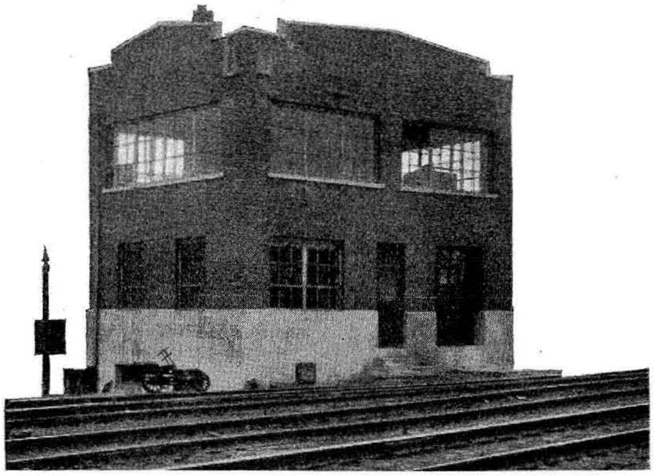
Simplified Electric

Plant at Detroit employs push-button control for color-light signals and desk levers for switches—Decided economy in first cost



Steel window sash provide ample daylighting in tower

An innovation in the electric control of interlocked color-light signals and power switches is found in the new Belt Line Junction electric plant recently completed by the Michigan Central at Detroit, Mich. The mechanical interlocking formerly in service at this junction was removed and replaced by the present electric plant in the course of a grade separation project in this vicinity. The most noteworthy feature of the new plant is the combination push-button signal control machine and track diagram. The color-light signals are controlled by means of push-buttons on this diagram, located according to the respective locations of the signals in the plant. Adjoining this control panel is a five-lever G-R-S table-lever interlocker for controlling six power-operated switch machines, and for the selection of traffic as between the Michigan Central and the Grand Trunk Western. Another feature of the plant is the absence of derails. The wire distribution outside of the tower is by means of parkway cable, while inside of the tower all wires are distributed in Square Duct conduit.

The six G-R-S Model-5A 110-volt power switch machines are controlled by the desk lever units in the tower. The high signals, of which there are three, are the G-R-S triangular type of color-light signal employing 18-watt, 10-volt lamps. The dwarf signals are the G-R-S Type-S, two-indication (red and yellow) in all cases except for the two Grand Trunk Western main line tracks, in which case the signal aspects displayed are red and green.

The plant handles all Michigan Central freight trains for the Belt Line, which serves most of the industries at Detroit, and also the Michigan Central's passenger and freight traffic between Detroit and Bay City. The Grand Trunk Western has six tracks in this plant, all of which are crossed by the double-track Belt Line connection.

Control Panel and Levers on Same Table

A three-story brick and concrete building has been provided for the control facilities as well as for a branch yard office and switchman's headquarters. A feature of the building is the use of steel window sash on all four sides. The building is heated by an Arco steam plant. The top floor is used jointly by the yardmaster and towerman. The signal control panel, the five table lever controllers and the relay racks for all of the control relays in the tower, are located in this room.

The push-button control machine for the signals resembles an illuminated track diagram such as commonly used at interlocking plants. The blue print of the track layout is glued to a ¼-in. Transite panel and covered with white shellac. The frame of the cabinet is of 1-in. angle-iron; the top, sides and back being $\frac{1}{16}$-in. sheet steel. In addition to the usual indicating lamps, a num-

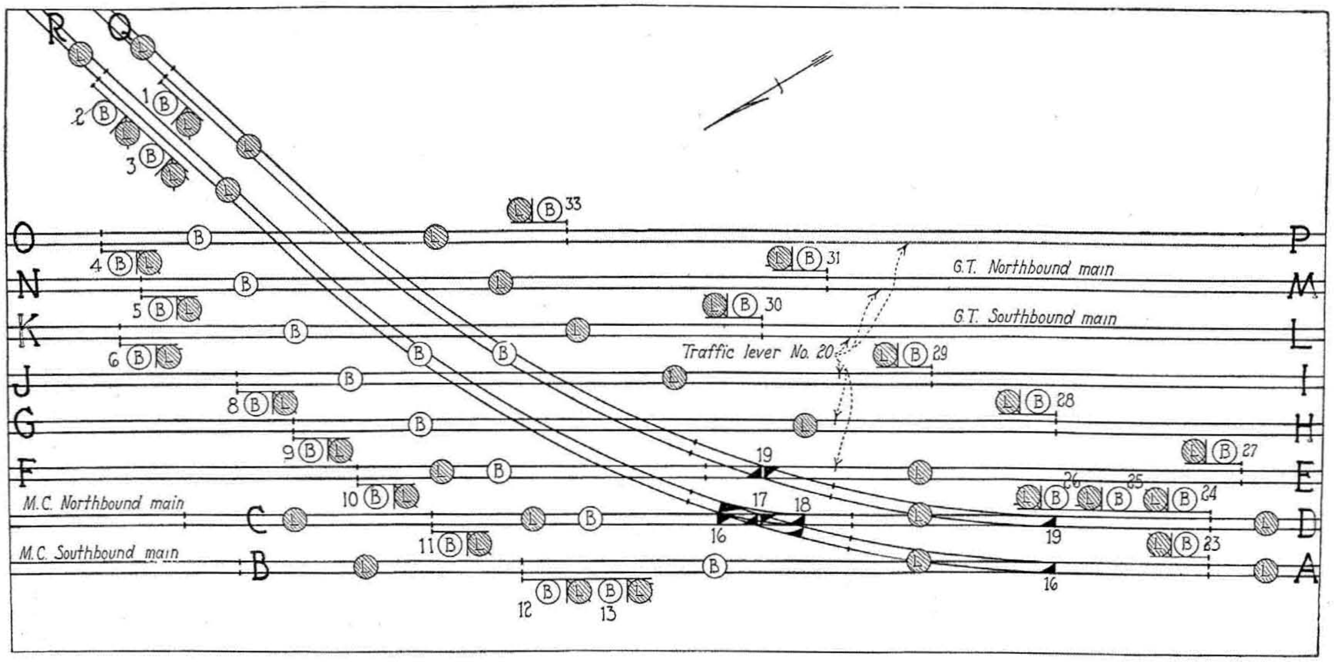
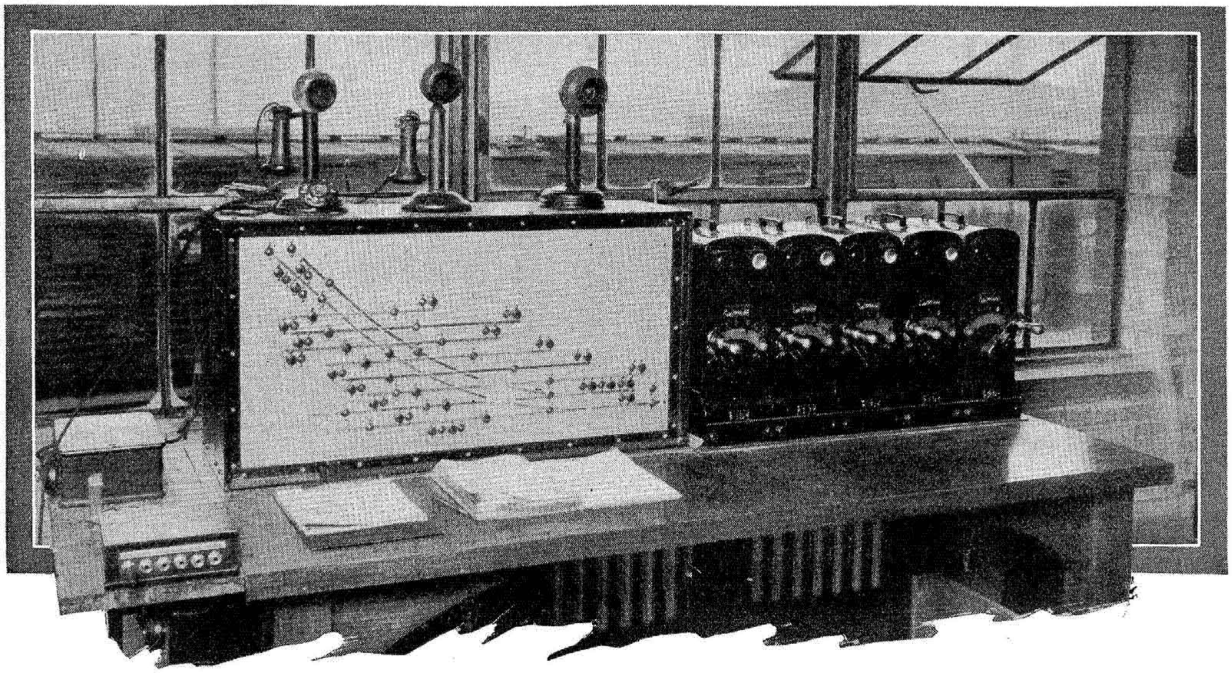


Diagram 1—Track and signaling plan of Belt Line Junction interlocker

Interlocking Plant on Michigan Central



Unique push button signal control diagram at the left and five desk levers for power switches

ber of Western Electric push buttons are mounted on this panel. Reference to Diagram 1, will show the location of these buttons and indicating lamps. It will be noted that a push button is mounted adjacent to a red switchboard lamp to represent each of the dwarf and high signals in the plant. In addition, track circuit repeating lamps are placed in the center of each track section. The red signal lamps are normally lit, because the red signal unit is the one normally operating. The track circuit repeating lamps, however, are normally out, these being lit only when a train enters the track section. There is also a push button in each track section for the purpose of changing a route, in the event that it is found necessary to do so before the signal is accepted by a train.

Each push button is provided with two normal and two reverse contacts; that is, two contacts are normally closed and two other contacts are normally open. The push-button contacts are wired to A.R.A. terminal blocks at the back of the control panel. This wiring was done in the Michigan Central signal shop before the panel was installed in the tower.

The five-lever G-R-S table interlocker is mounted on the same table as the signal control panel. The four units controlling the six-power switches are provided with high-voltage snap contacts for the 110-volt motor circuits. Each unit is provided with normal and reverse indicating positions. There is also an electric route lock on each switch machine lever. A red indicating lamp in the upper left corner of each unit informs the leverman when the switch machine has unlocked and is being operated to the reverse position. This lamp is energized only during the operating cycle. The fifth table lever, unit, the one at the extreme right, is a traffic control lever for interlocking the control of train movements northbound and southbound on the six Grand Trunk Western tracks and the diverging Belt Line train movements of the Michigan Central. The five table lever units are mounted on a common mechanical locking bed. Thus, the usual preliminary mechanical interlocking features as found in all plants are provided in this case.

An example of the mechanical interlocking will be given. For instance, traffic lever *20*, when moved to the right, will permit of northbound and southbound movements on the G.T.W. tracks. On the other hand, when lever *20* is moved to the left, it is possible to reverse switches *18* and *19* for a diverging movement over the Belt Line. The point is that, when traffic lever *20* is in the extreme right position, the Michigan Central switches *18* and *19* are locked in their normal position by traffic lever *20*. Also, when lever *20* is in the extreme left position, the reversal of switches *18* and *19* will lock traffic lever *20* in the extreme left position.

Operating Features

Reference to Diagram 1 shows that there is no interchange connection between the G.T.W. and M.C. at this plant. Assuming that traffic lever *20* is in the extreme right position, the northbound dwarf signal *31* on the Grand Trunk Western main line can be cleared by pushing button *31*. At the same time, it is also possible to clear high signal *26* on the Michigan Central for a through movement on that line. Operation of the button extinguishes the red indicating lamp, thus informing the leverman that the red signal has changed to green. Should the leverman desire to change the line-up, he would, in this case, push the button in the center of the track section in advance of signal *31*, and this would immediately restore the red signal at dwarf signal *31*. This operation would also initiate the operation of a time-element relay (with a time setting of one minute) which, at the conclusion of its operation, would permit the leverman to move traffic lever *20* to the left, preparatory to lining up the switches and signals for a Belt Line movement. If the leverman should push the wrong dwarf signal button, in other words should he push button *5* instead of button *31* on the G.T.W., he can immediately rectify his error by pushing button *31*. The last mentioned operation restores signal *5* to stop and lights the green signal at dwarf signal *31*. This operation involves no time delay.

Whenever the route is changed by pushing the signal restoring button in the center of the track circuit, the time-element relay is caused to operate, but only the signal on the particular track involved is changed to red; that is, any non-conflicting green signal on any of the other G.T.W. or M.C. tracks will remain green, even though the time-element relay starts to operate. A multiple connection of push-button contacts on the signal control panel prevents the changing of a green signal to red on any of the other non-conflicting routes between opposing signals. This push button contact is normally closed and it is through this contact, in each case, that any non-conflicting signals indicating green are maintained in this condition in spite of the dropping of the time-element relay *20-LRP*. Of course, in the case track section button *5-31T* is pushed, the signal stick relay *5-HR*, or *31-DR*, will become de-energized because the push-button contact *5-31T* will be opened by the operation of the button.

The signal indications are repeated on the signal control panel through the medium of Type-H relays in series with the 18-watt, 10-volt lamps of the signals. All of these repeating relays for the high signals are located on the relay rack in the control room. The cor-

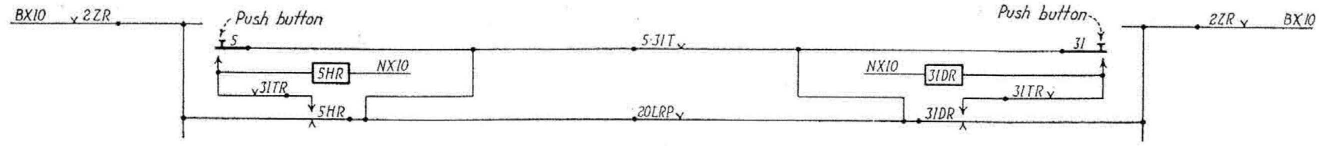


Diagram 2—Push button control circuit for signals *5* and *31* on G. T. W. northbound main

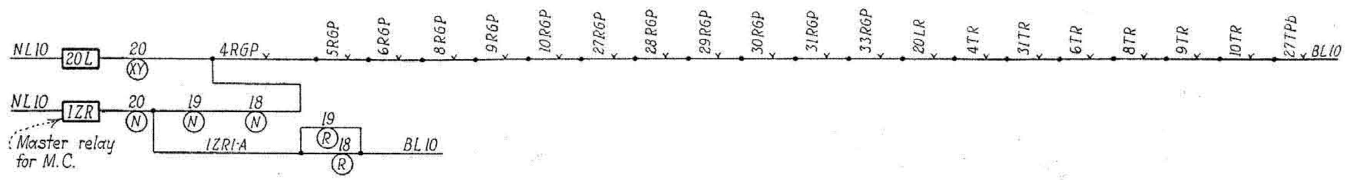


Diagram 3—Master relay control for Michigan Central routes

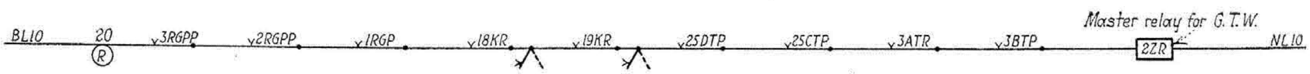


Diagram 4—Master relay circuit for G. T. W. signaling

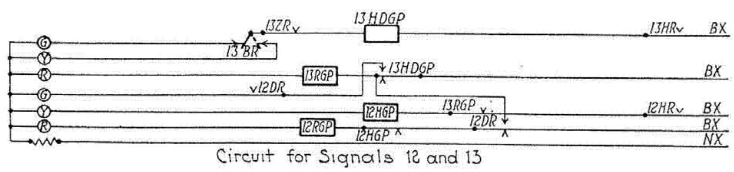


Diagram 5—Color-light signal control and repeater circuits for high signals *12* and *13*

Although this electric plant is the simplest of any on the M.C. it is none the less the most complete from the standpoint of electric locking protection. The interlocking of the electrical control is effected by means of two master relays designated on the circuit plan as relays *1ZR* and *2ZR* for the M.C. and G.T.W., respectively.

Circuit Features

When the leverman pushes the signal button he picks up a Type-H relay, which as shown in Diagram 2 is connected as a stick relay. That is, this relay sticks up in the energized position through a front contact of the track relay governing the section between opposing dwarf signals. This feature restores the signal to normal immediately upon the passage of a train at the signal. The non-automatic signals may be cleared when the track relay is de-energized by holding the clearing push button in. It will also be noted from Diagram 2 that each signal stick relay control circuit on the G.T.W. is carried through a front contact of the time-element relay (designated on the circuit plan as relay *20-LRP)*, in other words, the time-element really must be de-energized to restore a signal to normal after being cleared. It will also be noted, however, that there is a multiple connection through the contact of the track section push button for the particular track section be-

responding repeating relays for the dwarf signals are located outside of the tower in the proximity of the dwarf signals, and repeater relays controlled from these aforementioned series indicating relays carry the signal indications to the control panel. In order to equalize the lamp brilliancy of the high signals, a series resistance is inserted in each lamp circuit. This resistance may be adjusted to compensate for inequalities in the lengths of the respective lamp circuits. The signal indicating lamps on the signal control panel are lighted through the front contacts of the Type-H series indicating relays.

A brief explanation of the control of the master relays *1ZR* and *2ZR* will help to make clear the scheme of interlocked protection. Diagram 3 shows the control circuit for the M.C. master relay *1ZR*. Traffic lever *20* must be normal (in the extreme left position), and switches *18* and *19* must be normal and all signals on the G.T.W. must be red and all G.T.W. track circuit repeaters must be energized. This condition is obtained by checking the control wire through the front contacts of the red signal lamp repeaters and the track circuit repeaters. Once the relay *1ZR* is picked up, it is possible to reverse switches *18* or *19* for a diverging train movement over the Belt Line. It will be noted that when either *18* or *19* is reversed, relay *1ZR* is maintained in an energized position by a normal contact on traffic lever *20*, and then merely repeats the position of that lever.

The control of the G. T. W. master relay *2ZR* is effected in a similar manner, although in this case it is necessary to employ "trap" circuits on the two Belt Line tracks, owing to the fact that it was not considered possible to carry the track circuiting across the six G. T. W. tracks. These "trap" circuits employ two stick relays which are designated on the plan as *3BTR* (for the southbound track moving off of the Belt Line) and *25CTR* (for the northbound movement from the Michigan Central main line to the Belt Line). It will be noted in the control circuit of master relay *2ZR* that traffic lever *20* must be moved to the extreme right position and all of the M. C. Belt Line signals must be at stop. Also switches *18* and *19* must be normal, and the two "trap" circuit relays *25CTP* and *3BTP* must be up and also the track repeaters *3-ATR* and *25-DTP*.

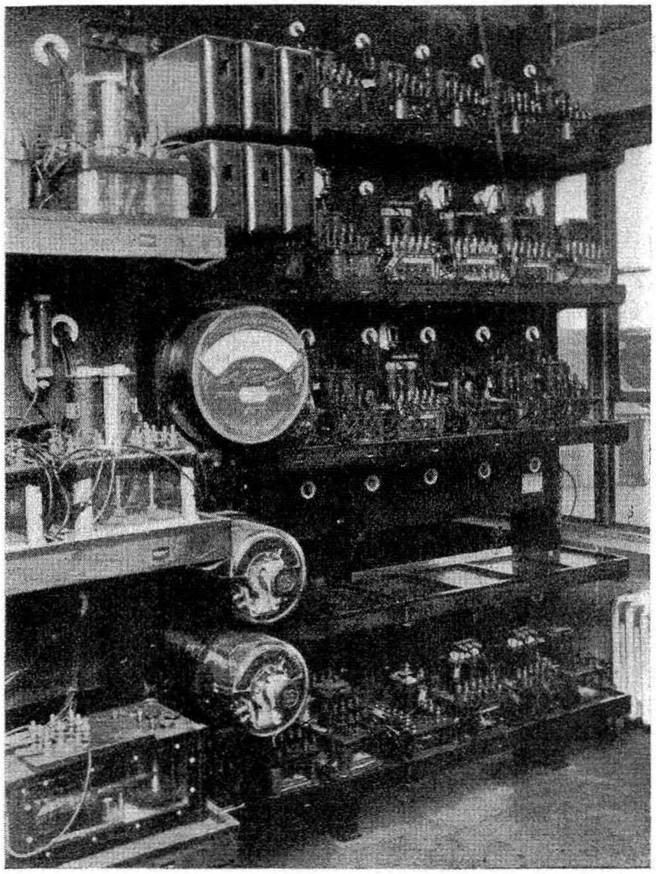
It should also be noted that the "SS" polarized switch indicating scheme is employed. The two "SS" relays of Diagram 4, shown as *18KR* and *19KR*, must both be in their normal positions. It should also be noted that the electric interlocking of the two master relays is carried out through the medium of traffic lever *20*. Relay *2ZR* can only be picked up when lever *20* is to the right, and correspondingly, relay *1ZR* can only be picked up when lever *20* is moved to the left.

Power Supply

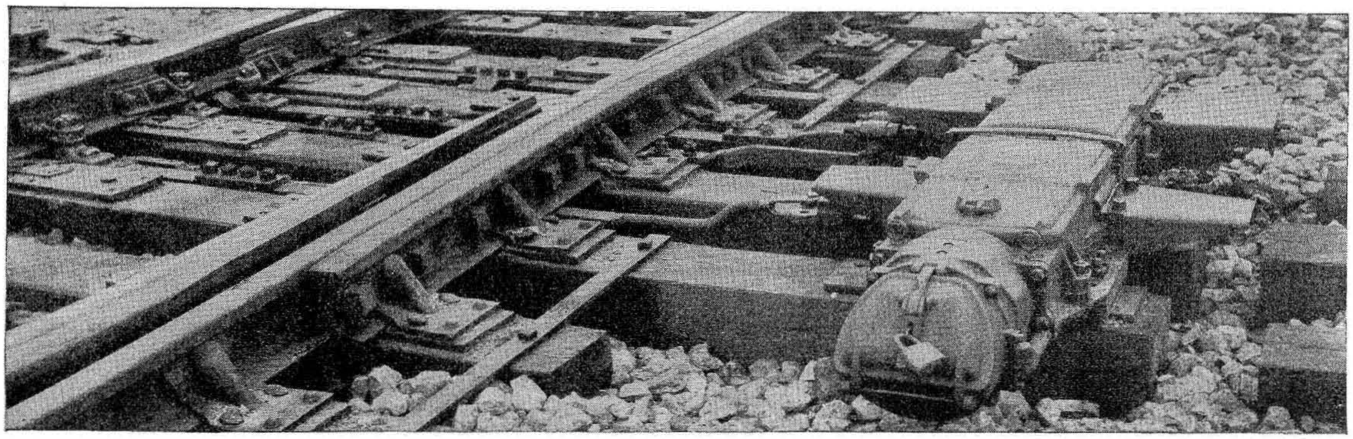
All of the control relays are mounted on wooden racks in the control room, and an ammeter for measuring switch machine current is also mounted on a relay rack. A G-R-S polarized cross-protection relay is provided for each power switch machine. There are also two clock-work time releases for effecting a change of route on the M. C. One of these time releases must be operated before the towerman can change a M. C. signal line-up from the main line to the Belt Line, or vice-versa. These two time releases bear no relation to the time-element relay provided for a change of route on the G. T. W. tracks.

A 55-cell Exide Iron-clad storage battery is provided in the basement of the tower for the operation of the 110-volt power switch machines. There are also two 5-cell Exide Type KXHS-7 batteries for 10-volt relay controls in the tower. A battery of 3-cells is connected to one end of the 5-cell battery for the purpose of providing a 16-volt emergency lighting battery for the color-light high signals outside of the tower. For charging the main interlocking battery, a Union Style-RP-10 rectifier, rated at 1 amp. continuously, is provided. There are also a Union Style-RX-10 ¼-amp. rectifier, for the three end cells and a Union Style-RX-21, 1 amp. rectifier, for the multiple connection of 5-cell batteries.

Two transformers are provided for signal lighting and storage battery charging. Each of these is a 300-watt G-R-S Style-K2 transformer with independent secondaries for the lighting circuits and trickle charging battery circuits. The primary winding is provided with terminals for 95-volts, 105-volts, and 115-volts. The lighting secondaries are so arranged that there are two 5-volt sections, four 1-volt sections and two ½-volt sections, one of these ½-volt sections being an independent secondary winding so that it can be connected into the lighting circuit at any point. There are also two independent 5-volt secondaries for battery charging, and also a 20-volt secondary for the same purpose.

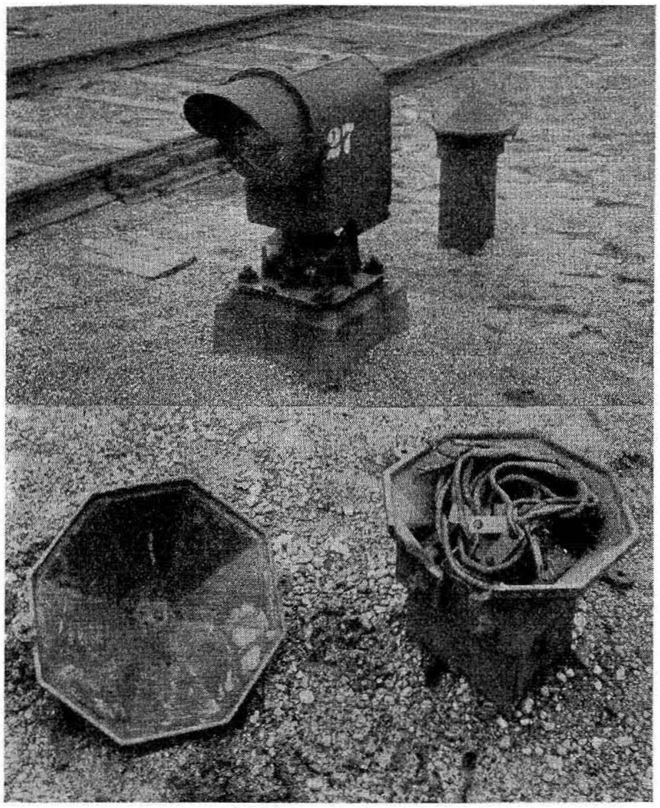


Relays, time releases and ammeter mounted on wooden racks



Model-5A power switch machine controlled from desk lever unit in tower

A Union Style ANL-30 power-off relay is provided to switch the high signals from a-c. to the 16-volt storage battery. Another power-off relay of the same type is arranged for the purpose of cutting over the Type-H push-button operated signal stick relays from the 10-volt a-c. supply to a 6-volt d-c. circuit. The dwarf signals are lighted from transformers located outside the tower, a 10-volt storage battery charged with a Union



Type-S two-indication dwarf signal and special cast-iron parkway outlet of M. C. design

Style-RX10, ¼-amp. rectifier being provided with a Union ANL-30 power-off relay to switch over to the battery when the a-c. power is off. Thus the plant is fully operative in the event of a commercial power failure. Two Square-D safety switches control the 110-volt circuits for the battery charging in the basement of the tower and also the 110-volt circuits carried in parkway cable to the rectifiers and transformers located outside of the tower for the purpose of feeding the dwarf signals.

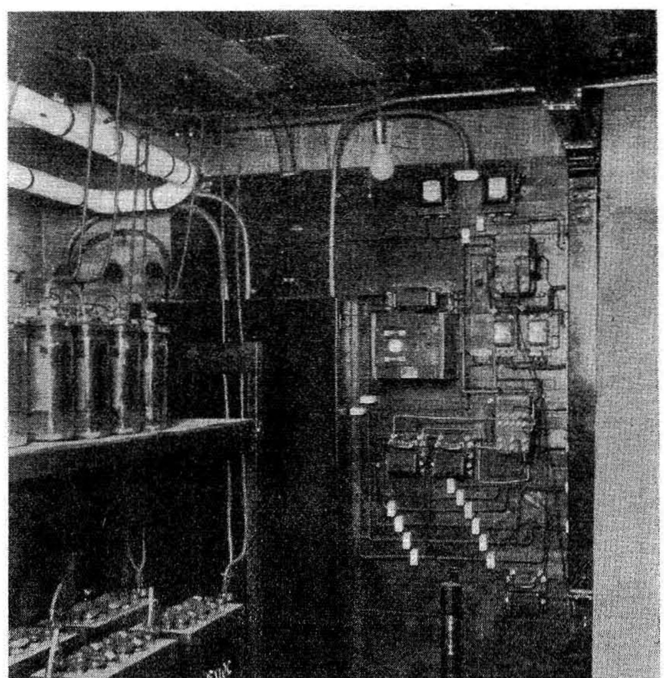
The parkway cables enter the basement of the tower through 3-in. pipe ducts, there being eleven 20-conductor cables made up of No. 12 wires. These cables are carried to a splicing cabinet in the room upstairs where connection is made to No. 16 Pullman flexible copper wires. From that point the control wires are carried in Square Duct steel conduit suspended from the ceiling. Each section of Square Duct conduit is provided with a number of "knockouts" and also with a hinged cover fastened in place by means of a spring clip. A similar installation of Square Duct conduit is used to good advantage in the basement charging room. The use of this type of conduit permits of extreme simplicity of wiring, because of the ease with which branch circuits may be run out of the Square Duct conduit by pushing out the proper "knockouts." This is the first interlocking tower on the Michigan Central where this form of steel conduit has been employed.

On the second floor of the tower a locker room is provided for yard switchmen, and another room is reserved for the exclusive use of a maintainer. This room, provided for housing a track motor car, has a sliding door facing the track. When raised this door slides back on an overhead steel track, completely out of the way. A steel locker is furnished for the maintainer's exclusive use. Steel shelving is provided in the maintenance room for storing tools and maintenance supplies. A Zerk forced-lubrication compressor, is used to lubricate the Zerk fittings on the power-operated switch machines.

Parkway Cables

The parkway cable for the high signals is carried directly up into the signal cases and terminated on the A. R. A. binding posts. In the case of the dwarf signals, the parkway is terminated in a special cast-iron parkway outlet box assembled by the Michigan Central signal department. This parkway outlet box is mounted on a 2-ft. section of discarded 60-lb. rail which is buried in the ballast. The parkway cable is clamped to the web of this rail section, and the splices to the rubber-covered wires leading to the dwarf signal or switch machines are made in the top, or cast-iron housing. These splices are soldered, taped and tagged with fibre tags.

At track circuits, the bootleg connection is made by using an old section of rail, about 2 ft. long, buried in the ballast. The parkway is clamped between two



Rectifiers, transformers and storage batteries in basement of tower

blocks of wood to the web of the rail. The soldered connection to the No. 9 copper-clad bond wire is squeezed between the two wood clamps to protect it from mechanical injury. This parkway outlet is approximately flush with the top of the ties. The track circuits are fed from one cell of Edison Type-B-4-H storage battery charged by means of a Union RX-10 rectifier, 4-ohm track relays being connected at the other end of each circuit.