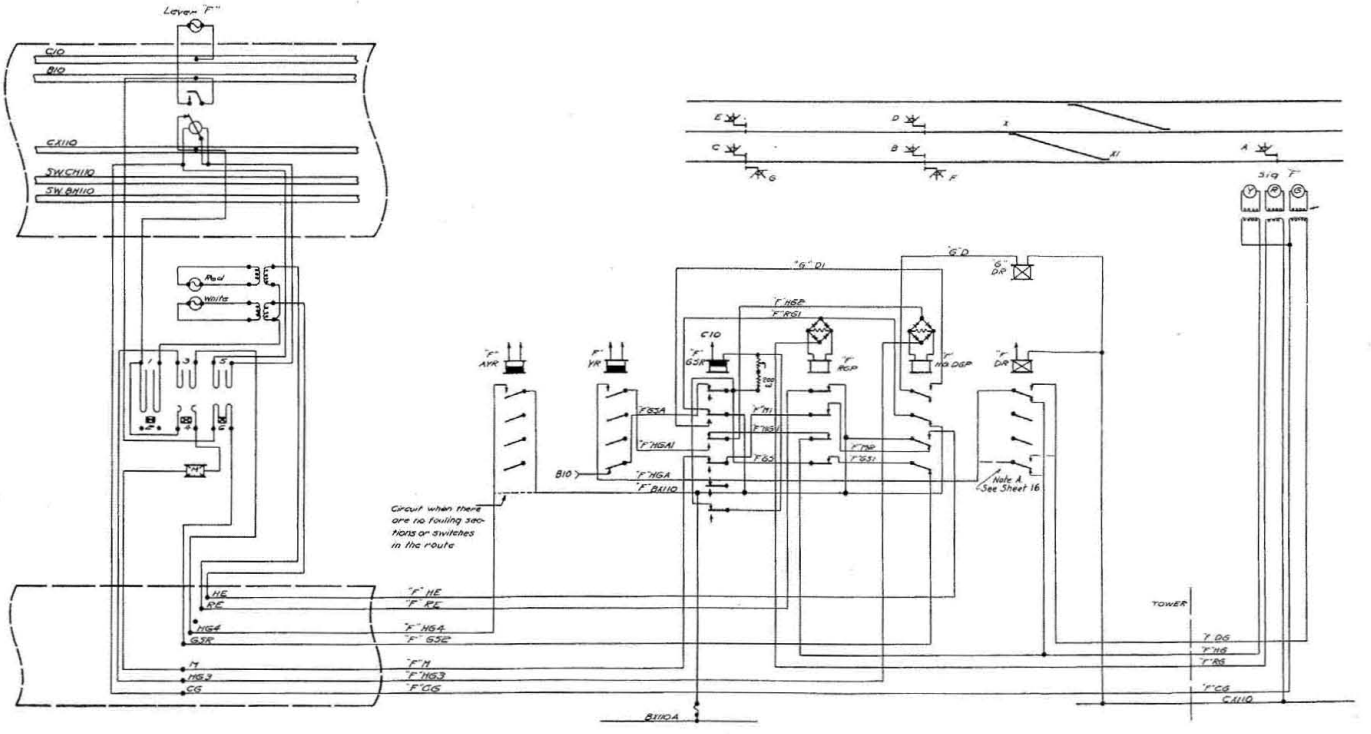
# Illinois Central Installs 68-Lever

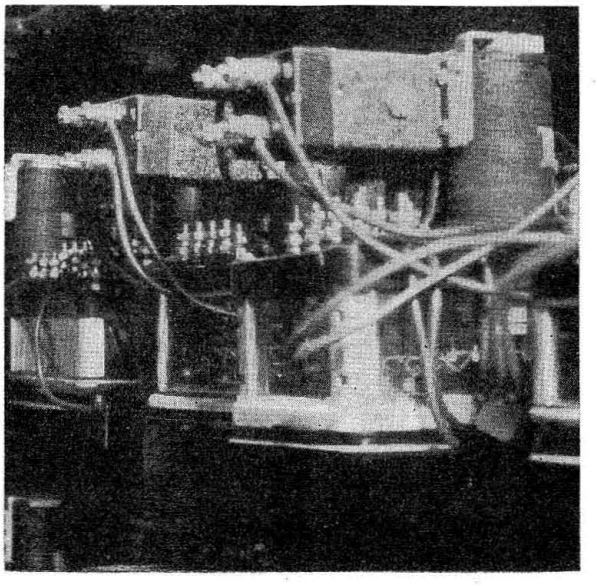



Relays "F"H&DGP and "F"RGP are 4-ohm d-c. Model-13 special relays with a special combination resistor and rectifier unit. This unit is in series with the special individual light transformer. These relays will pick up with their circuit closed and the corresponding signal-lamp burning; but, with the corresponding signal-lamp burnt out they will neither pick-up nor hold up. "F"DR picks up only when the next signal in the route displays a yellow or green indication. Where there are no switches between one signal and the next signal, a track relay is used instead of a slot relay. Fouling slot relays check through the switches in their route and those track sections which foul the route. Stick relays have a 5-sec. pick-up but their release should be about as fast as the other relays.

SEVERAL new circuits and other developments are included in the new electric interlocking recently placed in service by the Illinois Central at its Randolph Street suburban station on the electrified territory in Chicago. The present track layout of this plant involves a three-track throat expanding into 5 station tracks used by the I. C. and a lead to the old station layout now used temporarily by the C. S. S. & S. B. A total of 6 double-slip switches, 13 single switches, one derail and 36 signals are included in the present layout. The control machine has a 136-lever frame and 68 working levers, 9 spare levers and 59 spare spaces being provided for additional track facilities now under construction and contemplated.

The interlocking machine together with the relays, battery, etc., are located in an interlocking room on the track level which is on the second level below the street, the first level being taken up by the passenger station. The room is so located that the levermen cannot see the tracks or trains and must depend entirely on the lever lights and illuminated track diagram. Over 500 trains are handled through this plant daily and during the morning and evening rush hours as high as seven trains are operated in four minutes. Any failure of the interlocking would be disastrous to the train schedules. Therefore, when designing the interlocking, special consideration was given to every detail to prevent failures as well as to afford ready means of correcting trouble.

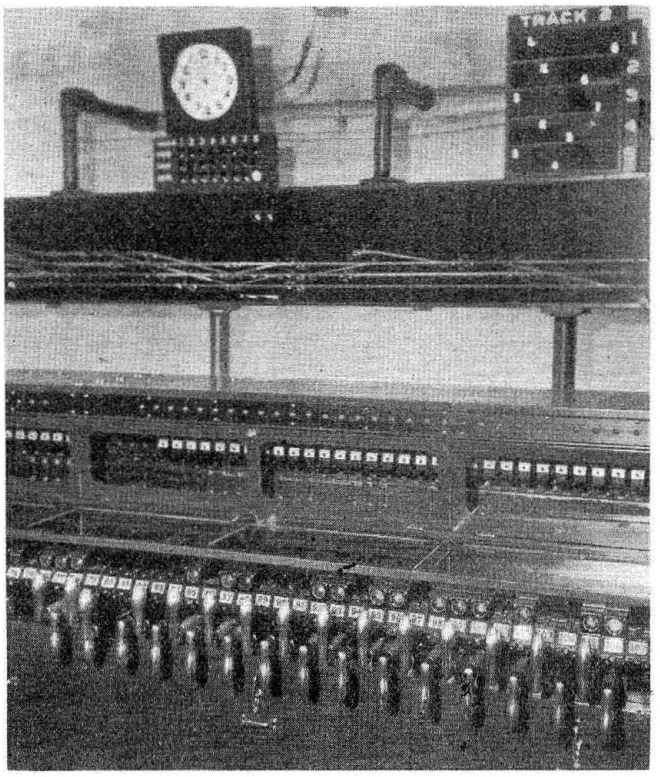
The exact location of all trains is indicated by an illuminated track diagram, the lights in each track section being illuminated when the corresponding track circuits are occupied. The diagram, mounted at the rear and above the machine, is 18 in. high and 12 ft. long, being constructed with a sheet-metal case and a front face of sheet bakelite. A drawing of the track layout was pressed into the bakelite when formed, thus resulting in a permanently waterproof surface. This bakelite was made up in sections 24 in. long so that in case of



Close-up of a d-c. relay and rectifier unit arranged for a-c. operation

# Electric Plant

## All relays in tower—Unique a-c.-d-c. signal control circuit checks lamp filament in signal



View showing a section of the interlocking machine, and part of the train-starting apparatus

revisions one section can be changed without disturbing the remainder of the diagram. In order to eliminate light reflection on the surface of the board and thus to improve the visibility of the diagram, it is illuminated by three show-case fixture floodlights located at the rear of the machine, the rays being directed upward.

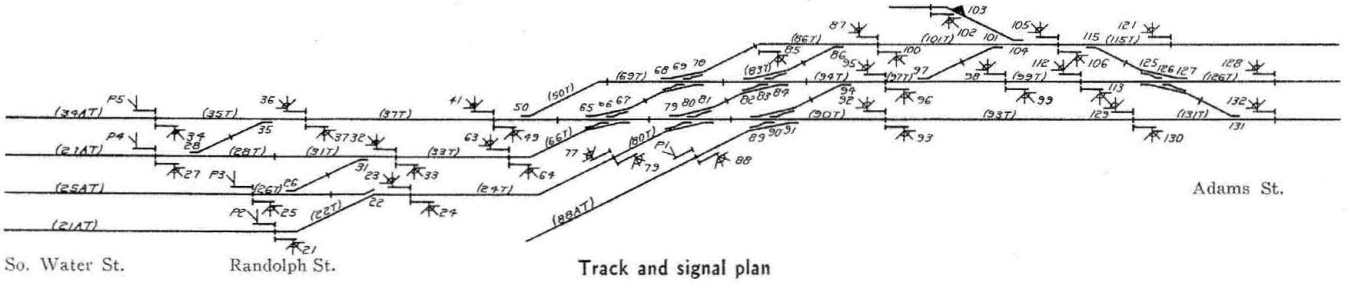
The aspects displayed by the signals and the position of the switches are indicated by lever lights. Each lever is provided with a lamp behind the lever number plate and on signal levers there is a second lamp with a 1¼-in. red lens above the number plate. When a signal lever is pulled from the normal to the reverse position the red lamp is lighted, but is extinguished when the corresponding signal changes to the Proceed indication, at which time the white lamp behind the signal number is illuminated. When the train, for which the signal was cleared, passes the signal, the red lamp is lighted and remains lighted until the lever is returned to normal. For each switch lever the lamp behind the number plate indicates, upon lifting the latch, whether or not the switch lever can be reversed or restored. The switches are operated by 110-volts d-c. using the regular G. R. S. dynamic-indication circuit. Each switch controls a separate polarized WP relay in the station and the signals are controlled through the contacts of the various WP relays for the switches in the route.

The interlocking machine is the General Railway Signal Company's unit-lever type. A separate lever is used for each single switch as well as for each switch in a crossover, this being done to facilitate locating trouble in case of a failure. Individual cross-protection circuit-breakers are provided for each signal, these breakers being mounted above the levers in the cabinet of the machine, and, as a novel feature, a small lamp with a red lens is mounted on the front of the cabinet above each breaker. When one of the breakers "kicks out" the corresponding red lamp is illuminated, thus providing a means for the maintainer or leverman to locate quickly the unit giving trouble.

as at the edge of the right-of-way there was no space for instrument cases, therefore, the circuits are so arranged that all relays and transformers are located in the interlocking room.

As shown in one of the illustrations, the track relay and the track transformer for each track circuit are located side by side on a shelf on the rack in the interlocking room. The relays are the Union Model 15-vane type and the transformers are Union Style W10. The current is limited by a 2½-ohm variable resistor in the feed end and a 10-ohm variable resistor in the relay end. The resistors are the General Electric porcelain-tube type and each is mounted alongside its corresponding transformer and relay as shown in the illustration.

The 28 track circuits are all of the single-rail type, one rail being bonded throughout as the negative side of the 1,500-volt propulsion circuit. This negative rail is, therefore, a common return for every track circuit feed and relay. A special arrangement was devised to insure continuity of the connection from the negative rail to the




Track and signal plan

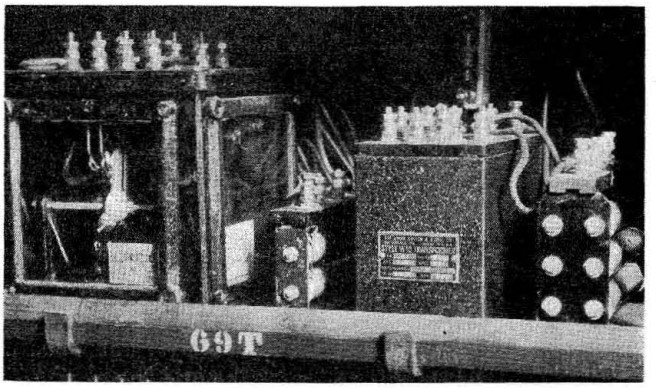
### Special Track Circuits

As the electric propulsion system is operated on 1,500-volts direct current, all track circuits and signal control circuits are operated on 60-cycle alternating circuit. On account of the limited clearance between tracks, as well terminals in the interlocking room. As a first means of precaution, two separate sets of connections of two cables each are run from the rail to the terminal board. Each cable consists of single-conductor No. 1 AWG parkway. Furthermore, each set of connections is attached to the rail at each side of a rail joint, the idea be-

ing that either one or the other of the rails could be changed out without breaking the continuity of the circuit. The immediate track circuit involved would, of course, be "out," but the other track circuits in the plant would not be. Therefore, as a result of using single-rail track circuits with the relays and track transformers in the interlocking room it was necessary to extend only two wires to the rail of each track circuit, one to each end.

### The Butridge Parkway Bootleg

Union heavy-duty bootlegs are used for making connections between the parkway cables and rail connections. These boxes are made of cast-iron, the inside dimensions being 2½ in. high and 5½ in. by 5½ in. and there is a 3-in. circular hole in the bottom. In each of two sides of the box there is a through bolt 4½ in. long. This bolt is insulated from the box with fiber bushings and washers, the bolt being ¾ in. in diameter through this section and is held in place by a ¾-in. nut on the inside of the box. The two ends of the bolt are turned down and threaded for ½-in. nuts. The parkway cable is brought up through the hole in the bottom and the conductor is terminated on the bolt, two nuts being used. On the outside end there is a lug which is threaded so as to be turned up on the bolt, a nut lock and nut being added to hold it in place. A No. 1 flexible copper conductor of 31 strands is soldered into a hole in this lug and the other end is welded to the rail. A section of circular loom is placed on the cable for protection.



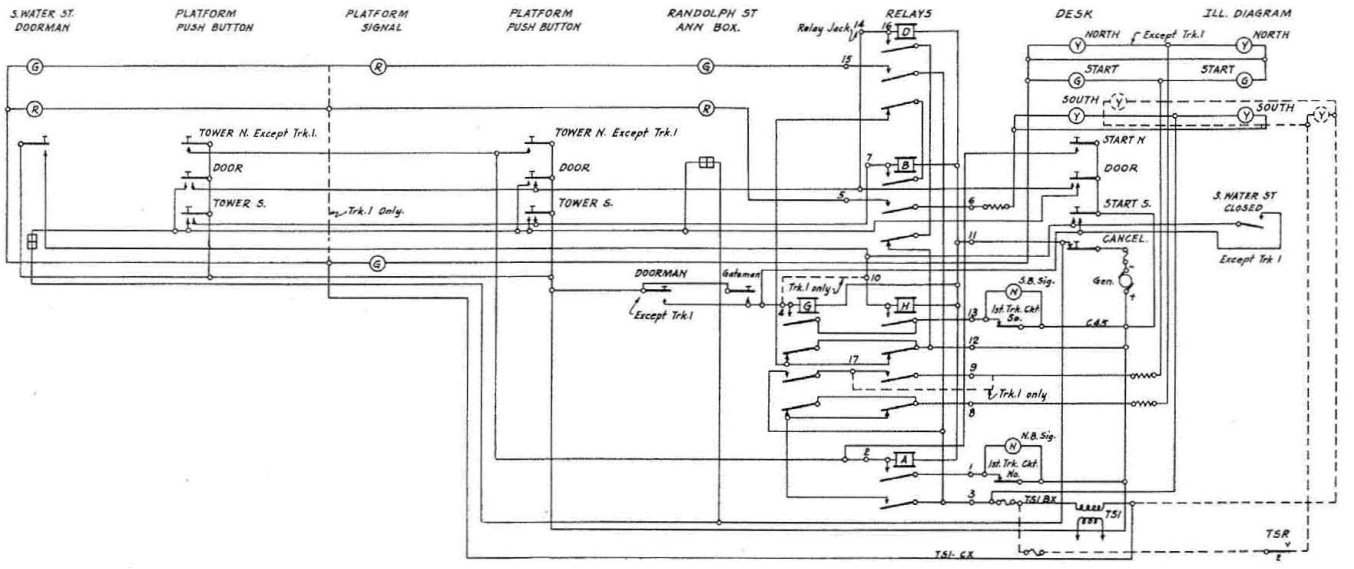

The a-c. relay and its corresponding transformer for each track circuit are mounted side by side

Each box is fastened by means of hook bolts, to the top of a concrete foundation 7 in. square and 20 in. long with a 3-in. round hole up through the center through which the parkway cable is brought up. In certain sections of the Randolph Street station layout the tracks are on concrete slabs with shallow ballast in which case the foundations were made of sections of boiler iron.

At each end of every track circuit there is a spark gap protector connected between the rails. The clearance between the gap points is 0.003 in., which will break down at 350 volts, thus affording protection for signal apparatus in case an overhead wire of the d-c. traction circuit should break and fall on the insulated rail.

### A-C.—D-C. Control Circuits

The signal control circuits are of special interest for several reasons. In the first place alternating current is used for these circuits, but the relays are the ordinary d-c. type, being operated through full-wave rectifiers. Furthermore, all relays are in the interlocking room, the only apparatus at the signal being an individual 110/10-volt transformer for each light unit. In addition to these features, this circuit checks the integrity of the lamp filament and if it is burned out the leverman does not get the complete indication on the lever and, therefore, at once knows of the trouble. The signal control circuit is shown in the accompanying sketch. The 110-volt a-c. circuit from the lever contact is connected to the rectifier-relay coil and is then extended to the respective signal unit being carried through the primary of the signal light transformer. A rebased double filament lamp, rated at 10 volts and 18 watts, is on a 7.5-volt feed. In case one filament burns out, the other will give enough light to afford a signal indication until the lamp can be replaced. The relays are Union Model 13, wound for 4 ohms, and the rectifiers attached to the relay are the Style-R5 rated at 10 volts maximum.



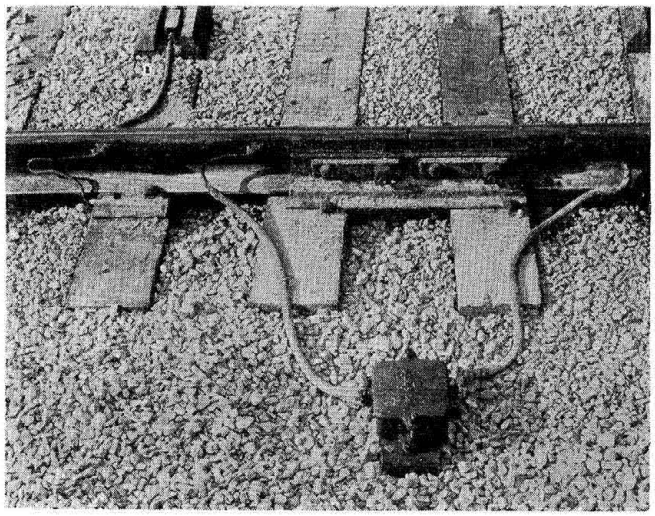

Circuit of train-starting system

### Time-Release Selector

Restoration of a signal lever to the normal position before an approaching train has entered the track circuit is prevented by controlling the signal indication circuit through a time-locking relay, having a 5-second pick-up, and through the signal repeater relays. A detector lock circuit for each switch is controlled through the track

relay of the section in which the switch is located to prevent the throwing of the switch under a train. Route and section locking may be released in emergency by breaking a seal on a special releasing device.

Only three clock-work time releases are required, the entire plant being sectionalized into three parts so far as this feature is concerned. Each respective release can be



View of special bootleg

selected to any one of several levers by means of a plug and jack arrangement housed in a sheet metal box beneath the release. When a leverman is required to effect a release, he breaks the seal of the box, pulls the plug out of the normal position, which breaks all the lever lock controls, puts the plug in the jack marked for the lever involved, and then starts the release. When the release runs down, the leverman can release any lever in the section by inserting plugs in separate jacks arranged for this purpose. After release is effected, the jack is restored to the normal position.

The signals are Union triangular color-light dwarf type, no overhead space being available for signal bridges. The signals are non-stick semi-automatic, (i. e.), one train can follow another as soon as the block clears without the leverman operating the lever to clear the signal for each successive train unless it is necessary to change the route. When a train passes out of the home block of a signal, the aspect changes from red to yellow and when the train passes out of the second block the aspect changes to green providing the position of the lever has not been changed. To permit a train to enter an occupied block the leverman places the lever normal and again reverses it which results in a red over yellow aspect which is a call-on indication. As a train advances through the plant the signals in the rear change their aspects progressively to provide more favorable indications to a following train. The two-light station platform entering signals, such as signals No. P1 and P2, are strictly automatic signals and are not controlled by the interlocking levers. Such signals normally display a yellow aspect with the block ahead unoccupied. With a train standing at the platform, the aspect is red over yellow, thus giving a call-on indication automatically for a following train closing in on the same track.

The switch machines are the G. R. S. Model 5A and no lock rods are used on the switches. This being low-speed territory, such practice is considered safe. Every switch is equipped with electric snow melters which may be turned on and off by means of push buttons in the interlocking room. These heaters melt the snow as it falls or blows into the switch points and prevent the difficulties which would result during snow storms if switches in this congested territory were cleaned by hand. Wherever possible the switch machine is located on the same side of the track as the negative rail for the return of the 1,500-volt d-c. propulsion current. With the switch machine thus grounded to the return, it is impossible to have a burnout of signal equipment in case a positive feed connection should fall on the switch machine.

## Relay Racks

The relay racks are made of 2-in. by 8-in. cypress planks bolted to 3-in. by 2-in. channel uprights, the planks being spaced 5 in. apart. Two such racks are placed back to back with about 18 in. space between, this space being allowed for running wires which are supported on ½-in. round maple pins extending from board to board. Most all of the relays are shelf type, but are supported on shock absorbing spring brackets. However, the track relays are on shelves supported by iron brackets from the racks.

The battery is on a rack, the framework of which is channel iron, welded. The main plant battery consists of 56 Exide EMGO-7 cells rated at 120 a.h. Six EMGO-9 160-a.h. cells are used for the route locking, etc. These batteries are charged by Union copper-oxide rectifiers.

A special feature of this plant is that the fuses for signal control circuits are not on the interlocking machine, but are on a terminal rack, this location being used so that a maintainer can readily locate a blown fuse and replace it without interferring with the towerman.

A telephone jack is located in each switch machine, junction box and manhole so that the maintainer may plug his portable telephone and get into immediate communication with the leverman. When the towerman

Color-light dwarf signals. Switch machines

wishes to call the maintainer to a telephone he pushes a button on his desk which lights a series of lamps located about 200 ft. apart throughout the length of the plant. These lights immediately attract the maintainer's attention. The arrangement avoids the use of objectionable howlers and loud speakers in this downtown area.

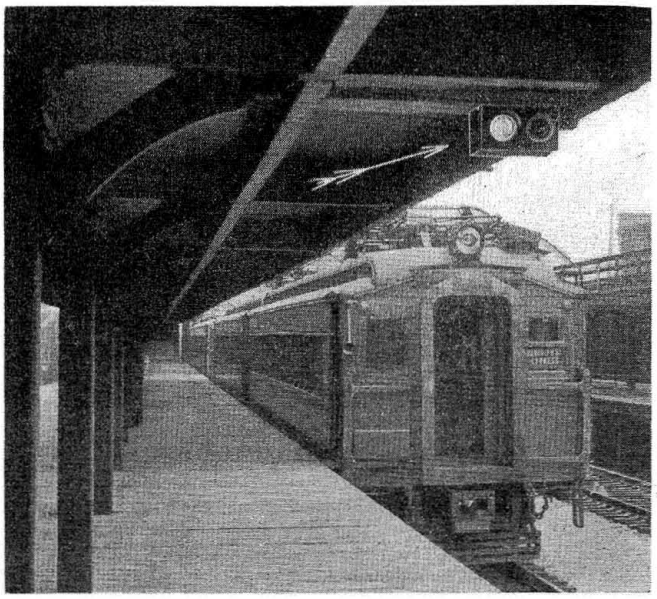
### Wiring Distribution

All wiring between the interlocking machine, relays, and terminal board, is No. 14 flexible Kerite. All wires run directly to relay terminal posts, Raco B-wire terminal eyelets being used. All wires for circuits extending outside the station terminate on single post terminals on a bakelite based multiple board. Likewise, cables coming in from the outside terminate on these terminals.

The plant cables are Okonite run in duct lines in the retaining wall, to sealed junction boxes from which Kerite parkway cable extends to the signals, switches, and track connections. This parkway cable is made up with two wraps of steel tape, but with no lead.

### Train Announcing System

In order to give the train director advance information as to order in which northbound trains on each track are



Light-type train-starting indicator

approaching Randolph street, a special train announcing system has been provided to facilitate the movement of trains through the interlocking plant to the proper platforms.

Each train carries a card in the front window bearing a symbol which shows the type of train and its originating point.

The symbols are made up of the following units:

| | |
|---|---|
| S—Special | 1—Hyde Park |
| L—Local | 2—67th Street |
| X—Express | 3—83rd Street |
| T—Tenant | 4—South Chicago |
| E—Empty equipment from outlying points | 5—Kensington |
| Y—Empty equipment from yard | 6—Blue Island |
| | 7—Matteson |
| | 8—72nd Street |

For example: "4S" means "South Chicago Special". "2X" means "67th Street Express", and so on.

As each train passes 11th street the switchman operates the proper keys to set up on the light indicator panels in the interlocking room these symbols in proper order for the track upon which the trains are approaching. A maximum of five trains may be set at one time for each track and these indications remain until the corresponding trains have been taken care of and each indication is then extinguished individually by the train director pushing a button on his desk.

### Train Starting System

For southbound movements it was necessary to provide a simple and flexible system of intercommunication between the train director in the interlocking room, the train conductor on the platform and the doormen up in the waiting rooms at Randolph street and South Water street, to secure complete mutual understanding with minimum delay and avoiding the use of the telephone as much as possible. A system of push buttons, light indicators, and buzzers, was developed which eliminates the necessity for acknowledging signals and provides burned-out lamp protection.

The installation includes the following equipment:

*Randolph street and South Water street Waiting Room*—A red and green light indicator with buzzer and push button suitably mounted at the entrance to each track.

*Platforms*—A two-way red and green starting signal suspended from the canopy at the center of the platform with a group of push buttons located approximately half way between the signal and either end of the platform.

*Interlocking Room*—A panel consisting of one green and two yellow lights with four push buttons for each track mounted on the train director's desk, with a repeater lamp panel mounted above the interlocking machine for information of the leverman.

The operation of the train starting system is as follows:

(a) The track diagram in the interlocking room indicates automatically to the train director and leverman when each station track is occupied.

(b) When a train is ready to receive passengers, the conductor pushes a platform button marked "Door," which lights his red platform signal and the green door indicator with one operation of the buzzer at both Randolph street and South Water street stations. If at any time it is desirable to speed up the movement of passengers through the station by allowing them to go to the platform before the train is ready, the train director may light the above lamps in the absence of the conductor by pushing a button on his desk.

(c) A half minute or so before leaving time, the conductor pushes a button marked "Tower" on the platform which extinguishes his red platform signal and the doormen's green indicators and lights the train director's yellow indicator, and lights the red door indicator and operates the buzzer at both Randolph street and South Water street.

(d) After closing the door the doorman pushes the button which extinguishes his red door indicator and the train director's yellow indicator and lights the conductor's green starting signal and the train director's green indicator.

(e) The train director has the leverman clear the interlocking signal and the train crew closes the train doors after taking all passengers on the platform or coming downstairs. The closing of the train doors automatically gives the motorman a starting signal in the cab. When the train passes the interlocking signal, it automatically extinguishes the conductor's green signal and the train director's green indicator and restores the system to normal.

(f) For a movement of empty equipment the conductor pushes the button marked "Tower" which lights the train director's yellow indicator and the director clears the starting signal and the interlocking signal.

(g) The director, if he desires, may clear the starting signal for a movement of equipment without waiting for the conductor to push the button.

(h) In emergency, or upon order from the dispatcher, the director may cancel any indication that has been set up at any time by pushing his "cancel" button for that particular track.

It may be noted from the circuit diagram for the train starting system that the three lamps are in series so that if any lamp burns out all three are out, thus affording a quick check so that the parties concerned can get on the phone quickly.