over a crossing with the South Chicago line of the Rock Island, at Oakdale near Ninety-first street in Chicago. This new interlocking replaces a combination of signal protection, including manually-operated crossing gates as well as interlocked dwarf signals; and although the gates and signals were handled by an operator, each train was required to stop before proceeding over the crossing. The new plant permits the elimination of stops for approximately 78 trains daily, and in addition, provides safety features impossible with the former arrangement.

The double-track line of the Rock Island involved in this crossing extends from Gresham interlocking, at Ninety-first street and Vincennes avenue, eastward to South Chicago. The Rock Island uses this line for the transfer movement of freight between the South Chicago industrial district and its Blue Island freight yard via Gresham interlocking, about four such train movements being made each way daily. Furthermore, this line is used by passenger trains of the Baltimore & Ohio and the Pere Marquette destined to or from Chicago, the P.M. operating four passenger trains each way daily and the B. & O. six passenger trains, as well as an occasional freight train. Thus an average of 28 trains pass through the plant east and west daily.

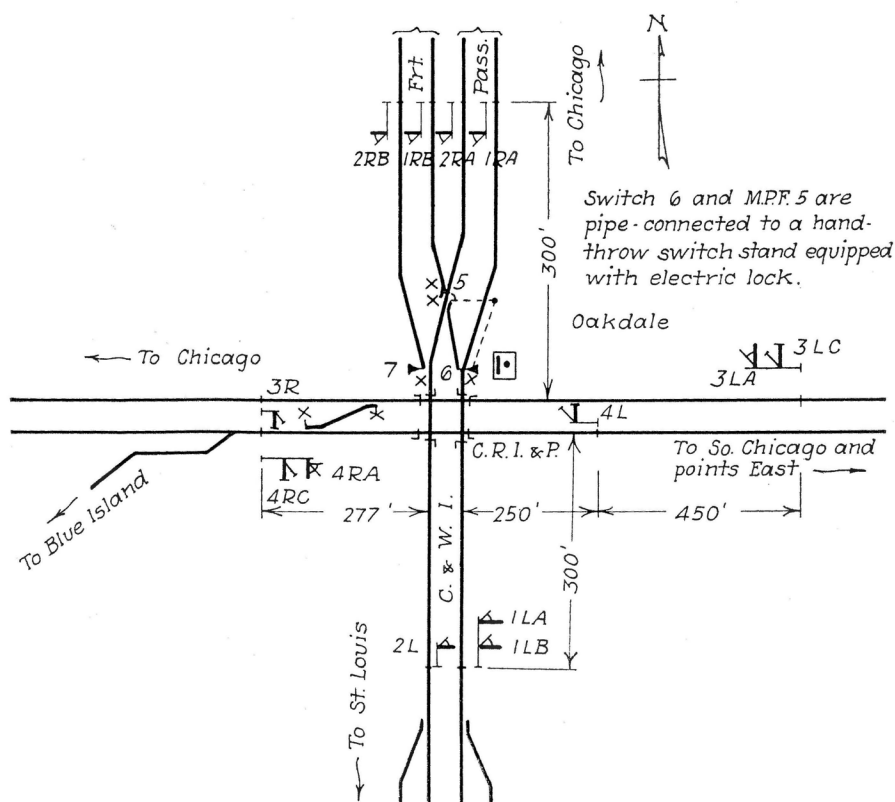
The C.&W.I. double-track over this crossing is a part of the line extending from Chicago to Dolton, Ill.,

Train movements at crossing of double-track lines governed by new signaling replacing obsolete layout

and in addition to handling the suburban passenger trains and freight transfers of this terminal and belt railway, the passenger and freight trains of the Chicago & Eastern Illinois are operated over these tracks between Chicago and Dolton. The Western Indiana operates four passenger trains and two or more freight trains each way daily, while the C.&E.I. operates nine passenger trains and an average of ten freight trains daily in each direction. Thus a total of 50 train movements are made daily on the north and south line over this crossing, which, added to the 28 trains over the cross line, makes a total of 78 trains daily through the plant.

The benefits being derived from this new installation, as compared with the former operation with crossing gates requiring each train to stop, are readily apparent. The grade on

the Rock Island line is practically level, as is also true for the line of the C. & W.I. approaching from the south. However, starting at a point a few hundred feet north of the crossing, the line of the C. & W.I. starts to ascend a heavy grade extending over an underpass. This condition introduced difficulties for all north-bound trains, as well as for south-bound freight trains; this handicap has, of course, been alleviated by the elimination of the stop at the crossing. The increase in elapsed time occasioned by stopping a train involves that lost while reducing speed, stopping, and again accelerating to normal speed, all of which amounts to from four to six minutes for a passenger train and from six to eight minutes for a freight train. Furthermore, the starting of long freight trains occasionally resulted in a draw-



All-Relay Interlocking

Expeditious handling of important passenger and freight traffic is effected by safely eliminating stop at a crossing

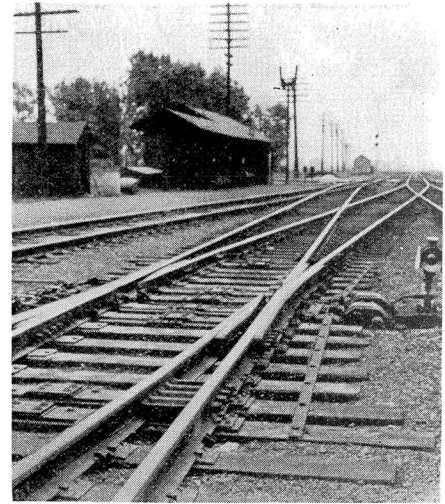
bar being pulled out, which introduced excessive delay to the freight train as well as to other trains scheduled for movement over the plant.

Track Layout

Trains are normally operated on the right-hand track of the double-track line of each road over the crossing. Just north of the crossing on the Western Indiana there is a two-track—four-track junction, the two passenger tracks being at the right and the two freight tracks at the left, as shown on the plan. The two switches 6 and 7, as well as the movable point frog 5, are operated by hand-throw ground levers with pipe connections extending through cranks to switch and lock movements. The operation of each of these switches is controlled by an electric switch lock mounted on a stand adjacent the switches. Each of these locks incorporates a vertical lever-operated

plunger, which fits into a hole in a bar connected to the switch connections. The operation of the hand-lever is controlled by an electric lock and, in turn, by a lever in the machine. Control levers now in use with the electric switch locks can easily be reassigned in case it is considered desirable at some later time to provide power switch machines for the operation of these switches and the movable point frog.

The four southward approaches to the crossing are governed by the four dwarf signals associated with levers 1 and 2 in their right-hand positions. Signals 1RA and 1RB are of the two-unit color-light type with red and yellow aspects for reverse-traffic moves. Signals 2RA and 2RB governing normal through movements, however, are Union Switch & Signal Company Type-H searchlight units. At present these are operative to two positions. The addition of a third aspect, so as to provide three-position



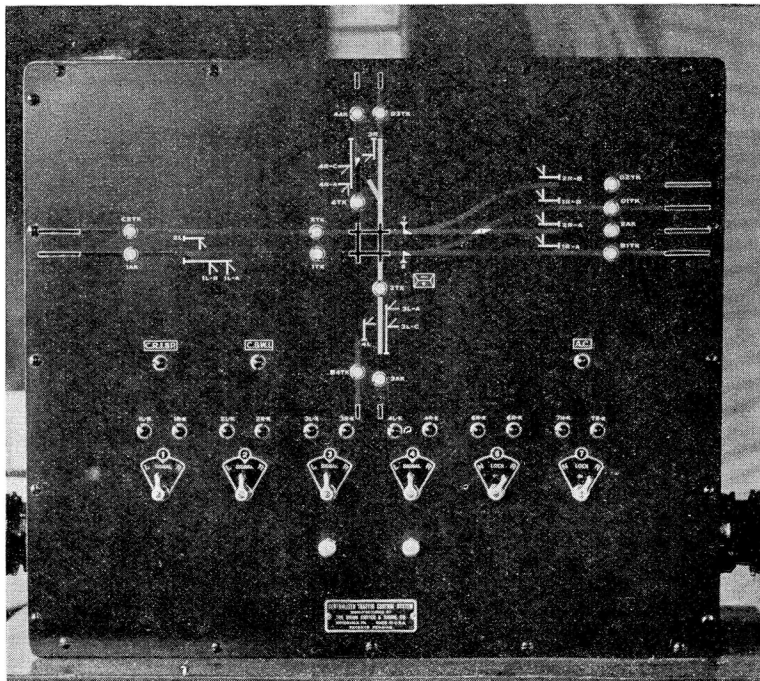
Movable-point frog operated by pipe connections

signaling, can easily be accomplished with this type of signal by extending the control circuits; this applies also to the northward home signal 1LA-B. Normal northbound passenger trains are governed by the high signal 1LA, whereas the lower unit, 1LB governs movements over the freight main involving the movable-point frog. Approach signals were previously in service on the Western Indiana. All interlocked signals are semi-automatic with non-stick operation.

Scheme of Interlocking

Prior to the recent improvements the Rock Island had automatic signaling in service on both sides of the crossing. Therefore, it was only necessary to rearrange the controls and location of existing equipment to be incorporated in the interlocking. The signaling at this point comprises three-position color-light units with all control, lighting and track circuits operating on a straight a-c. basis. The two-unit reverse-traffic signals 4L and 3R were added and the controls arranged for non-automatic operation to facilitate switching. Signals 3LC and 4RC were added to the Rock Island home signals to provide a calling-on yellow aspect. These units operate non-automatically and are controlled by pushbuttons under the corresponding levers on the control machine. This arrangement further facilitates switching operations by authorizing a low-speed movement into an occupied block.

The interlocking facilities are controlled by a C.T.C. type machine located in the operator's office in the



C.T.C. type control machine

Oakdale station at the crossing. The use of relay and electric locking in lieu of any form of mechanical relationship among the individual levers of the control machine represents a modern trend of interlocking design. One of the accompanying illustrations shows the six-lever control panel which governs all interlocked signals in the immediate vicinity of the cross-

proaching the crossing shall have been safely stopped or is in the clear. The converse of this statement applies also to the withdrawal of a Western Indiana line-up, for advance locking has been provided on all main-line normal-direction approaches. With all signals normal and the time limitation, if any, elapsed, the leverman reverses either lever 6 or 7, or both,

locked position. Closing the door also actuates a contact which breaks the lock-release circuit, resulting in greater immunity from a sticking lock causing false releasing, and economy of electrical energy as well.

The control panel includes the two pushbuttons governing the Rock Island calling-on signals previously noted. The operator has access to two sealed double-throw knife switches for emergency release of the detector locking affecting the two electric switch locks.

Control-Circuit Design

In an interlocking of this character it is obvious that every protective feature that ordinarily would be obtained from mechanically-interlocked levers must be replaced by equivalent or better protection involving electrical circuits and apparatus, if safe and reliable operation is to be achieved. This has been satisfactorily accomplished in this installation, as well as on other roads within recent years. For example, in place of mechanical locking preventing authorization of opposing movements over the crossing, traffic-direction circuits, 1-2FR and 3-4FR, have been provided for each road. Further, in lieu of electric locks on individual levers, one locking relay associated with each signal lever (designated 1LS, 2LS, 3LS, and 4LS) has been provided.

The FR circuits include the necessary track-repeater and lever contacts, and are arranged for proper "stick" operation. In addition to

ing as well as two electric switch locks. Amber lever lights repeat the clearing of all interlocked signals and the release of the electric locks, the circuits being selected through the GP and WP relays as well as the individual lever itself. The illuminated track diagram includes normally de-energized indication lamps on the various track sections, covering all approaches to the plant in addition to the crossing detector sections. An a-c. power pilot light has been provided.

A special feature of the panel indications consists of two separate lamps which repeat the setting up or occupation of any C.&W.I. route or any C.R.I.&P. route, respectively. This feature corresponds to the usual traffic-direction indications provided on C.T.C. installations involving traffic reversals. These indications are obtained by proper selection of the circuits through the lock-stick and traffic-direction relays.

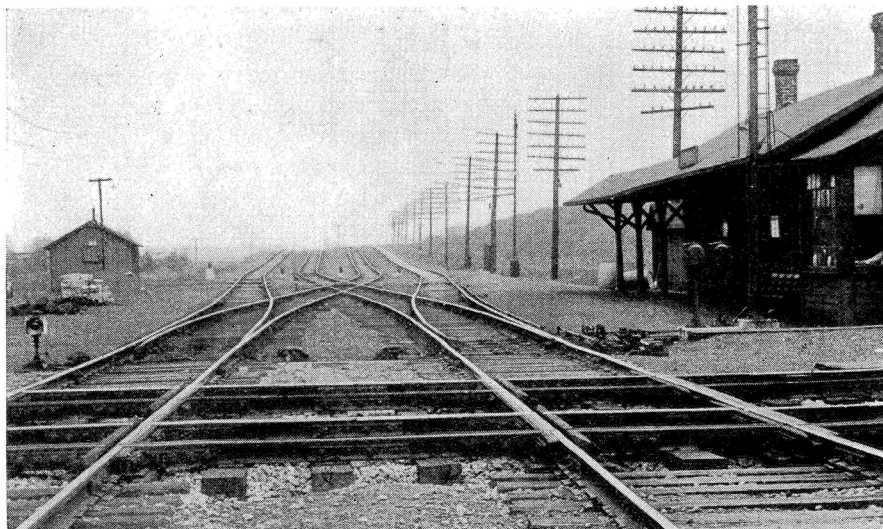
Operation of the Plant

In addition to the usual station duties and the handling of train orders the operator attends to the two switch and frog mechanisms and operates the signal control levers. To prepare a route over the Western Indiana all signal levers must be placed in the normal position, i.e., on center. If this involves the withdrawal of a Rock Island line-up before the home signal is accepted, and a train has entered the approach locking section, one of the two Style TC-10 clock-work time-releases must be operated, enforcing a one-minute delay to insure that the Rock Island train ap-

proaching the crossing shall have been safely stopped or is in the clear. The converse of this statement applies also to the withdrawal of a Western Indiana line-up, for advance locking has been provided on all main-line normal-direction approaches. With all signals normal and the time limitation, if any, elapsed, the leverman reverses either lever 6 or 7, or both,

which energize the electric switch locks controlling the interlocked switches and frog. Opening the door of the lock mechanism outside, the leverman reverses the lever, which in turn, unlocks the switch-point mechanism by withdrawal of the plunger. Having lined the switches the locking lever is restored to normal and the impending train movement is authorized by the operation of the appropriate signal lever "clearing" the signal.

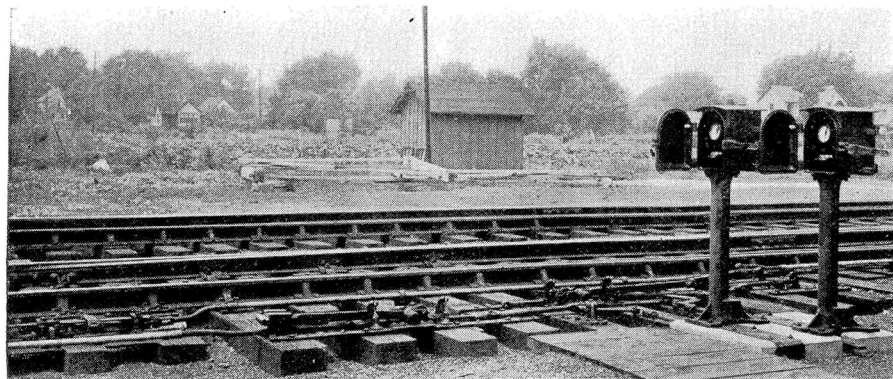
Although the C.T.C. type levers can be moved in any position at will



Northward view on the Western Indiana

the circuits are, of course, so designed that a false line-up can not be given, and that any faulty manipulation results in signal restrictions. Closing the door on the electric locks is mechanically impossible if the locking-plunger lever is not in the normal

these, the LS circuits involve the time releases for effecting the safe release of the approach locking, switch repeaters for route selection, and the signal-repeater relays for positive cross-locking. Each corresponding group of FR and LS circuits is close-



Switches controlled by ground levers with electric-lock protection

ly related one with the other so as to insure proper circuit selection. Finally, the FR and LS relays enter positively into the signal control-circuit combination in such a way that opposing train movements under signal authorization are rendered impossible. The locking relays also affect the release or retention of the electric switch locks, thus insuring proper handling of the interlocked frog and switches.

Each pair of interlocked switch points actuates a Type U-5 circuit controller. Double-wire, double-break circuits are run through these controllers in proper order so that a positive and accurate detection of switch-point positions is secured from the WP relays which they operate. These switch-repeaters are neutral relays, there being one provided for each position of the switch. Inasmuch as the m.p.f. 5 and switch 6 operate in unison, only one relay need be provided to repeat the two functions, the three groups of switch-box contacts being connected in series.

The HR relays are all neutral and are energized directly through the signal combination. Single shunts, used in connection with signal-repeater relay contacts in this combination, tend to insure the integrity of the HR relay operations. All of the ordinary d-c. neutral relays of the entire installation are of the Union DN-11 type; line relays are 1,000-ohm and track relays are 4-ohm. The a-c. circuits of the Rock Island utilize SLV-15 vane relays.

As a special precaution against improper shunting of the track circuits adjacent to the crossing frogs on the Rock Island, two track-repeater relays of the DN-18 type with slow-pickup and ordinary-release characteristics serve to bridge any short interval of time during which a light engine or motor car might momentarily fail to shunt either track circuit while passing over the frogs.

Straight A-C Lighting

Inasmuch as the Rock Island signaling would be interrupted in the event of an a-c. power failure there would be no object in providing standby d-c. lighting service. However, a double-throw switch has been arranged for selection between the Rock Island and the Western Indiana a-c. power service. This results essentially in immunity from power interruptions. All home signals are continuously lighted.

Power supply for all of the d-c. control circuits consists of a six-cell Exide EMGO-9 storage battery, charged by a Union RT-21 copper-

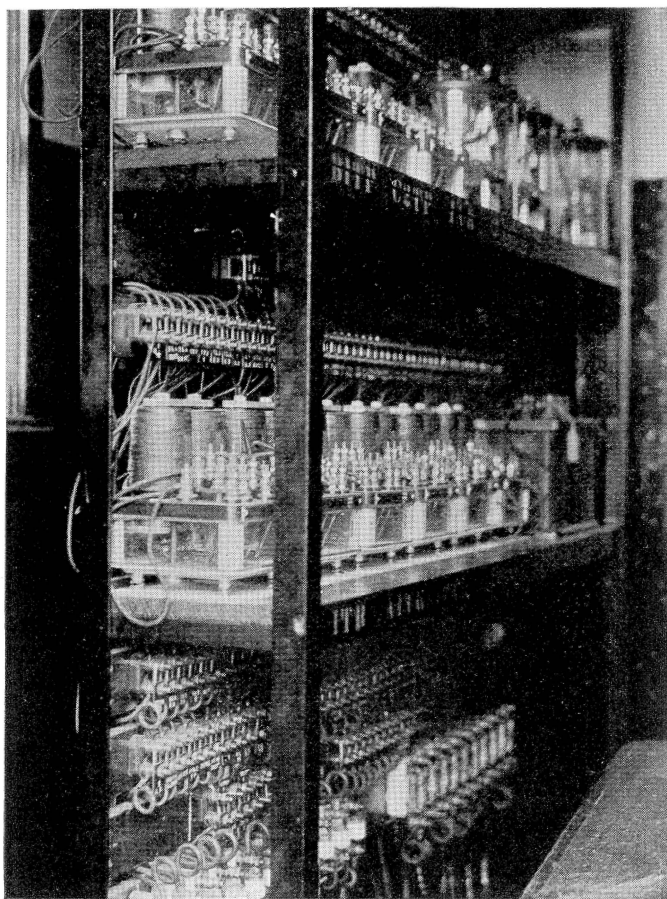
oxide rectifier. Two W-10 transformers serve the low-voltage lighting circuits. A single cell of DMGO-9 battery supplies each of the d-c. track circuits on the Western Indiana. These are charged by individual RT-10 rectifiers located in the Union type sheet-metal instrument housings.

Construction Details

A concrete house formerly used as a switchman's shanty was adapted for use as a relay and battery housing outside the station. This house accommodates 36 relays besides the main battery, a transformer, rectifier and terminals. Two tiers of four shelves are supported by a frame made of 1½-in. by ¼-in. angle irons secured by riveting. All underground

wire run in a wire chase overhead which connects to two 2-in. conduits. These conduits pass into the station directly to each side of the control board.

The rail bonding consists of two Copperweld strands per joint secured with 9/32-in. single channel pins. The wires are all run behind the angle-bars. The track leads are No. 8 parkway cables, track connections being made from a 30-in. wooden bootleg. After being stripped of the lead and steel-tape armor each cable end was soldered to a No. 8 flexible lead, using a 7-in. splicing nipple within the track bootleg. This nipple is sealed with paraffin to make the splice moisture proof. A roofed copper cap covers the top of the bootleg. The flexible lead is, in turn, soldered to



Wiring in concrete house is neatly arranged

wiring over the entire plant is in parkway cable, furnished by the Okonite Company; the cable leads enter the relay house through the floor and are terminated on the lower shelf opposite the battery. The other shelves are provided with two 3-in. terminal boards having a ¾-in. spacing to allow wires with eyelets to pass between, thus avoiding the necessity for drilled holes and facilitating the use of the eyelets.

Connections are made with the control panel inside the station with No. 14 Pullman special stranded copper

the regular Copperweld wires which are bonded into the rail.

The major items of material for this interlocking including the C.T. C. type control panel and all relays were furnished by the Union Switch & Signal Company. The design and construction was carried out by the signal forces of the Chicago & Western Indiana, under the supervision of G. Voelkner, signal and electrical engineer. The construction was directed by G. M. Kelley, signal supervisor, from plans prepared by this company.