A typical flasher installation on the Wabash

Highway Crossing Protec

by Several Railroads

Project, involving eight railroads, includes installation of new electric short-arm gates and flashers, with manual supervision at certain crossings, to replace various forms of crossing protection and provide increased protection

In June, 1946, the City of Gary, Ind., passed an ordinance requiring certain railroads operating within the limits of that city to install certain safety devices at street crossings along their respective rights of way. The majority of this work, which involved replacement of various forms of protection, such as manually-operated mechanical and pneumatic gates, watchmen, and other protection, as well as provision of protection at crossings formerly unprotected, has now been completed and is in service. The roads affected by the ordinance include the Pennsylvania, South Shore, Wabash, Baltimore & Ohio, New York Central, Michigan Central, Indiana Harbor Belt and the Nickel Plate.

Number of Crossings

This ordinance required new protection at 14 crossings on the Pennsylvania, 9 on the South Shore, 10 on the Wabash, 5 on the Baltimore & Ohio, and 2 on the New York Central main line. In addition to these are 9 crossings on the Joliet division and 12 on the main line of the Michigan Central, 3 on the Indiana Harbor Belt, and 8 on the Nickel Plate. Of the larger of these installations are those on the Wabash, Pennsylvania and Michigan Central, the routes of which through Gary are shown on the accompanying simplified map, Fig. 1. Unfortunately, space here prohibits detailed discussions of all of the installations, including construction practices and special features. Consequently, the following paragraphs are devoted to the installations on the Wabash and the Michigan Central. The installation on the Pennsylvania will be discussed in a second article to appear in a forthcoming issue of *Railway Signaling*.

Obedience to Protection

In passing the ordinance, requiring these installations, the City Council gave the Police Department authority under which to enforce obedience to the crossing protection ordered by the ordinance, thus: "*Section 3:* It shall be unlawful for any person to walk, run or pass under or over any railroad crossing gates while the same shall be down and extended over the street or sidewalk. It shall be unlawful for any person, other than the operator thereof, to raise by any means any gate lowered over any street or crossing. It shall likewise be unlawful for the operator of any motor vehicle, or the rider of any bicycle or other conveyance, or the rider or driver of any horse or team of horses, to go around or encircle any railroad crossing gate which shall be lowered and extended over any street or sidewalk, except in such cases where a person or vehicle may be trapped under any gate lowered after entering said crossing.

"*Section 4:* Any person violating Section 3 of this Ordinance shall be deemed guilty of a misdemeanor and upon conviction shall be fined in any sum not exceeding $100.00."

Protection Installed by Wabash

The Wabash has installed flasher signals only at 3 crossings and gates and flashers together at 7 crossings in Gary. The line involved in this installation is the main freight line between Chicago and Detroit, consisting of double track from the west to Washington street in Gary, from which point single track extends east. Automatic block signaling is in service. A total of about 4 mi. of road are involved in the installation of crossing protection, which is shown in Fig. 2. Traffic over the line consists of about 7 to 10 freight trains daily, plus numerous local switching movements in city limits. The maximum authorized train speed on the operating district is 50 m.p.h. However, over the crossings in Gary the speed is restricted to 35 m.p.h. by bulletin.

The first crossing in the project is at Clark road, where a single crossing bell was changed out to automatic flashing-light signals. The next crossing, at Fifth avenue, is joint with the Pennsylvania, where air gates were replaced by flashers and electric gates under auto-manual control of a joint Wabash-Pennsylvania watchman.

tion Installed

in Gary, Ind.

Typical installation of short-arm gates and flashers on the Michigan Central

The next street east is Taft, the crossing of which is joint with the Pennsylvania. Flashers were changed out to flashers and automanual electric gates, controlled by a Wabash watchman at the crossing. Flashers were installed at Van Buren street. The next five crossings east of Van Buren street involved the installation of auto-manual electric gates and flashers all under the control of a watchman in a new elevated tower at Broadway. These crossings include Madison street, Adams street, Washington street, Broadway and Virginia street. Pneumatic manual gates were retired at Madison street, Broadway and Virginia street. Single bell protection was formerly in service at the Adams and Madison street crossings.

Style of Gates

The gates on the Wabash are the Western Railroad Supply Company's Model 10, with Type 3564 mechanisms. The gate arms vary in lengtth from 17 to 36 ft., depending upon the width of the highway. The widest street is Broadway, where 36-ft. gate arms are used. Each gate arm is equipped with three lights with red Fresnel lenses, the end light burning continuously, and the other two flashing in coordination with the flashers.

The flashers are the Union Type HC-81, equipped with 8⅜-in. roundels and 10-volt, 18-watt lamps. Each flasher and gate location consists of a standard crossbuck sign, number-of-tracks sign and "Stop on Red Signal" sign, in that order from top to bottom. Flashers are the back-to-back type. Bells are provided at each location, and are arranged to cut out when the gates are down.

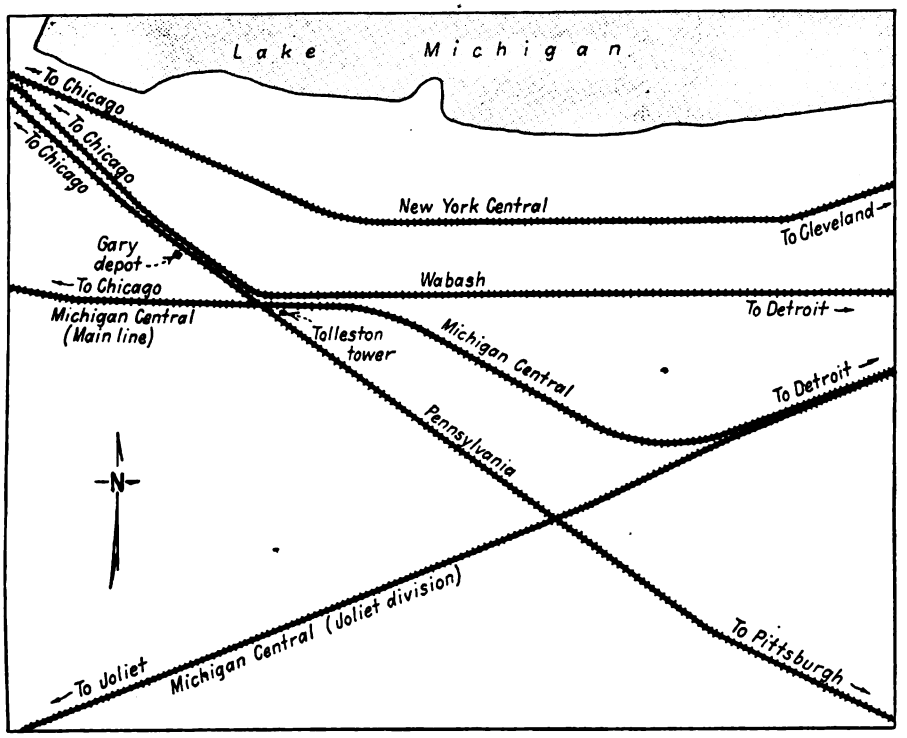


Fig. 1—Simplified map of the Wabash, Michigan Central, Pennsylvania and New York Central through Gary, Ind.

Flasher and Gate Controls

The flashers and gates are normally controlled automatically by track circuits, which are arranged to provide a minimum of 20 sec. warning time prior to the arrival of a train at the crossing. The crossing bell on each mast, as well as the lamps in the flashers and on the gate arms, operate 3 to 5 sec. before the gates start to lower. This pre-warning is accomplished by cascade control of two slow-acting relays. Lowering of the gate requires approximately 12 sec., after which the crossing bell stops ringing. After a train clears the crossing, the lamps in the signals and on the gate arms remain lighted until the gate has nearly cleared.

The control panel at Broadway consists of six-non-interlocked Type B-20 desk controllers, enclosed in a sheet-metal cabinet 24 in. high, 36 in. wide and 12 in. deep, mounted on an angle-iron base and supported by two 2½ in. pipes. An illuminated track diagram is located in the center of the panel, and has track occupancy lamps to repeat the approach sec-

Typical short-arm gates and flashers on the Wabash in Gary

This causes the gates to rise and the flashers to stop at the corresponding crossing.

Warning to Watchman

As a means of warning the watchman that he has cut out the operation of the protection at a crossing a red lamp above the right position of the lever is lighted. The watchman then keeps a close watch of the train or switching operation, and if a move is made toward the crossing, he returns the lever to the center position, causing the protection to operate again, which is indicated by the flashing red lamp above the center position of the lever. After the train leaves the area, the levers are restored to normal. When a lever is in the center position, the gates and flashers at the corresponding crossing are placed in operation

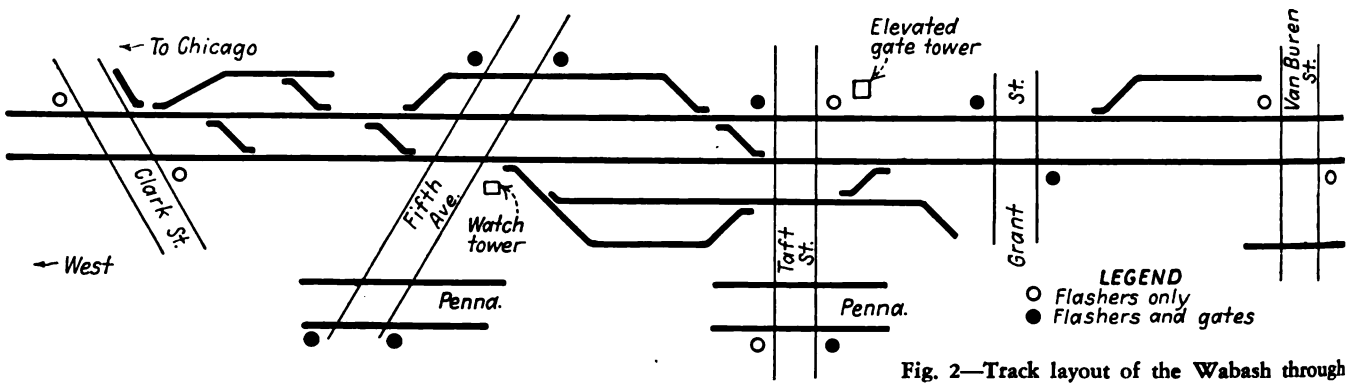


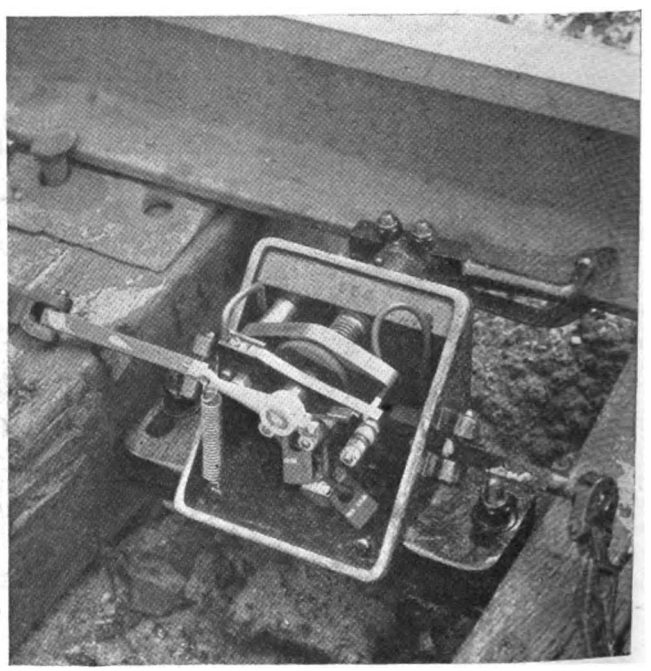
Fig. 2—Track layout of the Wabash through

tions. There are two levers for the control of the gates and flashers at Madison street and the flashers at Adams street, one lever being for each track. Double track ends at Washington street, and thus only one lever is required for the control of the gates and flashers at that street and at Broadway.

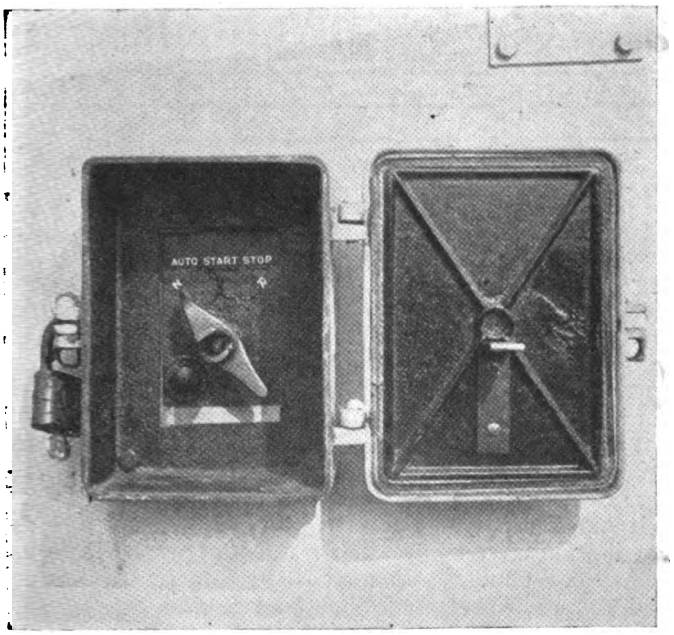
Position of Levers

The normal position of the levers is to the left, which places the gates and flashers on automatic track circuit control. This condition is indicated to the watchman by the illumination of a green lamp over the left position of each lever, marked "Auto". If a train enters the track circuit control section for a crossing, and the signals are in operation, the red lamp above the center position of the lever, marked "Start", for that crossing is flashed. If the train stops on the control section, or, when switching, makes a reverse move so that no movement is to be made over the crossing, the watchman moves the lever for that crossing to the center position. He then looks to see that conditions have not changed, and then pushes a button at the lower left, which releases a mechanical toggle, thus enabling the lever to be moved from the center position, "Start", to the right position, "Stop". regardless of track occupancy. Furthermore, gates and flashers cannot be cut out when the short track section over a crossing is occupied.

A mechanical locking arrangement is provided between the control and



Track instrument installed just east of Van Buren st. for the special control to permit protection at Madison and Adams st. to cease operation after a time interval

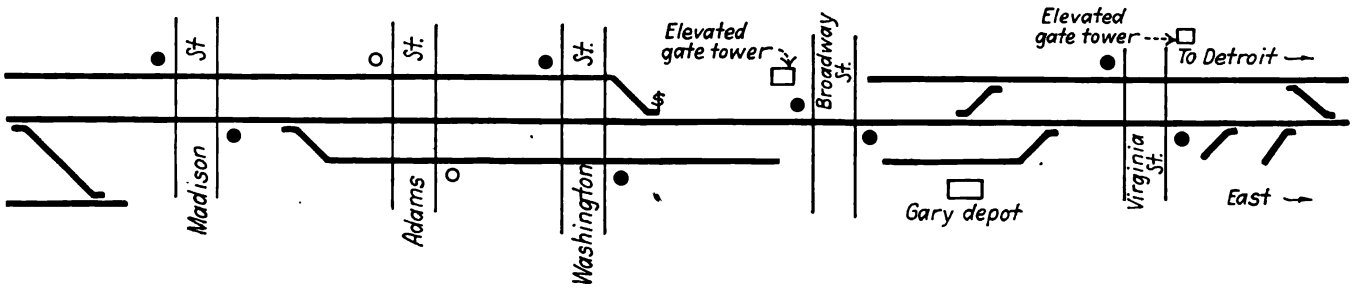


Three-position table lever for manual control at the end of an instrument case at one of the crossings

ing operations in the vicinity of Van Buren street when movements are made into various industrial tracks.

The track instrument was installed to prevent a track circuit failure from causing the timing circuit to perform and having the control circuits reduced in length for a through train. The circuit employed requires the track relay to be down and the track instrument operated by a train before any timing operation is commenced. Also, the track instrument circuit requires it to be in normal position prior to closing the normal open contact to start the operation.

At certain important crossings, such as Grant street trainman's manual control is provided. It consists of a three-position table lever, identical to those on the control panel in the watch towers, inset in the end of the instrument case, and the face of which is covered by a cast-iron box. The normal position



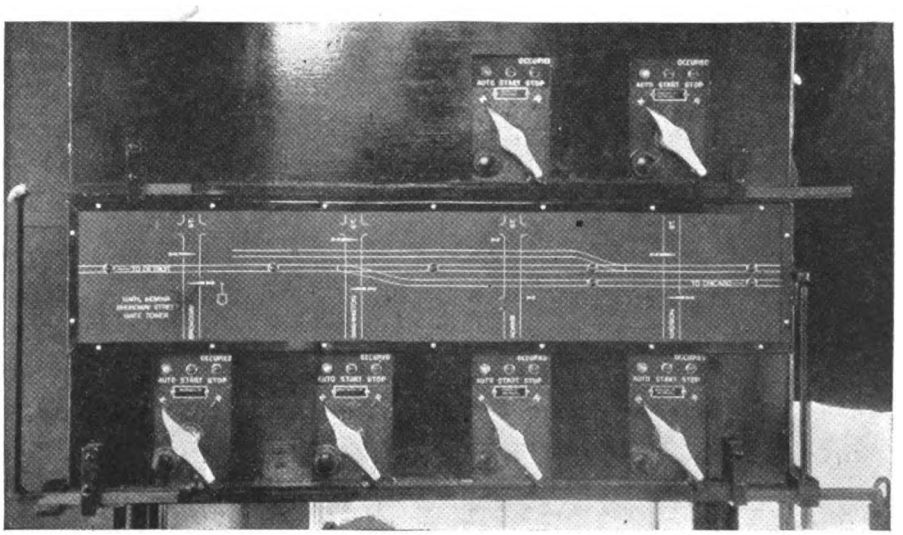
Gary showing the location of the new crossing gates and flasher signals

the door to the watch tower, to insure that the watchman cannot leave the tower without placing all levers in the normal position for automatic control. A detailed explanation of this locking arrangement appeared on page 321 of the June, 1942, issue of *Railway Signaling*.

Several special control circuits were installed to minimize the unnecessary operation of flashers and gates under automatic control when trains were switching. For example, due to eastward trains standing on the double track for a meet a special control circuit was installed to permit the protection at Madison and Adams streets to cease operation after a time interval. An R-38 track instrument, furnished by the Nachod & United States Signal Company, Louisville, Ky., was installed just east of Van Buren street as shown in Fig. 3.

An eastward train passing over this track instrument with the track circuit deenergized would start operation of a TH-10 thermal relay and after one minute the control would be cut out and the flashers would cease operation and gates would rise. The time interval is of sufficient length so as not to cease operation on a continued through movement. After the train had stopped and the protection ceased operating, it would start again when the train proceeded into the next track circuit. This special control feature is also of benefit for switch-

of this lever is to the left, the same as on the control panel, which is for automatic operation of the gates. Moving this lever to center, lowers the gates regardless of track occupancy, and all the way to the right raises the gates when a track, except for the short section over the crossing, is occupied and a train is not



The control panel at Broadway consists of six non-interlocked desk controllers

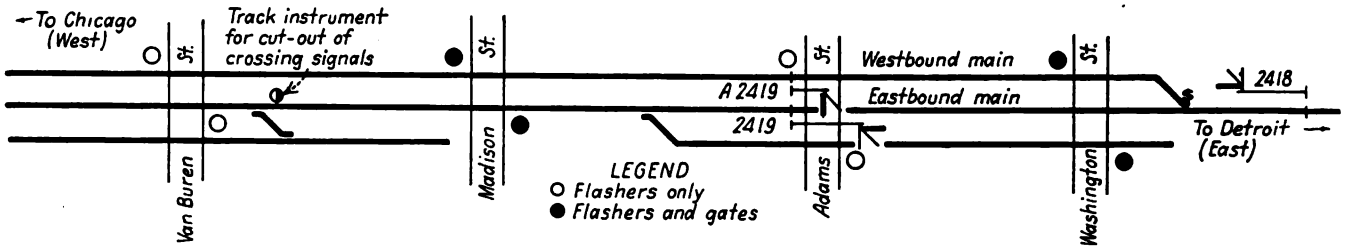


Fig. 3—Diagram showing location of track instrument for special control of protection at Madison and Adams streets

going over the crossing. The control box is locked with a signal lock and is made accessible to a responsible employee so the protection might be operated manually when changing rail, unloading ballast or in other special or emergency conditions.

To insure that the door to this control is not closed with the lever in any position but the automatic position, the center of the lever was slotted and finished specially in the Wabash signal shop. A piece of ¼ in. by 1 in. strap iron was bent in the shape of an "L" and riveted to the inside of the door, so that, when the door is closed, it fits into the slot and moves the lever to the automatic position if it has not already been placed in that position before closing the door.

Power Supply

The gate mechanisms are normally fed by 6 to 8 cells of Exide DMGO-7S, 60-a.h. lead storage battery on floating charge from a rectifier at each crossing. Two gate mechanisms when in operation usually place a drain of about 19.5 amp. on this battery. The flashers and lamps on the gate arms are normally a.c. lighted through a DN-22P or DN-11P type power-off relay, but in the event of a power failure, a separate set of storage battery is provided as standby. This consists of 5 or 6 cells of Exide EM-7, 120-a.h. lead-acid storage battery on floating charge from an RT-21 copper-oxide rectifier at each location. When in use there is usually about a 16-amp. drain. The a.c. power for this installation is supplied from a 220-volt power distribution circuit on the pole line on two No. 8 double weatherproof braided copper wires.

Track Circuits

Each of the track circuits, which average from 350 to 1,800 ft., except for the short track circuits over the crossings, is fed by three cells of Columbia high-voltage 500-a.h. primary battery in multiple. Short track circuits are fed by two cells of the same type battery in multiple. In all instances a Raco adjustable resistance is used in series with the battery.

The relays, rectifiers, storage battery and other equipment at each crossing are sheltered in 4-ft. 11-in., 6-ft. 9-in. or 9-ft .8-in. welded sheet-metal instrument cases. The primary battery for the track circuits are sheltered in Massey concrete battery boxes.

Underground parkway cable is used between the instrument cases and flashers and gates, and for track connections. This consists of No. 6 conductors for motor leads, No. 9 for track connections and No. 12 for lighting and other circuits. Cables under streets are run through a piece of 4-in. steel pipe which was pushed under the pavement. The line control circuits are on No. 10 weather-proof Copperweld. Where connections are made between the pole line and instrument case the line drop messengers are not fastened to the instrument cases, but to a separate precast concrete post, thus eliminating strain on the case.

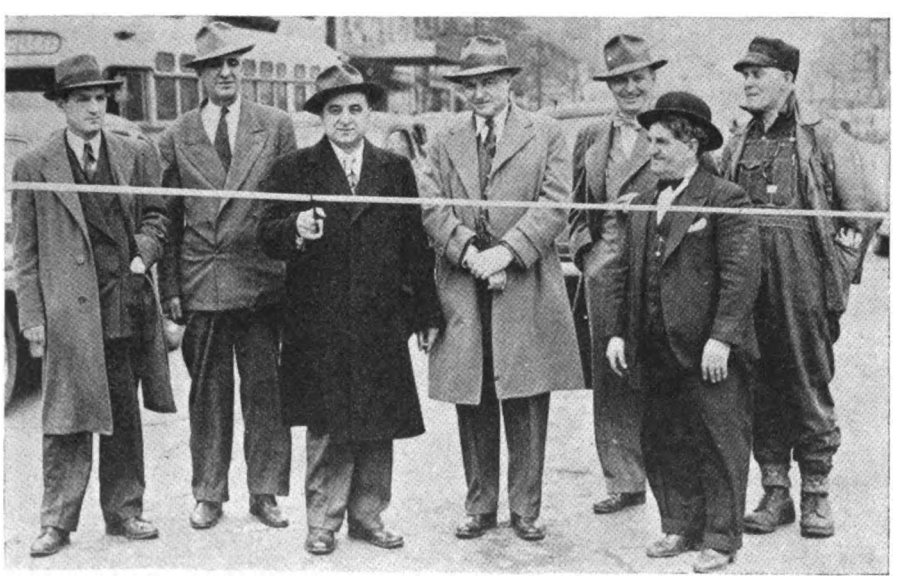
Rail Bonding

The rails are bonded with Cadweld weld-type rail-head bonds where 112-lb. rail is in service. Drive-in type rail-head bonds are used elsewhere. The bootlegs are the duplex type mounted on one side of the track as a matter of facilitating maintainers' inspections. Connections to the rail from the bootleg are made with a duplex stranded bond wire connection and Raco terminal having a ⅜-in. plug.

Precast Foundations

All foundations for flashing-light signals and flashing-light signals with short-arm gates are of the Massey precast concrete type. Where flashers only are used the masts are mounted on 48-in. foundations. Where gates and flashers are used together on the same mast a 79-in. foundation is used. Instrument cases are mounted on 48-in. foundations. As a means of preventing rust on the under sides of instrument cases where they are placed on foundations, before the case is set in place, a piece of heavy asphalt paper is placed over the top of the foundation as a water seal. Instrument cases, as well as the signals, are painted white.

This installation was planned and installed by the signal forces of the Wabash, under the direction of G. A. Rodger, signal engineer. The major items of equipment were furnished by the Union Switch & Signal Company and the Western Railroad Supply Company.

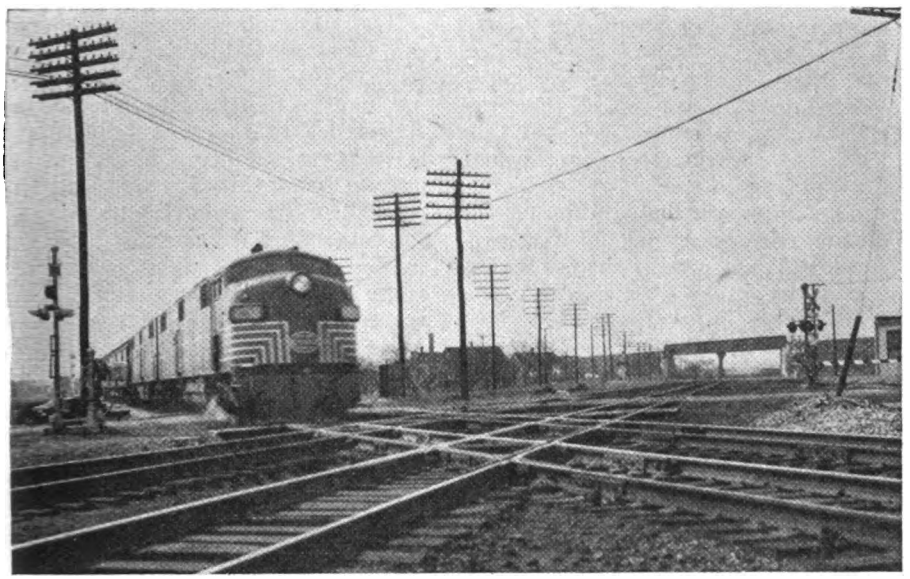


Gary Post Tribune Photo

G. A. Rodger and L. B. Yarbrough (fourth and fifth from left), signal engineer and assistant engineer, Wabash, with civic officers at inauguration of new protection

The Michigan Central Part of the Project

Two lines of the Michigan Central were involved in this project. One is the double-track east-west main line between Chicago and Detroit, which crosses the Pennsylvania at Tolleston interlocking. The other Michigan Central line is the single-track Joliet division, which connects with the foregoing line in east Gary and extends southwest through Gary to Joliet. Automatic block signals are in service on the main line, but not on the Joliet division. Traffic on the Michigan Central main line consists of approximately 50 trains daily, while that on the Joliet division consists of approximately 10 trains daily.



Eastbound M.C. train crossing Garfield street at Tolleston interlocking

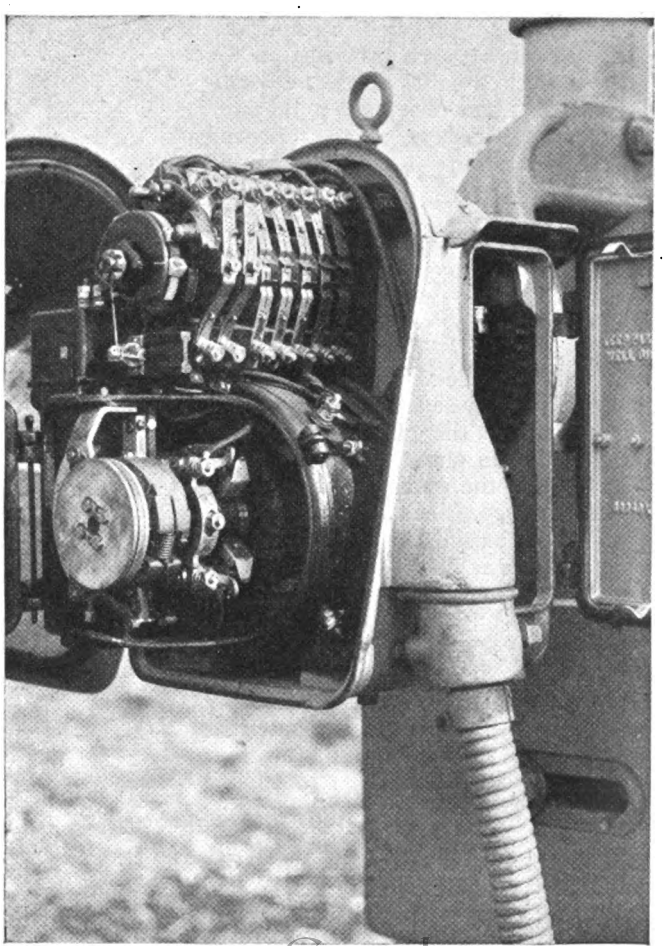
The work on the Joliet division of the Michigan Central involved the installation of additional back-to-back flashers on existing signals at Adams and Washington street crossings in south Gary. Automatic flashlights and bells were installed at Louisiana, Tennessee, Delaware, Jackson and Madison streets in lieu of cross-buck signs, at Monroe street in lieu of automatic bell and at Harrison street in lieu of automatic wig-wags. Due to the simplicity of this work, a diagram of the territory is not reproduced here. The largest project on the Michigan Central is that on its main line passing through the central part of Gary, shown in Fig. 4.

As shown in Fig. 4, the first crossing involved is at Burr street, where gates were added to the existing flashers and bell. The electric gates and two sets of flashers were installed at the next two crossings east, namely, Taft and Roosevelt streets, replacing manual gates. Two sets of flashers and gates were installed at Cleveland street, replacing an automatic bell. One gate and a set of flashers were installed at Garfield street, this being a joint installation with the Pennsylvania, which crosses the Michigan Central at this point.

Two gates and two sets of flashers were installed at Grant street, Madison street, Adams street and Washington street in lieu of manual gates. At Broadway two gates, two sets of flashers and two sets of pedestrian bells and flashers were placed in service, replacing manual gates and automatic bell. At Virginia street and Indiana avenue two gates and two sets of flashers were installed, replacing manual gates at Virginia and automatic flashers at Indiana. There are some intermediate streets shown on the diagram where protection was already in service and which was continued in service.

Control Panels

This protection is arranged for normal automatic track-circuit control. However, with switching going on at various places along the line, manual supervision has been provided in order to eliminate the delays to highway traffic at certain crossings. For example, the towerman at the M.C. Tolleston tower at Garfield street has control over the gates at certain streets. Similarly, the watchman at



A Type-3563 mechanism for Model-10 crossing gate on the Michigan Central

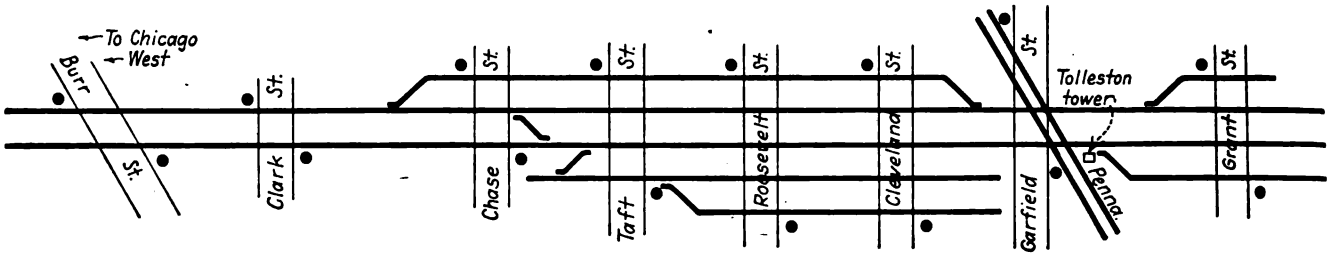


Fig. 4—Track layout of the main line of the Michigan

Broadway has control over the gates and flashers at certain streets.

The control panels at Tolleston and the other locations on the Michigan Central are the Western Railroad Supply Company's Sig-Na-Trol type. Each panel is mounted on two pieces of 3-in. pipe about 3 ft. above the floor, the pipes being held firmly in place by flanges bolted to the floor. At the top of the panel is an illuminated track diagram, track-circuited sections being shown in solid white and non-track-circuited sections being shown by two light lines. Each approach section is repeated by a normally-dark yellow light. Each short street track section, either main line or siding, has a separate normally-dark yellow occupancy light, indicating that the gates cannot be manually raised or the flashers stopped. If one of several short track sections over a crossing is occupied, all the short-section lights are lighted simultaneously, being connected in multiple. Directly above each crossing on the panels is a red light, which is normally dark. These flash when the corresponding flashers at the crossing are in operation.

Levers on Panel

Directly below the track model is a row of levers, each corresponding with the crossing protection they control. A two-position up-and-down lever is provided for each crossing controlled. These levers are normally up. To lower the gates at a crossing, the watchman pushes the lever down. To restore the gates to normal, the lever is raised. The gates then follow, providing the short track section over the crossing is not occupied.

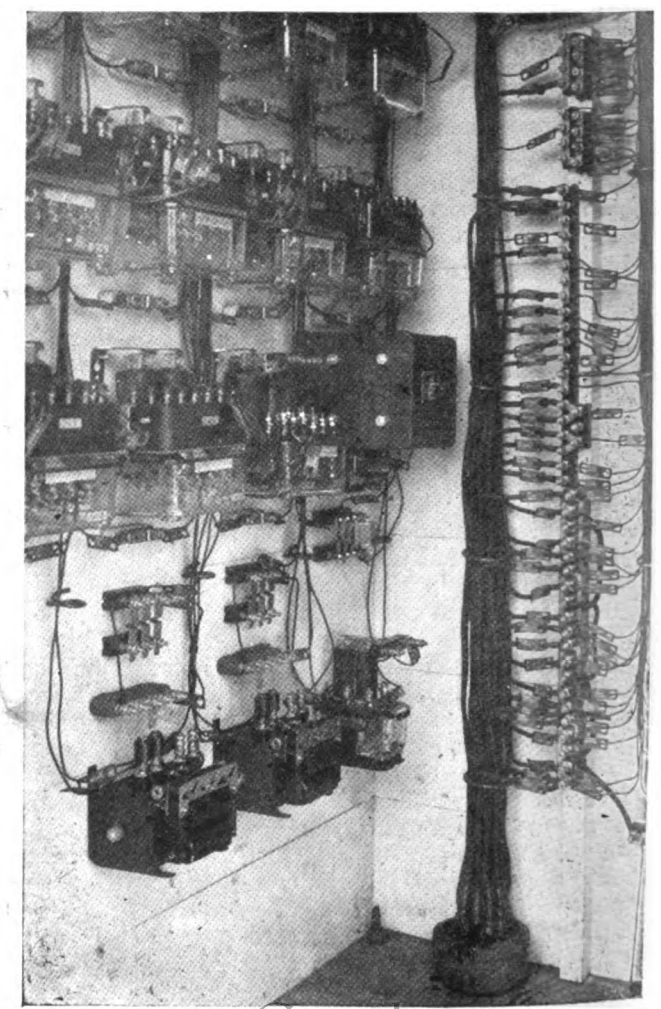
In addition to these levers on the panels, two push-buttons are provided below each lever, one for each track, for raising the gates when approach sections are occupied and the gates are down. If a train approaches on either track and stops to switch, or for other reasons, without passing over the crossing, the watchman presses the button for the track concerned, and the gates rise, thus eliminating obstruction of highway traffic. When the train is ready to proceed over the crossing, the watchman lowers the lever above the button, as described previously, which lowers the gates. When the train has cleared the short track section over the crossing and the lever has been restored to normal, the gates again rise.

The automatic control previously mentioned is supplemented with two-speed starting sections for the majority of the crossings mentioned, this feature preventing unnecessarily long warning time for slow moving trains. At some locations where it was impractical to use manual supervision, automatic timing circuits are provided to cut certain track sections out of the operating circuits when a train has stopped with a particular section and is not to immediately pass over the crossing.

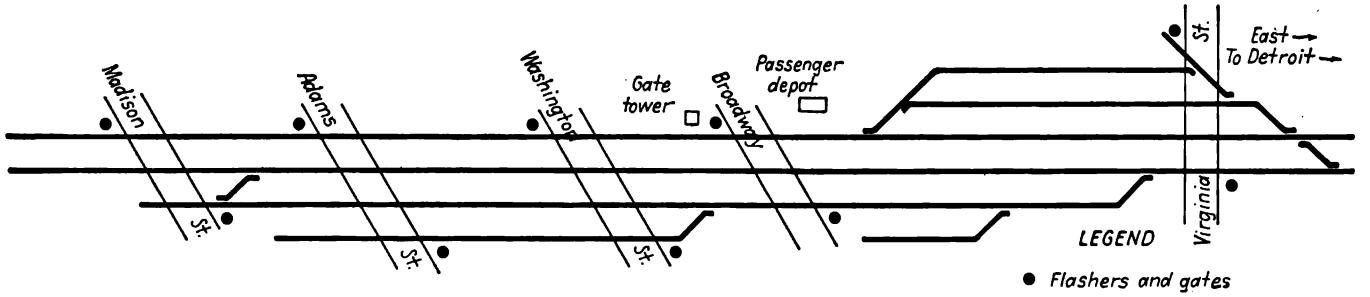
The gates on this installation are the Western Railroad Supply Company's Model 10, with Type 3563 mechanisms designed to drive both up from 0 deg. to 90 deg., and down from 90 deg. to 45 deg., descending by gravity from 45 deg. to 0 deg. This mechanism has a clutch and governor for controlling the speed of the gate in both directions. The governor is controlled by centrifugal force, which is mechanical. Motor control contacts are actuated by the armature of the hold-clear magnet.

The Gate Arms

The gate arms, which vary in length from 16 ft. to 32 ft., are painted black and white, and are equipped with three lights with red Fresnel lenses.



Interior of a wood instrument house at crossing, showing apparatus and pot-heading of the underground cables in house



Central through Gary, showing location of new protection

At the gate and flasher locations an interesting construction feature is that the gates and flashers are mounted on separate masts, a standard practice on this road. The reason for this is that in the event a gate post is struck by a vehicle, chances are that the flashers will remain intact, and thus provide protection. In such an event, repair work would also be simplified and time would be saved.

The flashers are the General Railway Signal Company's Type XA, mounted back-to-back, and are equipped with 12-16 volt, 21 cp. lamps and 8⅜-in. red lenses. At each location the flasher signals also include a standard crossbuck sign, number-of-tracks sign and "Stop on Red Signal" sign. Bells are also in service at each crossing. As long as the gates are down and the flashers are operating, the bells continue to ring.

Manual Control

At every crossing on this job a manual switch-key controller is provided for use by trainmen when it is desired to make a movement over the crossing and flashers and gates are not operating automatically. In other words, when a local freight or other train is to pass over the crossing a trainman inserts and turns his switch key in the controller which starts the operation of the gates and flashers.

This control is not stick, and the key must be held in the start position until the train has entered the short track circuit section in the crossing. The switch key can then be removed, the operation then being automatic. It is impossible to cut out the operation of the gates under any circumstances when the short track section over the crossing is occupied. Maintainer's test switches are also provided at every crossing.

The Power Supply

A power distribution circuit is in service on the pole line to provide a.c. power at all crossings. This is a 110-volt circuit on two No. 8 weatherproof copper wires. At each crossing where the gate arms are under 25 ft., a set of six cells of Gould Type NPR-441 or Exide lead-acid storage battery, rated at 120 a.h. at 12 volts, is in service for operation of the gate mechanisms. Where the gate arms are over 30 ft., a 14-volt battery, made up of the same type of cells, is used. This battery in either case is on floating charge. The flashers and gate-arm lamps are normally a.c. fed, with provision made to transfer to the above battery in case of a.c. power failure. Power-on lights are in service at each installation to indicate that the a.c. power is on. Each track circuit is fed by a single cell of 120-a.h. storage battery on floating charge from a full-wave copper oxide rectifier, with an adjustable resistance in the relay end of the circuit. No battery is housed in instrument shelters with relays and other equipment, Massey concrete battery boxes adjacent to the instrument cases or houses being used.

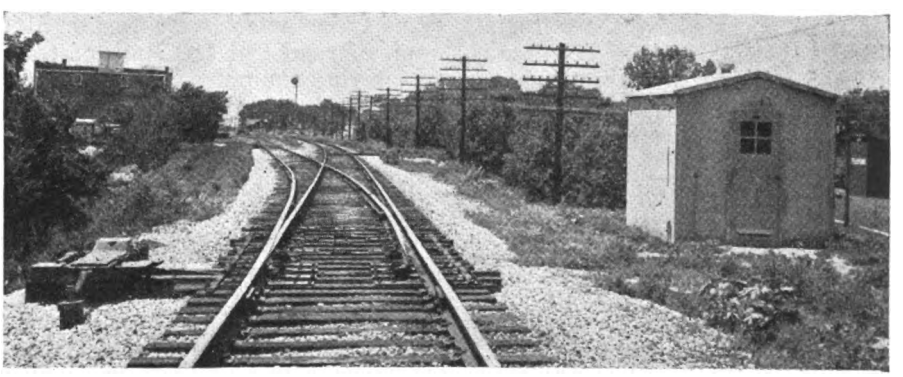
Instrument Houses

The relays and rectifiers are mounted in wooden houses at the crossings. As a means for absorbing vibration, coil springs are placed around the anchor bolts between the top of the concrete foundations and the bottom of the house. Plug couplers are used on the line relays to facilitate replacement. Underground cables entering the houses or cases are brought up through the floor in a piece of cast iron soil pipe, the flange end being up, and which is filled with dry sand and pitch compound as a pot head. From the pot head individual wires are led to terminal posts by bridle rings.

Underground parkway cable is used between all shelters and flashers and gates, using No. 8 conductors for motor leads and lighting, and No. 10 conductors for bootleg connections to the track. The underground cables at flasher and gate locations are terminated in a base-of-mast junction box. Individual conductors are then run to the flashers and gate mechanisms. Open line circuits are on No. 10 weatherproof Copperweld wire on the pole line, and case wiring is No. 14 flexible. Line drops are made up of No. 12 single conductor, solid weather proof wires, supported by No. 6 solid Copperweld messenger. An interesting construction feature is the use of rubber insulators, furnished by Continental Rubber Works, for all pole line signal control circuits.

Ready mixed concrete was used for foundations on this job, the holes being dug and forms placed by the railroad. This construction practice proved satisfactory and saved a considerable amount of time in getting the foundations in place.

The installation work was planned and performed by the regular signal department forces of the Michigan Central, under the supervision of F. T. Warmington, assistant signal-electrical engineer, the principal items of equipment being furnished by the Western Railroad Supply Company and the General Railway Signal Company.



In C.T.C. territory on the Burlington