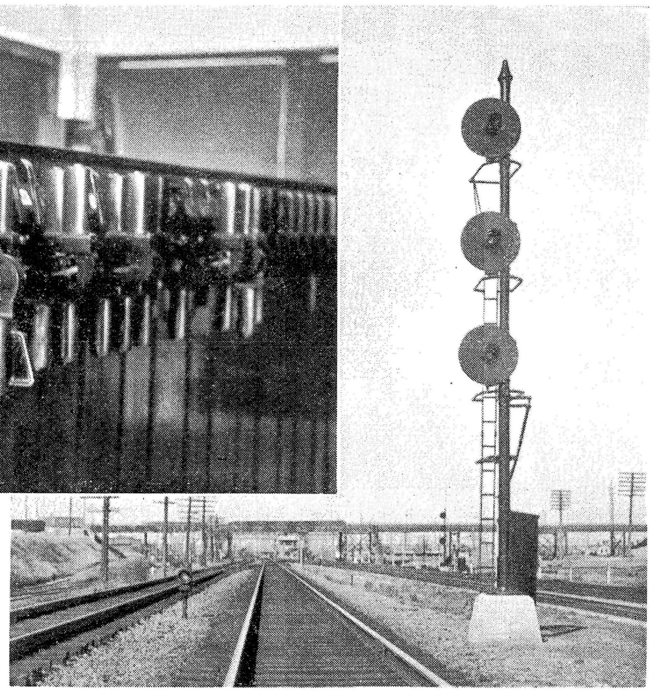


New York Central Interlocking at Syracuse

Aerial lead cables for distribution—New type mercury rectifier for switch operation—A-c. primary feeds for lock circuits and track circuits

An electric interlocking with 63 working levers has been installed by the New York Central at Syracuse Junction, 2.5 miles west of the station at Syracuse, N.Y. An electro-pneumatic interlocking had been in service at this location since 1903, where the four-track main line of the New York Central and the double-track West Shore line come together and where the main line tracks separate, the two passenger tracks running through the city to the old station and the freight tracks extending around the north side of the main section of the city. The occasion for extensive changes in the track layout and interlocking was brought about at this time by the construction of a new passenger station at a location several blocks north and east of the old Syracuse station. The new double-track line through this new station diverges from the old passenger main line just east of the Syracuse Junction interlocking and extends through the city via the new station on an elevation following the West Shore right of way so as to eliminate all grade crossings with streets. The construction of this new line necessitated several track changes and extensions of the interlocking at Syracuse Junction. As it was not practicable to extend the old electro-pneumatic plant, it was necessary to install an entirely new interlocking.

The new signal station building is of concrete and brick construction located on the north side of the tracks about 300 ft. east of the old tower. The new interlocking machine has an 80-lever frame, using 44 levers for 46 signals, 17 levers for 25 switches and 3 derails, 2 levers for traffic levers, totaling 63 working levers, 17 additional spaces being spare.

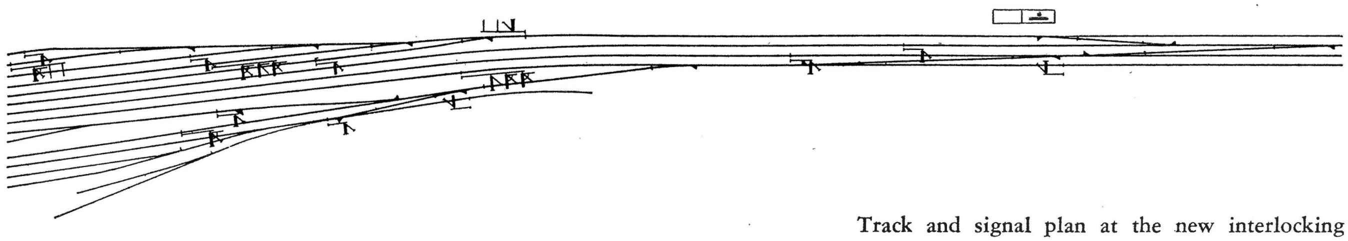
The interlocking machine is of the G.R.S. Model-5 Form-A all-electric type equipped with latch-lever locking and forced-drop electric locks. The switches are operated and indicated by the regular G.R.S. system, using dynamic indication with individual cross protection. One lever is used for the control of each cross-over, double indication being provided.

Electric locks are not provided on signal levers. Each slow-speed signal lever is equipped with a 15-second mechanical time release which, with the signal red repeater, controls the route-locking stick relays. Approach locking for the high-speed routes is obtained by placing approach-locking stick relays in the controls of the route-locking relay. Approach locking is released by manually-operated two minute clockwork time releases.

A small lamp is mounted behind the frosted glass number plate on each lever. On a switch lever this lamp is lighted when the lever is unlocked electrically, thus informing the leverman that it can be used. For the signal levers this number plate lamp is illuminated when the signal is cleared and remains lighted until the signal assumes the stop position. The polar relays are glass enclosed but the leverman can get to them to reset them. Likewise he can replace a fuse but he cannot get to any other apparatus in the machine. A special fuse tester with a light as an indicator is provided.

Power Supply of Special Interest

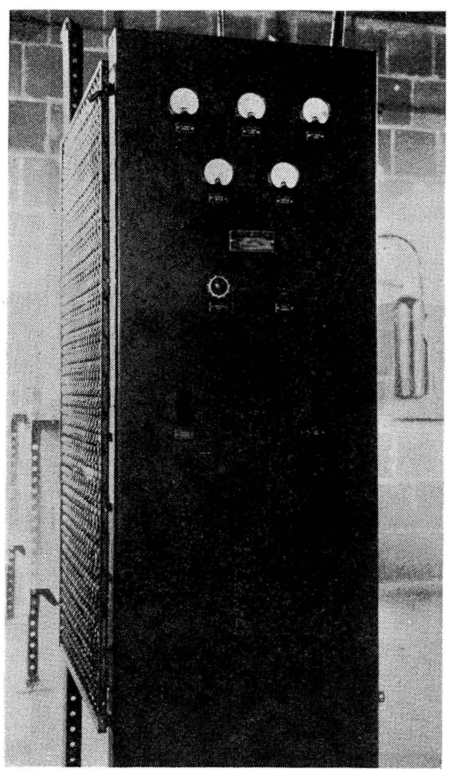
The 110-volt d-c. switch machines are normally supplied with power from a new type mercury pool recti-



Track and signal plan at the new interlocking

fier rated at 30 amps. and 120 volts. A set of 100 Edison-AH4, 150 a.h. cells automatically functions as a standby source of power for the switch machines in case the a.c. supply fails or the rectifier ceases operation.

The starting of the mercury-pool rectifier is automatic, using a scheme in which, by means of a solenoid outside the tube, a contact over the mercury pool is drawn down into the mercury to strike the arc. The mercury-pool tube is of a design specified by the signal department of the New York Central, differing from the conventional type of mercury-arc rectifier tube in that the anodes are sealed in with fernico, a metal having the same expansion characteristics as glass, thus permitting peak currents several times that permitted with a conventional pinched glass seal.



Instrument panel for power rectifier

The battery is on a floating charge of intermittent direct current taken from the peaks of the cycles of positive current from the rectifier output. This result is effected by a FG-104 phanotron tube which acts as a valve allowing current to flow into the battery when the instantaneous value of the rectifier output exceeds the battery voltage. With this arrangement the potential of the high-voltage bus for the feed to the switch machines is maintained at only the desired voltage, as it is not affected by the charging voltage of the battery.

When one or more switches are being thrown, the power demand is supplied directly from the rectifier without the ordinary loss of efficiency inherent with the usual method of charging the battery and operating the switches direct from the battery. The mercury tube control equipment instruments and panel were furnished by the General Electric Co.

The low-voltage direct current control and lock circuits are fed from a G.R.S. type BP size 248 rectifier, floating a set of ten 300 a.h. nickle-iron cells. The rectifier is rated to deliver 4½ amps. at 20 volts. At 15½ volts d.c., the normal load of the control and lock circuits with the charging current is 4 amps.

Automatic Ground Detector

A ground-detector system which operates automatically has been installed as a part of this plant. One of these ground detectors is provided for the high voltage d-c. switch ma-

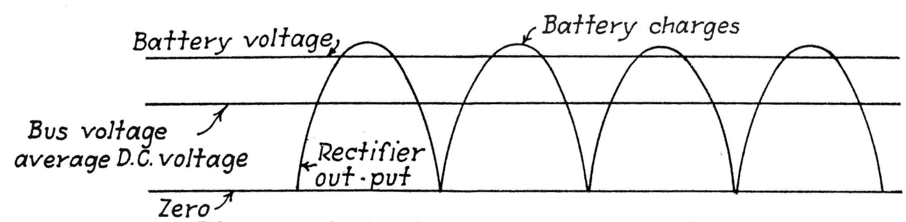
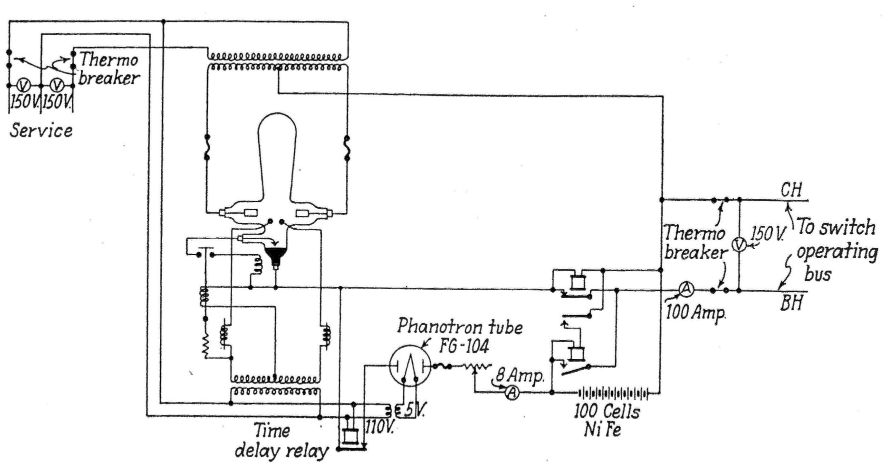
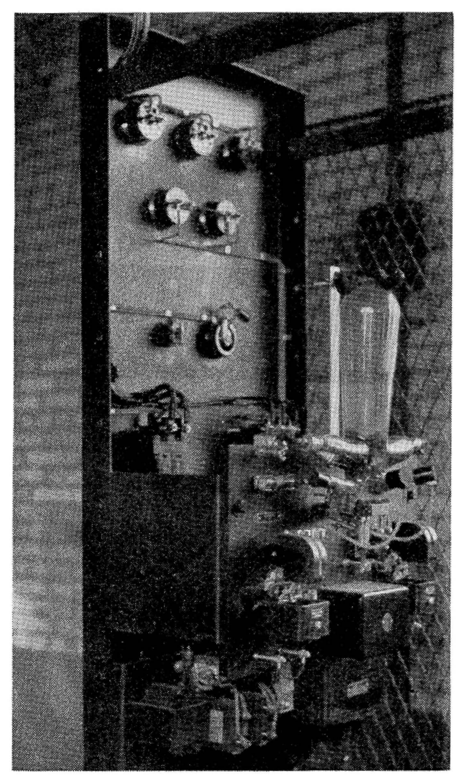


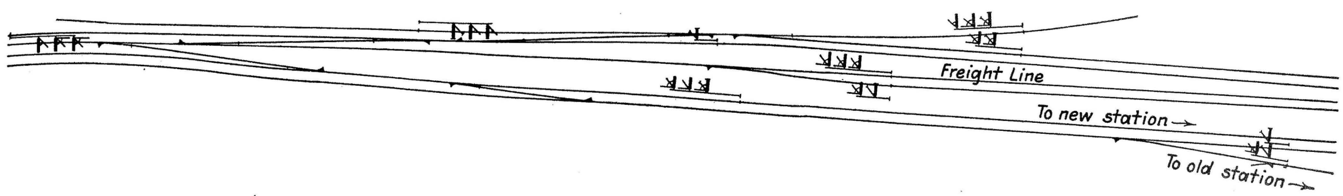
Diagram explaining charging voltage from rectifier



Circuit diagram for power rectifier



The rectifier starts automatically



at Syracuse Jct. involving 63 working levers

chine control circuits and another for the low-voltage control circuits. Each ground detector system consists of a special balanced relay, a set of buttons mounted on a small panel attached to the relay in front of the coils and a set of lamps mounted on the panel above the rectifier, as shown in the illustration. Connections are shown on the diagram.

The specially balanced relay is made up of a G.R.S. Style-K flasher relay frame. The two neutral coils of the relay, those shown at the outside, are each wound to 4000 ohms, while the center coil is wound to 560 ohms. The ground-indicator is placed across the 15-volt bus that supplies energy to the control circuits. From the diagram it will be noted that the two coils A and C are in series across the low-volt battery. These two coils are nicely balanced so that the pivoted armature is normally on center, but a difference of 0.7 m.a. will destroy the balance and operate the relay. Contacts 1 and 2 are normally closed so that the connection between the coils A and C is connected to ground. Contact 3 is normally on center while contact 4 is a split contact opening either front or back when the armature leaves the center position.

If a ground occurs, relay G is de-energized which lights a red lamp on the illuminated track diagram in the operating room. At the same time the pointer connected to the armature, which can be seen through the glass cover of the ground indicator, moves to one of the markings negative or plus depending on the polarity of the ground. By the leverman noting the number of the lever operated, the position of the train or route lined, etc., the maintainer has information at once of the ground and where to look for it.

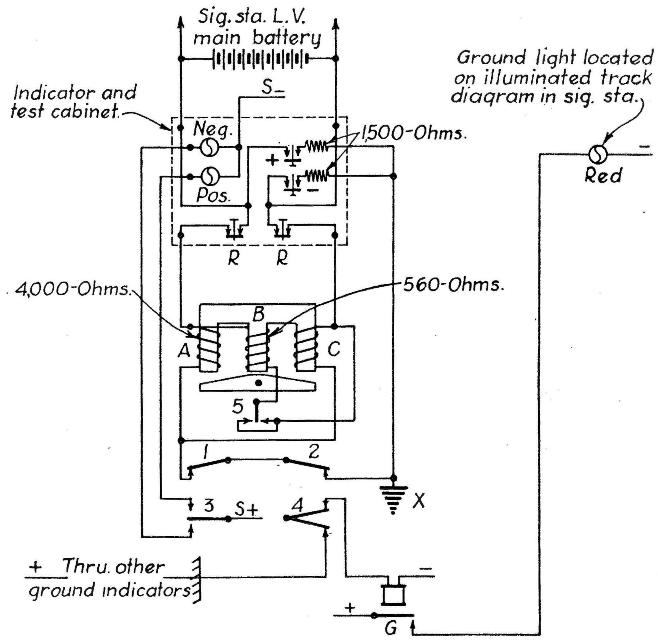
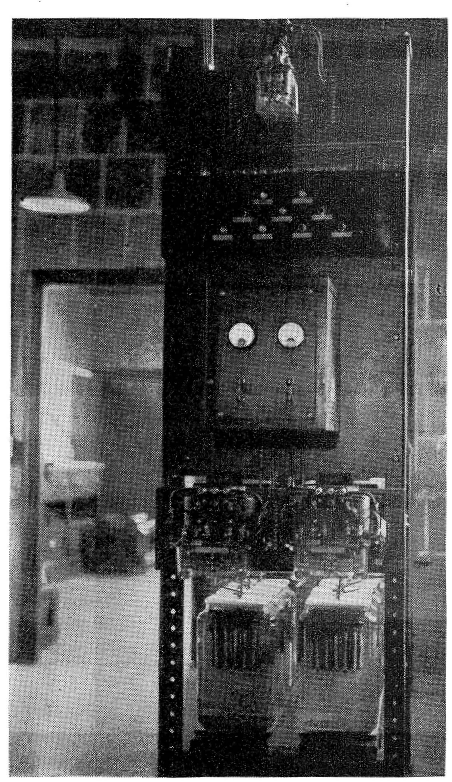


Diagram of circuits for automatic ground detector

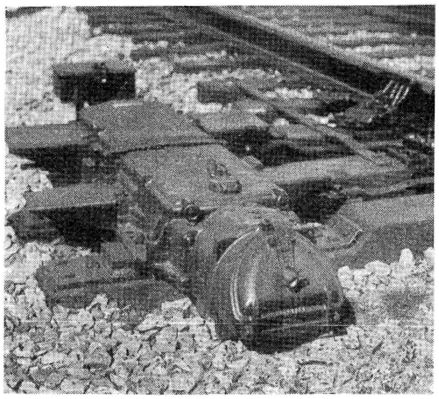
The operation of the balanced relay when a ground comes on is as follows: If it is a positive ground, coil C would be energized stronger than coil A, because the ground would be shunting coil A, thus providing additional current for coil C, which would throw the left end of the pivoted armature up, thus opening front contact of contact 4, dropping relay G as explained above. As the left side of the armature moves up toward coil C it reduces this air gap and increases that to A. This further increases the flux of coil C and further reduces that of coil A, however, due to the tension of contacts 2 and 4 and due to contact 1 removing normal ground, contact 3 is employed to energize coil B on the center leg to insure that armature will lock up against coil C.

The maintainer then goes to the indicator panel, which is mounted on the relay, where he pushes the button restoring the relay to the normal position. If, after releasing the button, the indicator remains normal, he knows that the ground was on a circuit not then energized. By reproducing the movement or set up, the ground will come on and he will note which circuit in closing trips the indicator. The relay as arranged will detect a ground of 7000 ohms but can be made to indicate a ground of approximately 50,000 ohms.

A test switch is provided to place temporary grounds of 1,500 ohms (plus or minus) on the battery for the purpose of checking the operation of the indicator and lamps not normally lighted. Incidentally, however, the maintainer makes use of this to check the extent of the ground that comes on; for example, if the indicator shows a positive ground the maintainer will place the temporary negative ground on the circuit by moving test switch in the direction marked



The special ground-detector relays are mounted below the rectifier, and the indicating lamps are above



The ties are dapped so as to lower the switch machine with reference to the rail

negative. If, after releasing the switch, the indicator shows negative, he knows that the positive ground is more than 1,500 ohms, and if it shows a positive ground he knows that it is less than 1,500 ohms, while if it remains clear he knows that it is approximately 1,500 ohms. The high-volt indicator is similar to the low volt indicator except that the coil resistances, etc., are correspondingly higher.

Track Circuits Fed from Rectifiers with Primary Battery Standby

The track relays are 4-ohm Type-K, size 2, with a pick-up of approximately 64 m.a. and a drop-away of 41 m.a. Each track circuit is fed normally from a G.R.S. Type BY automatic rectifier. A set of 3 Edison 1000 a.h. primary cells is provided as a standby source of power for each track circuit to be used in case of an a.c. power outage. As shown in the diagram the primary battery is normally on open circuit, its connection to the track feed being controlled through a back contact of a 50 ohm Type-K size 2, d-c. cut-in relay which is normally energized by the direct current potential being fed from the rectifier to the track. The cut-in relay is equipped with an adjustable spring tension which opposes the pull of the armature and this spring tension can be adjusted so as to cut the battery in the circuit when the d-c. voltage supplied by the rectifier is reduced to any certain reading. These spring tensions are so adjusted that the battery is cut in when the voltage from the rectifier drops to equal the normal voltage of the battery and vice versa; in case the a-c. power is turned on after being off, the cut-in relay picks up when the d-c. voltage from the rectifier exceeds the normal load voltage of the battery. With this arrangement the feed to the track circuit is not interrupted during changes from one source of power to another.

The half-wave Type B¼ rectifier valve, connected in the circuit as shown, is used to prevent the battery voltage from energizing the cut-in relay during the time the a-c. power is off. An indicating lamp controlled by the cut-in relay shows the maintainer when a battery is cut in due to a blown fuse, a rectifier failure, etc.

Aerial Cables for Main Wiring Distribution

An important feature of this new Syracuse Junction plant is the use of lead-covered aerial cables for the main wiring distribution over the plant. The cables are made up according to New York Central specification. One cable throughout the length of the plant includes a twisted pair of No. 14 conductors which are used for the maintainer's telephone circuit.

Each of the lead cables is about 2 in. outside diameter and weighs about 4 lb. per foot. Each cable is suspended from a messenger consisting of seven strands of extra high tension No. 8 Copperweld wires, the diameter of the messenger being ⅜ in. rated at 13,800 lb. breaking strength. These messengers are attached to either side of an A.A.R. Signal Section concrete posts set not more than 35 ft. apart. The cables are suspended by Raco cable straps spaced 14 in. apart. At points where the cables leave the messenger to enter housings, or at cable line corners, Raco cable clamps with wood inserts are used. At each end of each main run the messengers are held by strong metal posts set on concrete foundations poured in place.

In the tower, as well as in the outlying junction boxes and instrument houses, the lead cable is run to the terminal board, the lead sheath being left on as far as practicable, at which point the cable is pot-headed, and from the pot head to the terminal the insulation on each conductor is protected by a varnished cambric sleeve which is slipped over the insulation and sealed in the pot head.

Instrument Housing in Field

At a centrally located point at the east end of the plant, as well as at a similar location on the west end, there is a welded sheet-metal house, 6 ft. by 10 ft., for the housing of instruments and battery. In addition to the power supply systems already explained, there is, in each of these houses, a battery of two sets of 18 cells each in parallel, of Edison-BH4 storage cells which is provided as stand-by supply for line circuits, the signals and signal lamps in the respective sections of the plant. Each of these sets of cells is charged by a Type-BT rectifier. The terminal boards and relay racks in these houses are of practically the same construction as in the main signal station, as will be explained later.

From these houses and intermediate junction boxes on the main cable leads, the circuits are extended to the switch machines, signals and track connections in underground trench cable

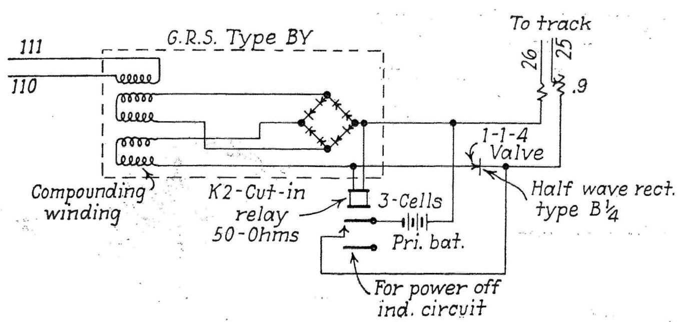
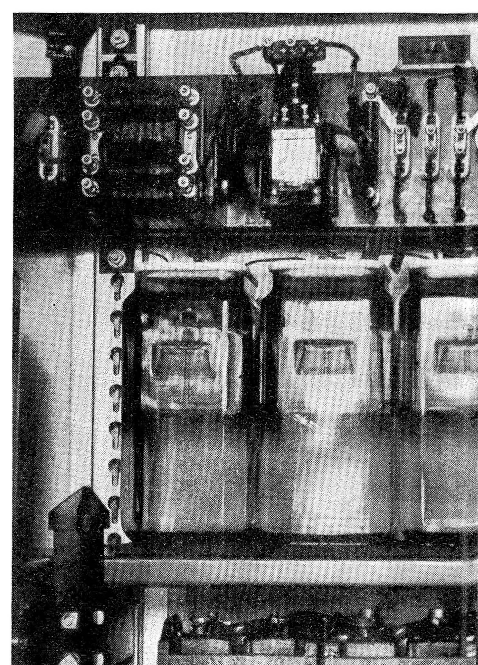
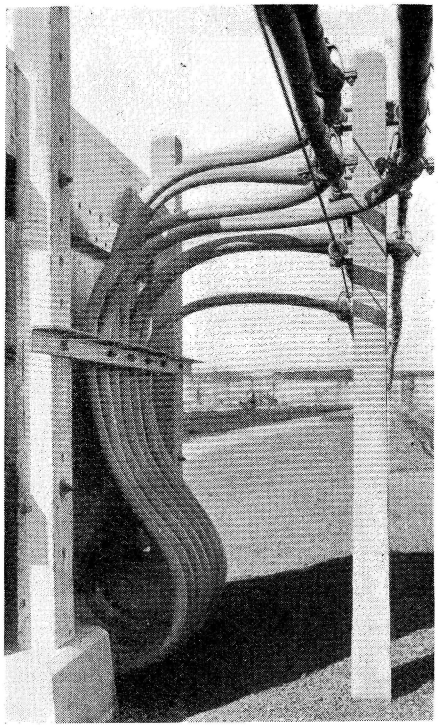


Diagram of track circuit feed



Typical arrangement of rectifier, relay, and battery for track circuit feed



Construction where cable line enters junction box

which is buried at least 18 in. and surrounded by 3 in. of sand, and, in addition, a 1-in. creosoted wood plank is laid on top of the sand to prevent damage to the cable from picks or other track tools.

Each of these underground cable runs is marked on the surface of the ground by cast-iron marker plates. The plates have arrows pointing in the direction which cables extend from turns or junctions. The plate 6 in. in diameter, set level with the surface of the ground, forms the top of a pedestal 18 in. high set in the ground.

At all points where parkway cable comes up out of the ground, it is run through an 18-in. section of cast-iron pipe, and the void is filled with asphaltum, the purpose being to protect the covering on the cable at the ground line where changes in moisture are most conducive to deterioration.

At each switch machine the underground cable is brought up into a cast-iron terminal box set on a concrete foundation located about 2 ft. from the end of the switch machine. Single-stranded conductors extend in a made-up cable from these terminals to the machine so as to allow for vibration of the machine with reference to the terminal box. This cable is painted with asphaltum to protect it from the weather and salt brine drippings from refrigerator cars. At high signals and at signal bridges, the trench cable is carried up the bridge masts and to the signals, the sections above ground line being painted with an asphaltum compound.

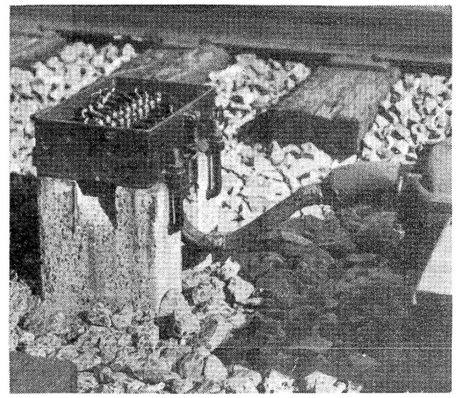
At rail connections, the underground cable is brought up through a Raco bootleg outlet to the connection on top from which two stranded Copperweld wire cables extend to two plugs in the rail.

Relay Rack in Signal Station

In the signal station the main room of the ground floor is utilized as an instrument room. The relays are all of the wall type with spring mountings, and are attached to sheet-metal boards supported from angle-iron uprights, which go to make up the Raco relay racks. The face of each board is 8 in. high. The first board is set 16 in. from the floor, and there is a 4 in. vertical space between each of the six boards on each rack. The racks are set back to back with 24 in. spacing from face to face, the intervening space being used for wire and cable runs. A space of 33 in. is allowed from the face of one rack to the next one.

Beneath the racks there is a pit 18 in. deep below floor level which is used for incoming cable runs, this area being normally covered in the runways by steel plates. The lower boards or panels are used as terminal boards, each incoming cable wire being terminated on a Raco bakelite-based terminal, these terminals being furnished in blocks of six each. Alongside each relay there is a bakelite template with individual holes through which wires are brought separately, each hole being marked to show to which post of the relay the wire is attached.

The wiring in the relay racks and other instrument houses is No. 14 solid single-conductor with 4/64 in. rubber insulation, and the wiring in the interlocking machine is No. 14 stranded with 19 strands concentric lay having 4/64-in. rubber wall insulation. All single-conductor rubber-covered wire has braid which is flame and moisture proof.



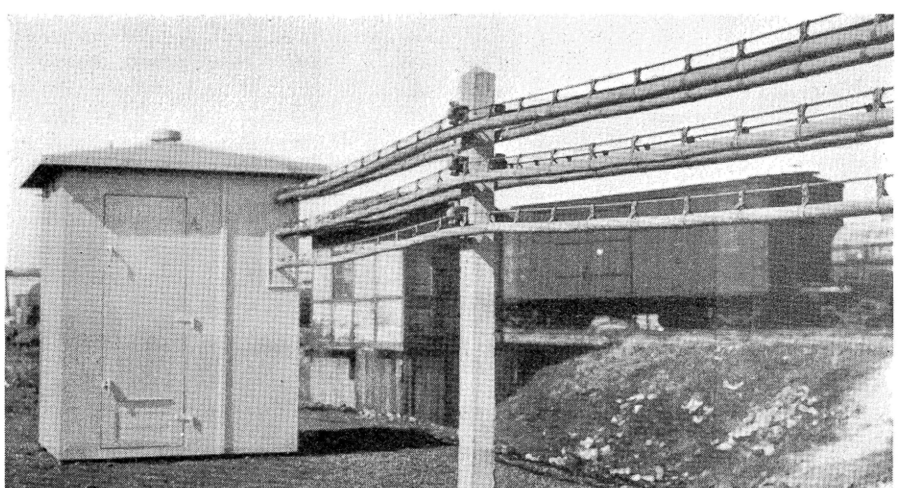
At each switch the underground cable terminates in a cast-iron junction box

Pit Beneath Interlocking Machine

The interlocking machine sets over a hole in the floor, thus forming a pit, the floor of which is a steel grating set 52 in. below the floor level of the tower, thus allowing full head room for a man to stand under the machine within easy reach of the apparatus and wiring on the interior of the interlocking machine.

The wiring is brought up from the relay racks to the machine in small made-up cables of single conductors which are held together with cable straps and are supported from ½-in. round rods. In addition to three fixed electric lamps, a lamp on an extension cord is available to illuminate the pit.

This interlocking was planned and installed by signal department forces of the New York Central, the major items of interlocking equipment, relays, rectifiers, etc., being furnished by the General Railway Signal Company.



The aerial lead cables are a feature of the new installation