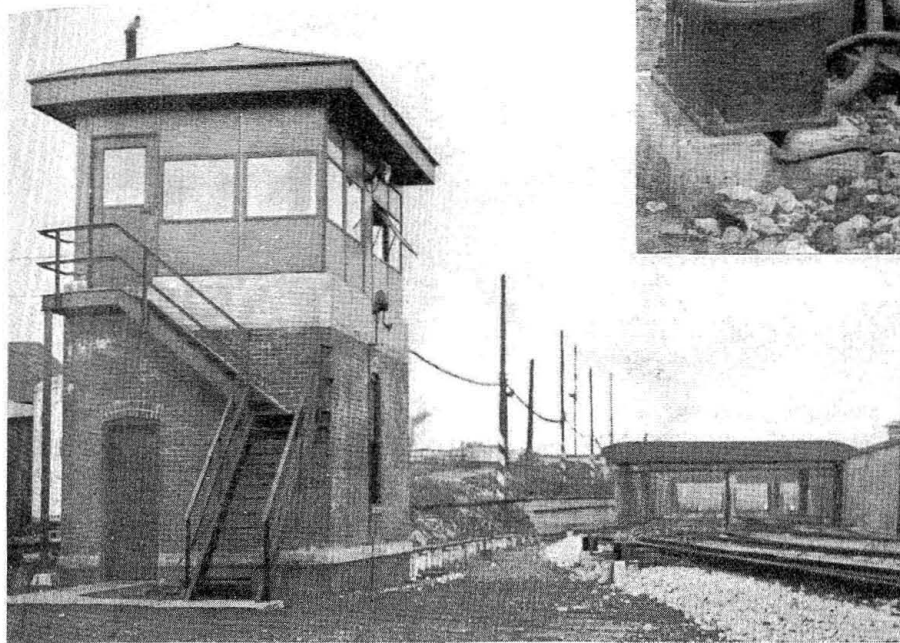
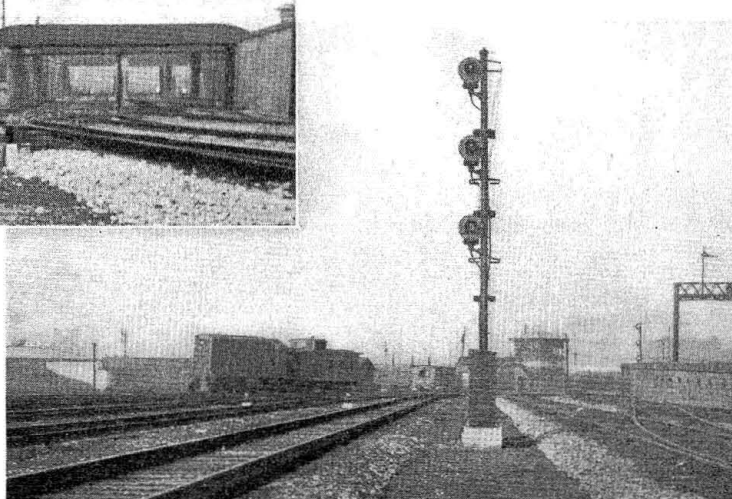




Above—Typical electro-pneumatic switch movement. Left—View looking north through subway with 16th street tower in foreground. Below—Signal 12R at 16th street plant



Two New Interlockings On the C. & W. I.

Straight pneumatic plants installed in 1900 on busy Chicago Terminal territory are replaced by two entirely new electro-pneumatic plants including light signals and modern tower buildings

THE Chicago & Western Indiana has recently replaced two pneumatic interlockings with two new electro-pneumatic plants, one at 15th Street and the other at 16th Street in Chicago. Dearborn street passenger station faces north on Polk street. The station track layout is of the stub type with all trains entering and leaving from the south end.

From the Dearborn street terminal,

a multiple-track layout with four or more tracks extends south for approximately 0.8 mile to the 15th Street interlocking, and then a four-track lead extends west and south through a depressed underpass, known as the "subway," under multiple-track lines of three other railroads. The 16th Street interlocking is located at the south end of this subway, and the towers for the two interlockings are about 1,200 ft. apart.

Traffic

The Chicago & Western Indiana tracks through these two interlockings and intervening subway, as well as the tracks on the north to the Dearborn station, handle all the incoming and outgoing passenger trains of the Atchison, Topeka & Santa Fe; Chicago, Indianapolis & Louisville; Erie;

Grand Trunk Western; Wabash; and the Chicago & Eastern Illinois. In addition, the Chicago & Western Indiana operates suburban train service, so that the total average number of scheduled passenger trains daily is approximately 69.

Train Movements

The roundhouse and coach yard are located near 51st Street, so that there are numerous light-engine and empty car movements back and forth through the interlockings. The freight houses and certain team tracks of these various roads are located north of 15th Street, and the principal freight yards of these roads are at points south of 16th Street, thus requiring numerous movements of short trains, cuts of cars, and light engines through the interlockings, as well as various switching movements within the interlocking areas. Thus, in brief, the underpass with the 15th Street interlocking at one end and the 16th Street interlocking at the other end, all form sort of a "bottleneck" through which approximately 200 to 250

through the subway more efficiently, thus reducing delays.

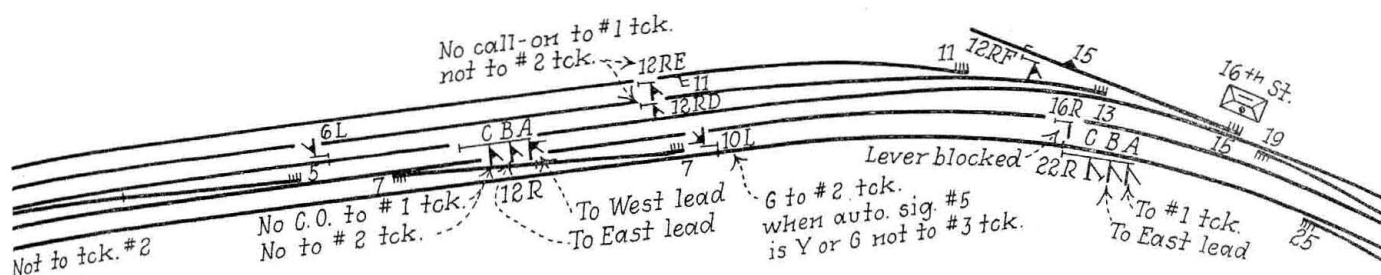
In the 15th Street interlocking, a double-slip switch with movable-point frogs was replaced with heavier rail. This movement is situated about midway between the tower and the east portal of the subway on the East Lead, at which point a tangent track extends to the yard lead tracks of the Grand Trunk and Chicago & Eastern Illinois freight yards. In addition to this, a crossover, No. 27, was installed between the East Lead and No. 1 track, a short distance north of the tower. The installation of this crossover provides a run-around route, if required,

thus necessitating the light engines of this road to use the East Lead in both directions when making light moves between the station and roundhouse. With the desire to eliminate main line derails, 4 derails were removed from service within the limits of the 15th Street plant.

In the previous signaling arrangement at 15th Street, switching movements to and from the West Lead and the turnouts leading to the Erie freight house were governed by signals located at approximately the same locations as the new ones. However, if the West Lead were occupied at any point between these turnouts and 16th

reduces train delays to a minimum.

Within the 16th Street plant territory, a single switch, a single-slip, double-slip, and movable-point frog were replaced by crossovers No. 3, 5 and 7 at 18th Street. As the space was available, it was felt that this new arrangement would be more efficient than the slip switches, the installation of which is usually confined to territories where the space for regular crossovers is limited. This change was also facilitated and made possible by the abandonment of an interchange track at 16th Street. Prior to the installation of these crossovers, a train could be routed from No. 3 track to

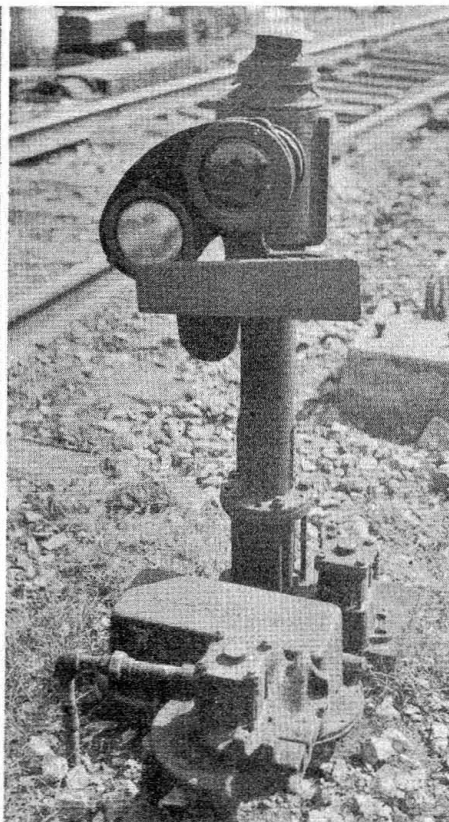
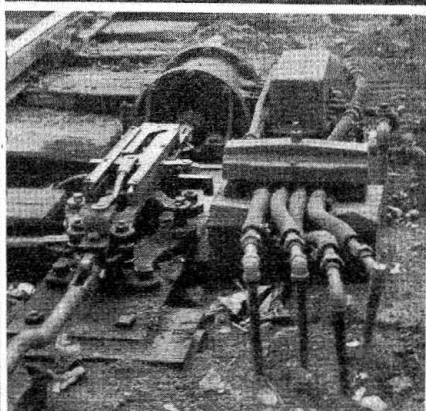
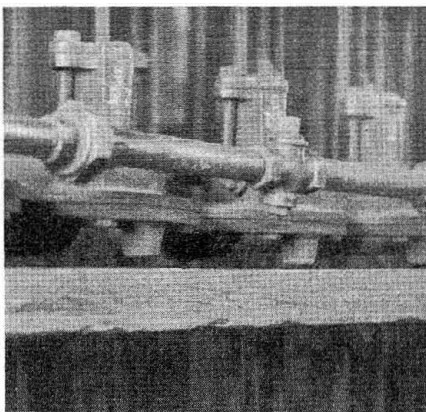
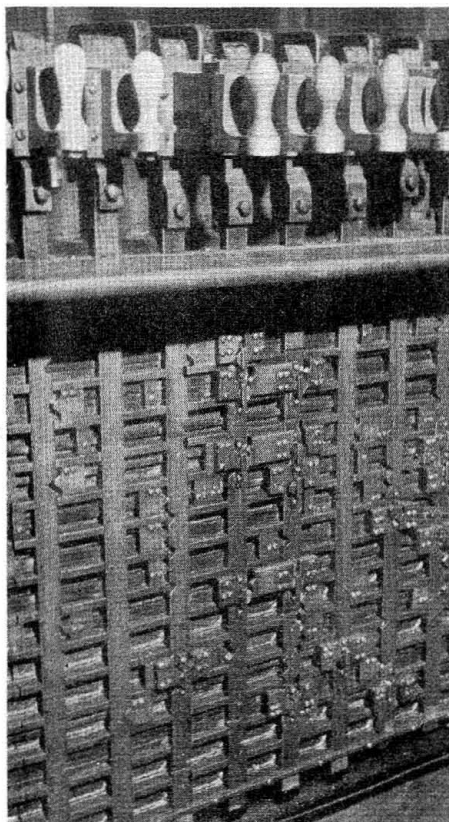


for light engines when the East Lead is obstructed north of this crossover towards the Dearborn terminal, thus reducing delay. This move could not have been made heretofore, and may be explained by the fact that the Santa Fe enginehouse is located on the east side of the line beyond 16th Street,

Street, it was impossible to admit a train to this block until it was unoccupied. Under the new arrangements, a train can be admitted to this section on a call-on signal, despite the fact that it might be occupied at any point. This use of call-on signals increases the efficiency of the layout and

the East Lead, but a train could not be routed from the East Lead to No. 2 track. Under the new arrangement both of these movements are now possible, greatly facilitating traffic through these plants.

At 17th Street and 19th Street, existing signal bridges were removed



Left—Old air machine. Center top—Air valves. Center bottom—Air switch and lock movement. Right—Air signal

Automatic signal 6 on No. 1 track at 20th Street is an electro-pneumatic semaphore and displays green with signal 22RA at yellow or green-over-red-red and yellow when 22RA is otherwise.

Call-On Signals

The signaling now in service is considerably more flexible than ever before, because of the provision for call-on aspects and controls for practically every home signal within the plant limits. Moves into an occupied block, which could not be made before, in most cases, until that block was unoccupied, can now be made in most instances, except those instances, which, if a call-on signal were displayed for certain routes, would permit a train to enter a block, where the direction of traffic is fixed for the opposing direction, thus causing conflicting train movements. This may be illustrated by signals 12R, 12RE, 12RD, 12RF, 6R, etc., the aspects of

ating mechanisms. The lamps used therein are rated at 10 volts, 13.5 + 3.5 watts, double-filament type, with precision bases. An automatic circuit for dimming the signals at night throughout both of these plants is controlled by an Edison sun relay, mounted on a pole near the 16th Street tower. The sun relay controls an ANL-30 power-off relay, which in turn cuts in and cuts out the dimming circuit during the dark and light hours of the day respectively. This eliminates such a brilliant and blinding light at night and effects a saving in power.

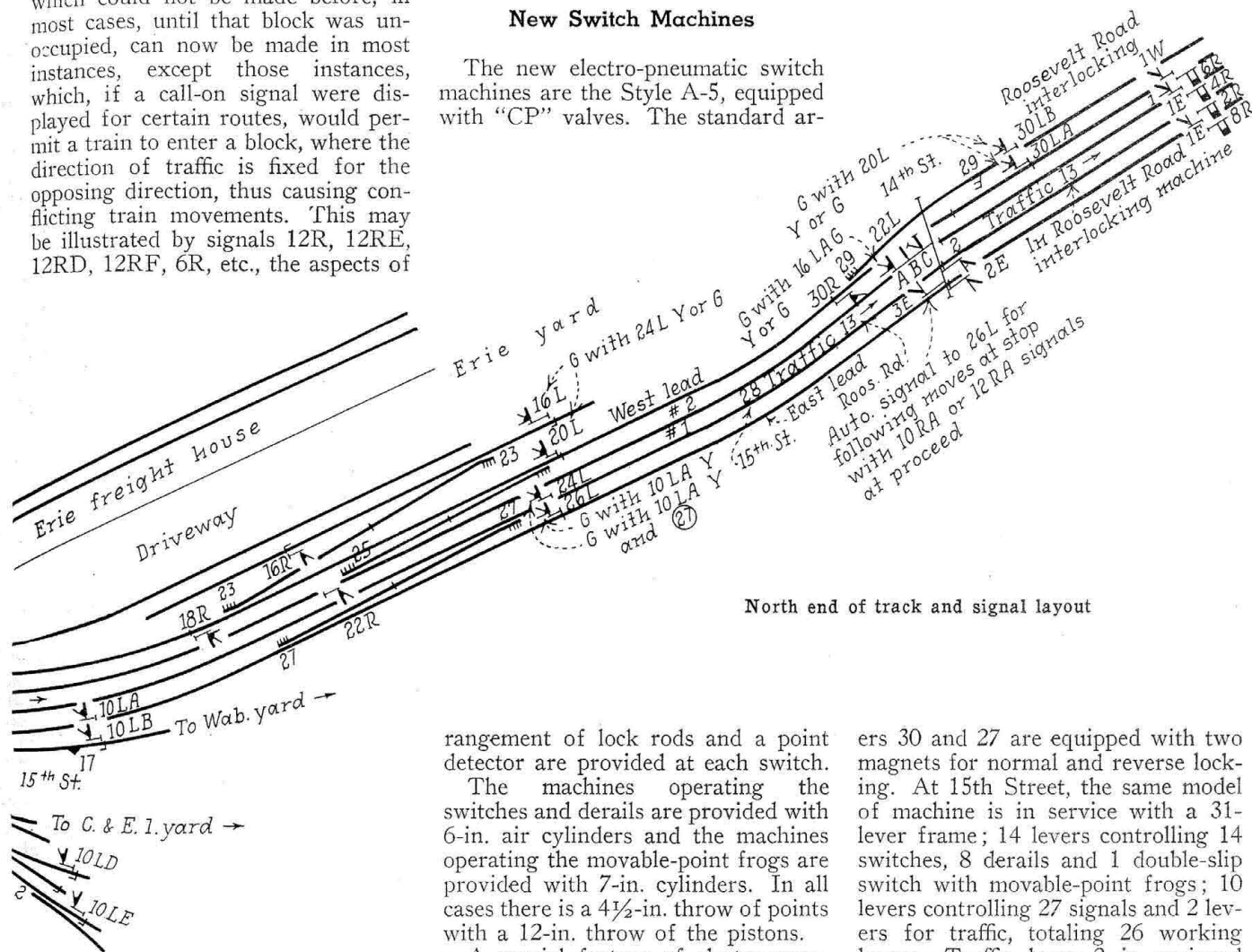
New Switch Machines

The new electro-pneumatic switch machines are the Style A-5, equipped with "CP" valves. The standard ar-

subway, the main air line is on the wall, but on the remainder of the territory it is underground.

New Interlocking Machines

The new interlocking machines are of the Union, Model-14, E.P. Type. At 16th Street the machine is composed of a 31-lever frame; with 10 levers controlling 12 switches, 3 derrails and 2 single slips with movable-point frogs; 9 levers for 29 signals, totaling 21 working levers. Traffic lev-



North end of track and signal layout

which were described previously. These signals will not display a call-on aspect for certain routes. However, with this provision for the call-on aspects for most of the signals throughout the plants, track capacity is greatly increased, thus reducing delays.

New Signals

The new dwarf, high and bridge signals are all of the Union Switch & Signal Company's Style H-5 searchlight signals, with plug-in oper-

angement of lock rods and a point detector are provided at each switch.

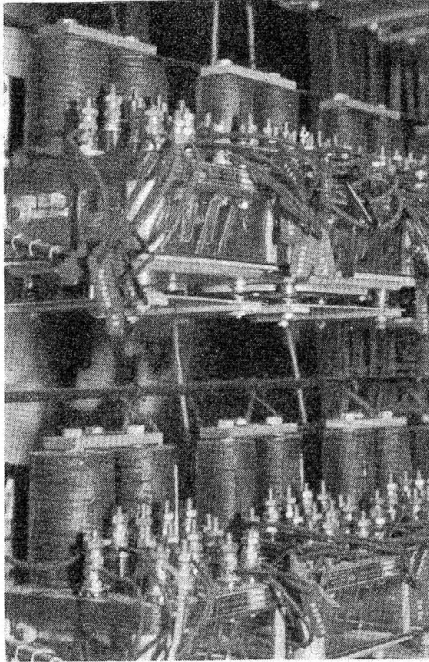
The machines operating the switches and derrails are provided with 6-in. air cylinders and the machines operating the movable-point frogs are provided with 7-in. cylinders. In all cases there is a 4½-in. throw of points with a 12-in. throw of the pistons.

A special feature of electro-pneumatic valve housing at each switch is the provision of a vertical type terminal board, designed by the C. & W. I., to replace the ordinary horseshoe shaped terminal mounting. This new terminal board permits the use of standard Signal Section terminal posts with nuts, thus insuring reliable connections. Furthermore, the installation and inspection of the wires is facilitated.

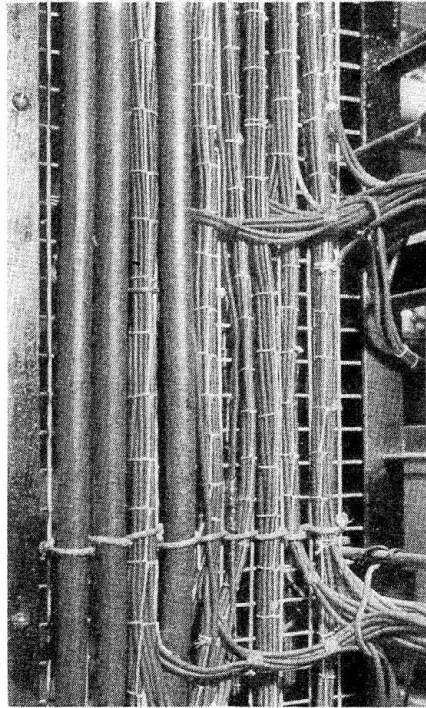
The compressed air for operating the switch machines is taken from a 3-in., extra heavy galvanized main pipe line extending to a compressor at the Dearborn Street station. In the

ers 30 and 27 are equipped with two magnets for normal and reverse locking. At 15th Street, the same model of machine is in service with a 31-lever frame; 14 levers controlling 14 switches, 8 derrails and 1 double-slip switch with movable-point frogs; 10 levers controlling 27 signals and 2 levers for traffic, totaling 26 working levers. Traffic lever 2 is equipped with two magnets for normal and reverse locking. Traffic lever 28 is equipped with one magnet for reverse locking. Lever 24 is a three-position lever with the "L" position for signal control and the "R" position for traffic. Lever 24R locks lever 28 normal. Lever 24R locks lever 28 normal.

For displaying call-on aspects, a button is provided below each lever. When a block is occupied and it is desired to admit a train into that block, the lever controlling the desired signal is manipulated and the button depressed. The standard arrangement of indication lamps is provided below the levers of each machine.



Left—View of wall-type relays in basement of 16th Street tower. Below—Vertical wire and cable runs are supported on wire meshing on the racks



Indications as to the locations of trains are shown on an illuminated track diagram, suspended at an angle by a short chain from the ceiling. Opal lights indicate track occupancy and are normally dark. A yellow and green light are placed adjacent to each other with an arrow pointing in each direction on the track diagram for traffic locking indication. When traffic is set normal the green light is illuminated, but when reversed, the yellow light is illuminated.

Complete electric locking is provided including approach detector and route locking with sectional release. The group time-release system is in service, thus necessitating but one clock-work time release for each interlocking. In each tower, two yellow automobile fog lamps, suspended on brackets from the ceiling, provide illumination of the interlocking machine and interior of the tower. An advantage of this type of illumination is the absence of glare.

Loudspeaker System

In addition to the ordinary telephone service between the levermen in the 15th Street and 16th Street towers, a new system of direct telephone communication was installed for exclusive service between these two towermen. The system includes a combined loudspeaker and transmitter in each tower. The loudspeakers are on the line constantly, and, therefore, no ringing apparatus is required. For example, when the leverman at 16th Street tower wants to talk to the 15th Street tower, he holds down a small lever while talking, and the speech is reproduced in the loudspeaker at the other tower. This com-

munication system is powered by 110-volt a-c., and a red pilot lamp on each set is lighted constantly when the equipment is in operating condition. A Telechron electric clock is mounted on the wall of each tower, near the illuminated track diagram.

Tower Buildings

The old towers were constructed with brick walls for the first story and frame construction for the upper story, wooden floors being used throughout. When reconstructing each of these towers, the brick walls of the first story were retained, but the upper story and wooden floors were removed. Using the one story walls as supporting structures, a concrete slab was poured in place for use not only as a floor for the second story, but also as support for the walls and roof of the second story, which are of Truscon fireproof construction, using slabs of insulating material covered with sheet iron, the vertical wall slabs being held by channel irons which also support the steel frame roof structure. French type swinging windows with all-metal frames and sashes are used throughout on the new portions of the buildings. Three Truscon "I" beams, 8 in. by 5 in., are spaced 3 ft. 4 in. apart in the concrete floor so as to be directly under the machines.

The old wooden floors at ground level in the towers were removed and

new concrete floors poured on steel beams for supports. Beneath the ground level floor, there is a shallow cable vault, which also is floored with concrete, and is used to bring the underground cables into the tower. This vault is provided with a drain. Each tower is heated with hot water radiators connected to a coal-burning Arcola heater on the ground floor.

In each tower, the relays are located on open type relay racks, enclosed by a combination of wire screening and meshing. The racks are made up of angle irons $\frac{1}{8}$ in. by $1\frac{1}{2}$ in. by 2 in., with supporting angle irons 3 in. by $1\frac{1}{2}$ in. by $\frac{1}{8}$ in. at the ends. No shelves are used, the wall-type relays being supported on angle irons $\frac{1}{8}$ in. by 1 in. by 1 in. spaced 15 in. apart. Round rods $\frac{3}{8}$ in. in diameter, with National Copperweld cable rings are used for wire distribution on the racks. Pullman special, 19-conductor cables of stranded No. 14 wire are used between the machines and the racks. These cables are run through the second floor from the machine, in fiber tubes, 1-1/16 in. outside diameter, $\frac{7}{8}$ in. inside diameter, each cable being $\frac{3}{4}$ in. in diameter. The cables are run on vertical strips of 1 in. square, No. 13 gage, wire meshing to which it is tied, upon coming through the floors to the racks.

Underground cables from the outside are brought up through the cement casement floor from the vault through $1\frac{1}{2}$ in. steel pipe nipples. They are taped and painted with an insulating paint and then distributed to several rows of terminals at the base of the racks.

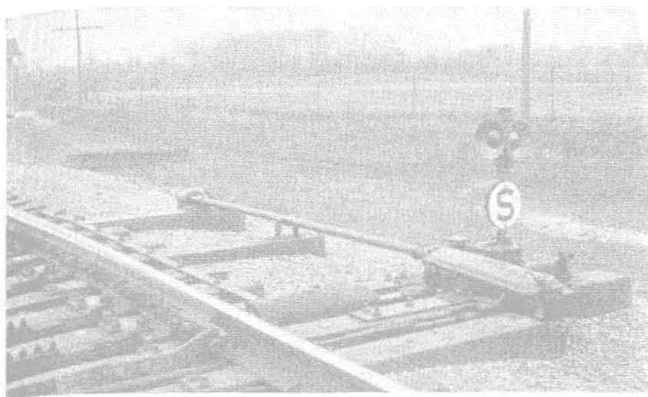
Power Supply

Direct current track circuits are used, the circuits being fed from one cell of M-5 Exide storage battery on floating charge from an RX-10 rectifier. The feed to the track is adjusted by an 8-ohm or 2-ohm fixed and a 25-ohm or 8-ohm adjustable resistor. The main battery for control circuits, located in each tower, is made up of 7 cells of Exide M-9 storage battery, on floating charge from an RP-21 rectifier.

Power is supplied at 21st Street at 220 volts and is stepped up to 440 volts to run to 16th Street. A 2-conductor No. 4 cable, underground, is used for power transmission. Another supply is located at 14th Street with automatic changeover. Two aerial cables of 48 and 19 conductors, extend between the two towers on a pole line.

Entirely new wiring distribution systems, using underground cable, were installed from the towers to the

(Continued on page 135)



View of the spring and oil buffer mechanism, Type-A facing-point lock, hand-throw stand, "S" target sign and target switch lamp

flected out of normal position by a passing train, and later the points again close, the point-detector, having been operated, will lock out, and hold the contacts open and signals at stop until the switch is inspected and the controller reset.

Design of the locking mechanism allows for shifting of ties and running of the rail such that overthrow of the plunger, from that cause, sufficient to prevent unlocking for a trailing move, is impossible. Nevertheless, if circumstances are such that the plunger might possibly not be withdrawn sufficiently, the circuit controller is operated to hold the signals at the Stop aspect until the condition is corrected.

Based on the fact that improper alinement of this switch would be detected by the mechanism and result in train stops, many of which might be unnecessary, the new switch was equipped with proper plates and braces to hold it in place, the same as an interlocked switch would be equipped. Heavy tie plates, 1 in. thick, are held in place with screw spikes. Adjustable rail braces are used on the tie ahead of the points as well as on the No. 1, 2, 3, 5, 7, 8 and 9 ties under the points. An insulated gage plate $\frac{3}{4}$ in. thick and 8 in. wide is used on the No. 8 tie, and this plate extends on top of the tie to form a mounting plate for the escapement housing. This arrangement maintains the correct relative position of the rails and the escapement housing. Although it is not necessary to maintain rigidly the relative location of the escapement and locking mechanisms, a $\frac{1}{2}$ -in. by 2-in. tie strap is applied on each side of the switch. An adequate number of anti-creepers were applied to minimize running of the rails.

In order to make the switch operate freely by minimizing the drag of the points on the plates, a pair of roller bearings, furnished by the Union Switch & Signal Company, were installed between the No. 7 and the No. 8 ties. Normally, these roller bearings support the switch points,

but, when a load is placed on the points, the plates under the bearings spring down and allow the points to rest on the tie plates.

Based on extensive tests made on the Pere Marquette as well as other roads, a spring switch installed at the end of a passing track using a No. 10 turnout will save an average of 8 min. for each freight train by eliminating the train delays and stops formerly occasioned by the

necessity of operating the hand throw stand. As between two spring switch layouts, one with a No. 10 turnout permitting an average speed of 15 m.p.h. for the length of a freight train including 70 cars, and a No. 20 turnout permitting an average speed of 30 m.p.h., the No. 20 turnout permits the train to pull out of the switch in half the time, and, furthermore, when the train is all out on the main line it is already up to a speed of 30 m.p.h., whereas with a No. 10 turnout it would have to lose more time in accelerating to 30 m.p.h. Thus the No. 20 turnout saves about 5 min. or more depending on the grades and the capacity of the locomotive with reference to the tonnage being hauled.

This installation, including the signaling changes and additions, was planned and installed by the signal forces of the Pere Marquette, the major items of equipment being furnished by the General Railway Signal Company.

New C. & W. I. Interlockings

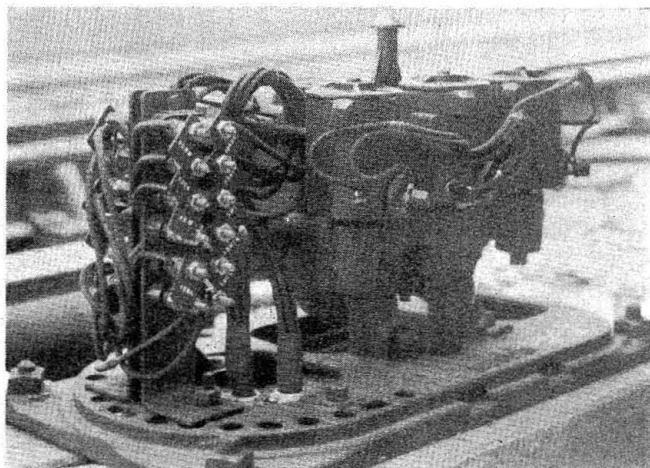
(Continued from page 132)

various junction boxes, instrument cases and switches in the two plant areas. Single-conductor No. 8 cable is used for the connections to the rails, and multiple-conductor No. 14 for other circuits. The cable is made up of insulated conductors, filler, lead sheath, filler, two wraps of steel tape, filler and an outer covering of impregnated cotton duck, this last item being a special feature developed by the C. & W. I. because this duck has a long life. The insulated wires and cables on these installations were furnished by the Okonite Company.

The control relays are of the DN-11 and DN-22 type, and the indicating

relays are of the LT-10 type. The transformers are of the W-10 and W-20 type. The clock-work time releases are of the TC-10 type.

The reconstruction of 15th and 16th Street interlocking plants was handled under the general jurisdiction of F. E. Morrow, chief engineer, Chicago & Western Indiana, with planning by F. E. Beutler, assistant engineer. The construction work in charge of V. R. Walling, superintendent, was performed by company forces under the direct supervision of George M. Kelley, signal supervisor. The major items of equipment were furnished by the Union Switch & Signal Company.



Typical "CP" valve of switch and lock movement. Note the vertical terminal board at left