Illinois Central Alternating Current Signaling

Construction Details and the Special Features of an Interesting Underground Conduit Installation

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The Illinois Central recently installed automatic block signals on its Omaha line from Sixteenth and Clark streets, Chicago, to Parkway, Illinois. This section consists of 10 miles of double track and carries the western through freight, through passenger, and suburban trains of the Illinois Central and all the Chicago freight and passenger business of the Soo Line. Five interlocking plants are included. The section of track shown in Fig. 2 is typical.

The high-tension power lines of the Sanitary District of Chicago and of the Public Service Company of Illinois parallel the right-of-way for a considerable distance, and their proximity led to the adoption of alternating current signal apparatus. Power is supplied by the Sanitary District at 2,300 volts, 60 cycles, three-phase, four-wire. The arrangement of the main transformer poles is shown in Fig. 4. The three transformers are oil-cooled and have each a normal capacity of 7½ KVA, with a 30-minute continuous overload capacity of 50 per cent. Five and 10 per cent taps are provided on the primaries. The transformers are star-delta connected and deliver 4,400 volts to the transmission line. Transformer fuse plugs are used for opening the circuit on the primary side and oil switches on the secondary side.

The transmission line consists of three No. 6 B. & S. gauge copper wires. They are carried overhead on the signal department's own pole line from the Chicago River to Parkway. The type of line construction and the relative location of the line transformer poles and the signals are illustrated by Fig. 12. The line transformers are oil-cooled, Scott-connected and deliver energy to the signal equipment at 110 volts, two-phase, three-wire. They have a rated capacity of ½ KVA with a two-hour continuous overload capacity of 50 per cent. The protective apparatus consists of three F-2 lightning arresters and three fuse cutout boxes arranged as shown in Figs 11 and 13. A suitable platform is provided to facilitate working at the transformers.

From the Chicago River to Sixteenth and Clark streets all wires are carried in underground cables. Fig. 10 shows the three-conductor pot head with petticoat cap for three No. 6 B. & S. gauge conductors and for mounting on a three-inch conduit. The power cable is Okonite, three-conductor No. 6

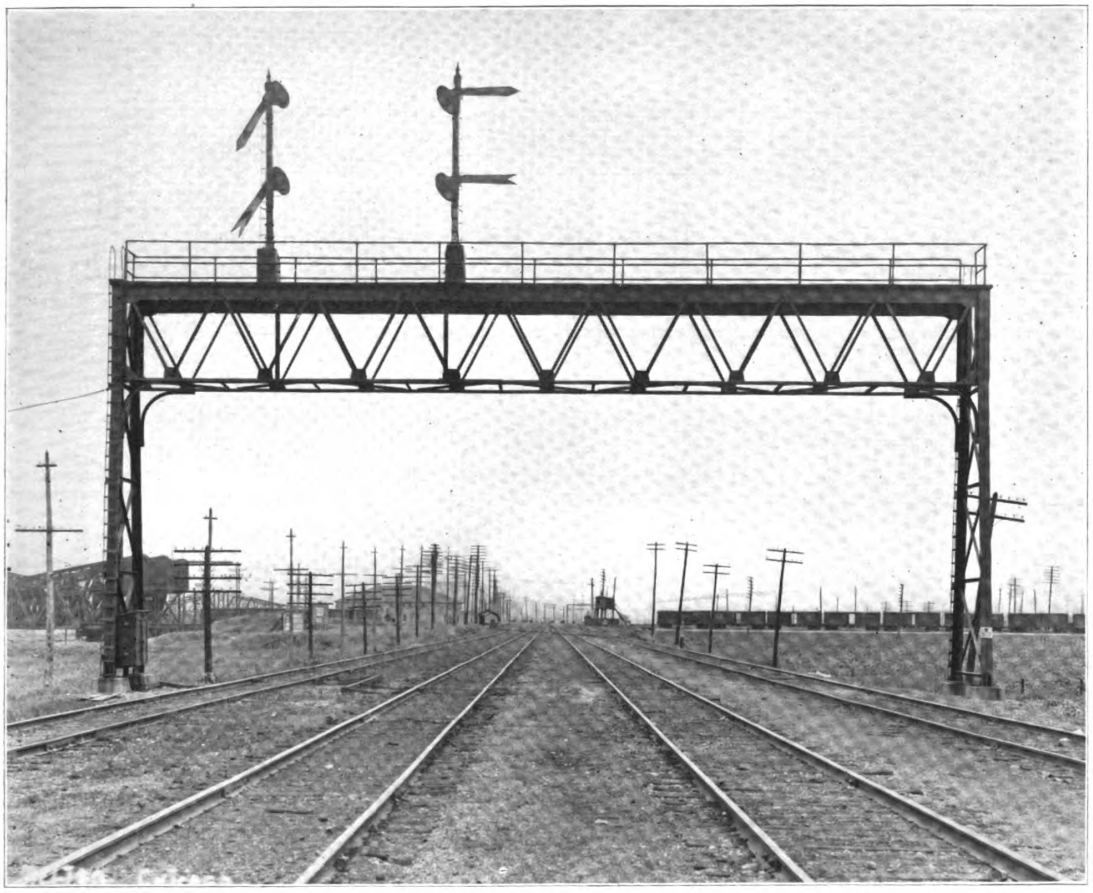

Fig. 1. Showing One of the Signal Bridges That Is Typical of the Installation.

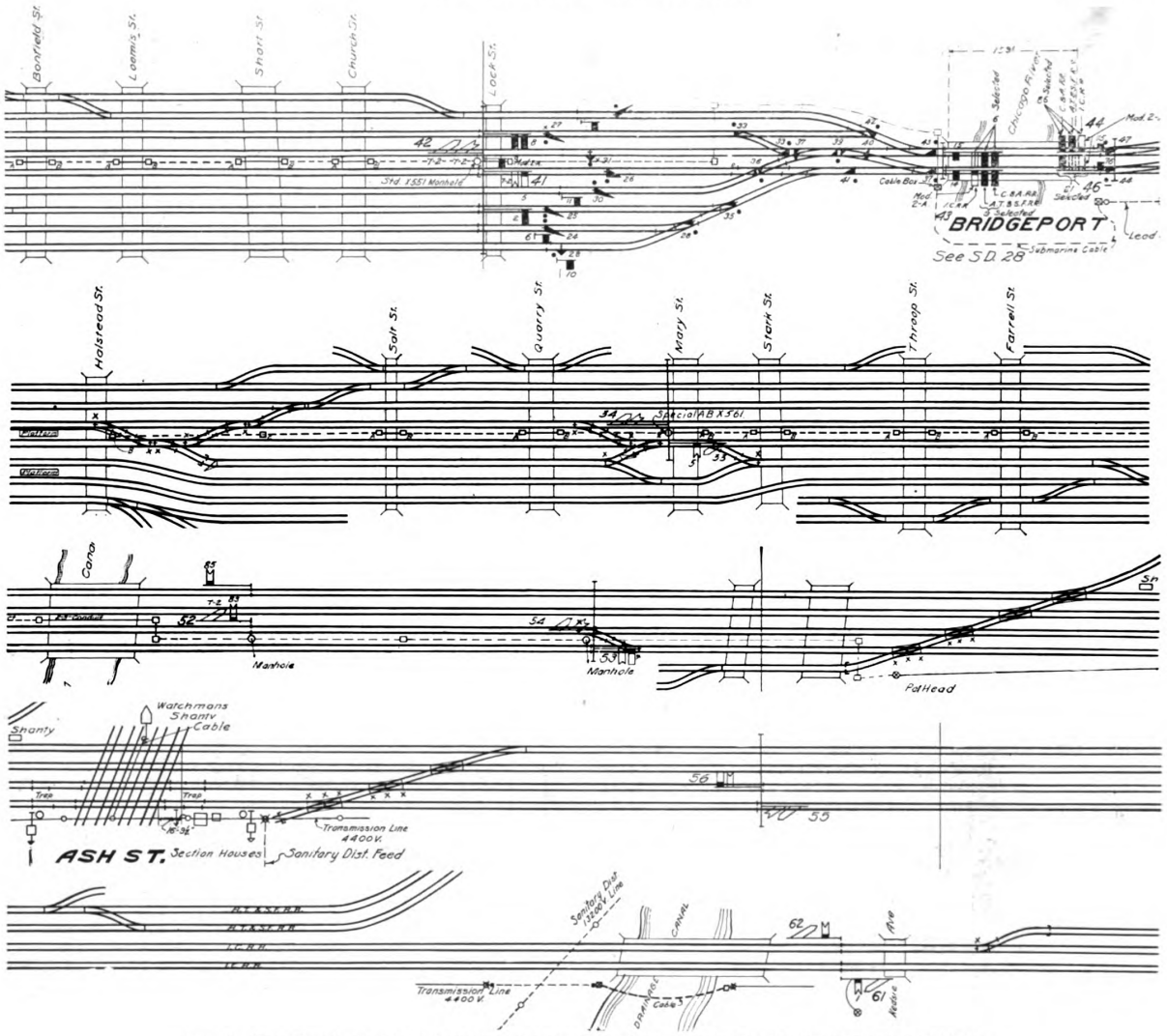

Fig. 2. The Track Layout and Signal Diagram, Showing the Underground Conduit Locations.

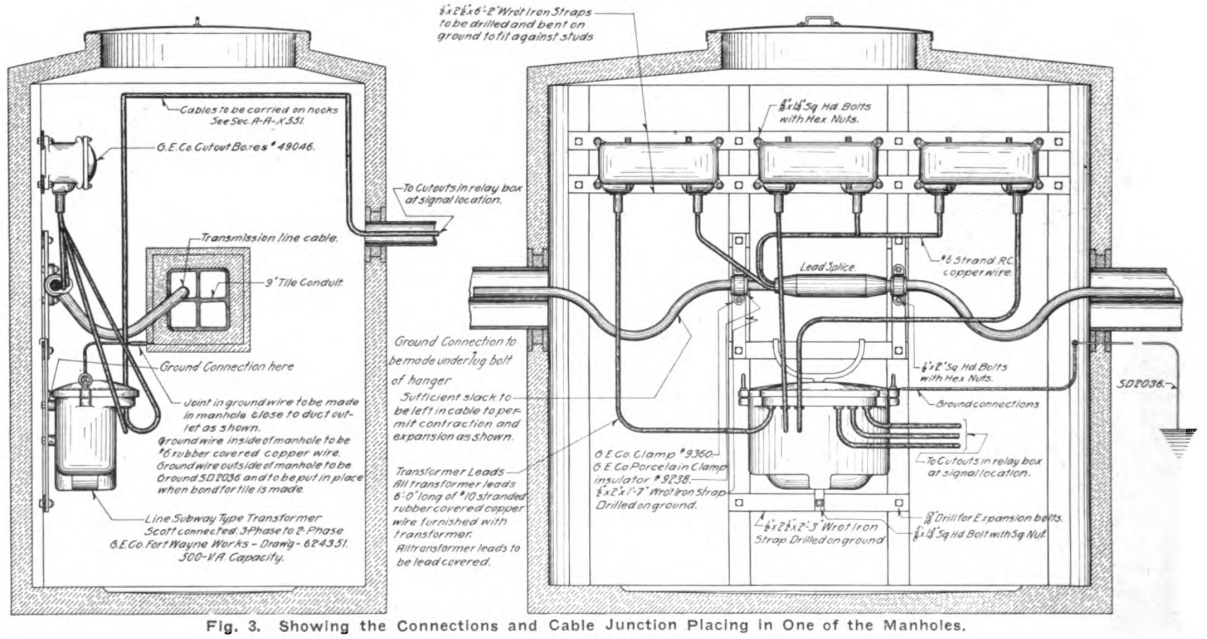

Fig. 3. Showing the Connections and Cable Junction Placing in One of the Manholes.

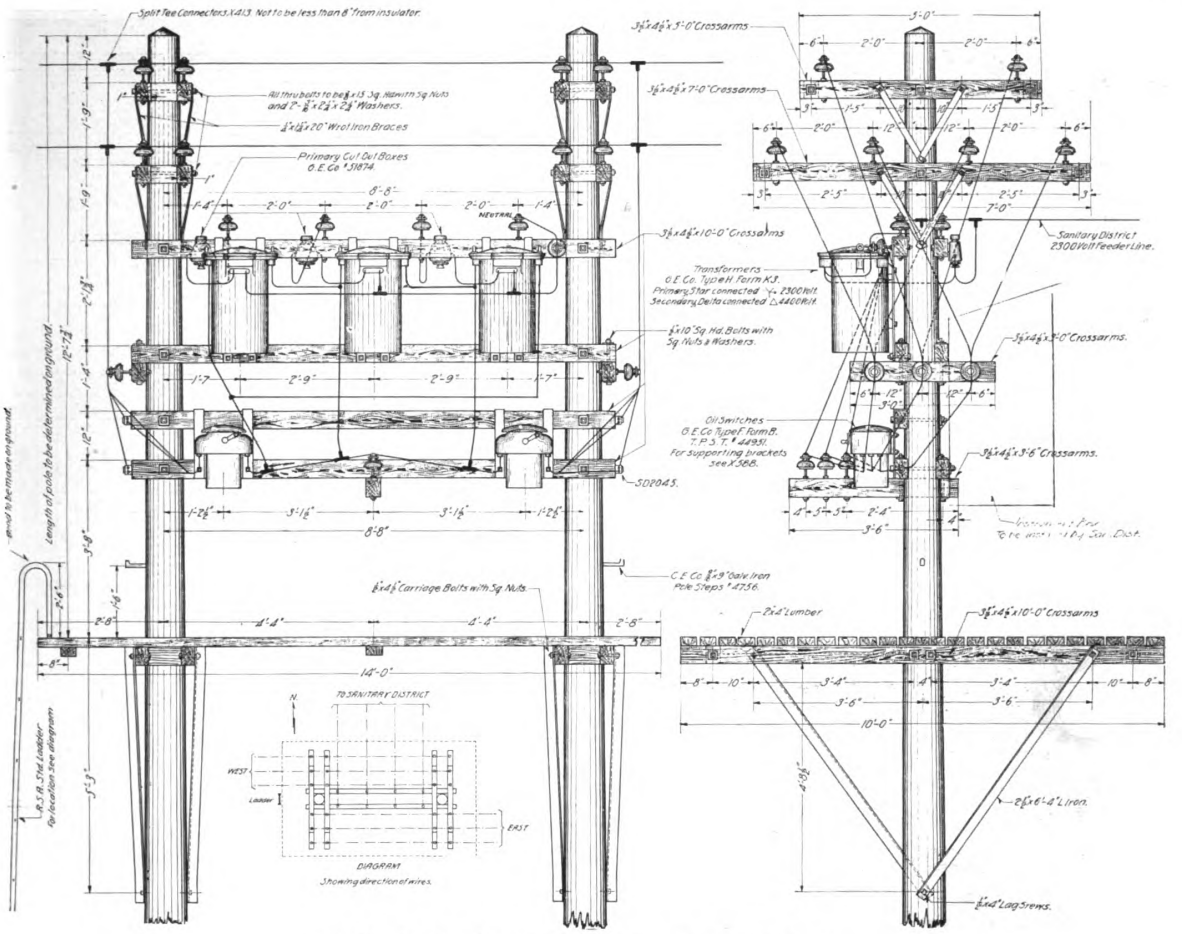

Fig. 4. Details of Construction of Main Transformer Poles.

B. & S. gauge solid soft-drawn copper with 4/64-in. 30 per cent pure Para rubber insulation and a 3/32-in. lead sheath. The signal and telephone wires are carried in 10, 12, 14 and 20-pair Okonite telephone cables, each conductor being No. 14 B. & S. gauge, solid wire with 3/16-in. wall or rubber insulation, one wire of each pair taped and one pair in each layer braided; cabled as per R. S. A. specifications; jute filled, and covered with one layer of tape and a ⅛-in. lead sheath.

The conduit consists of a four-duct clay tile laid in concrete. Manholes and junction boxes are of concrete and wire ready

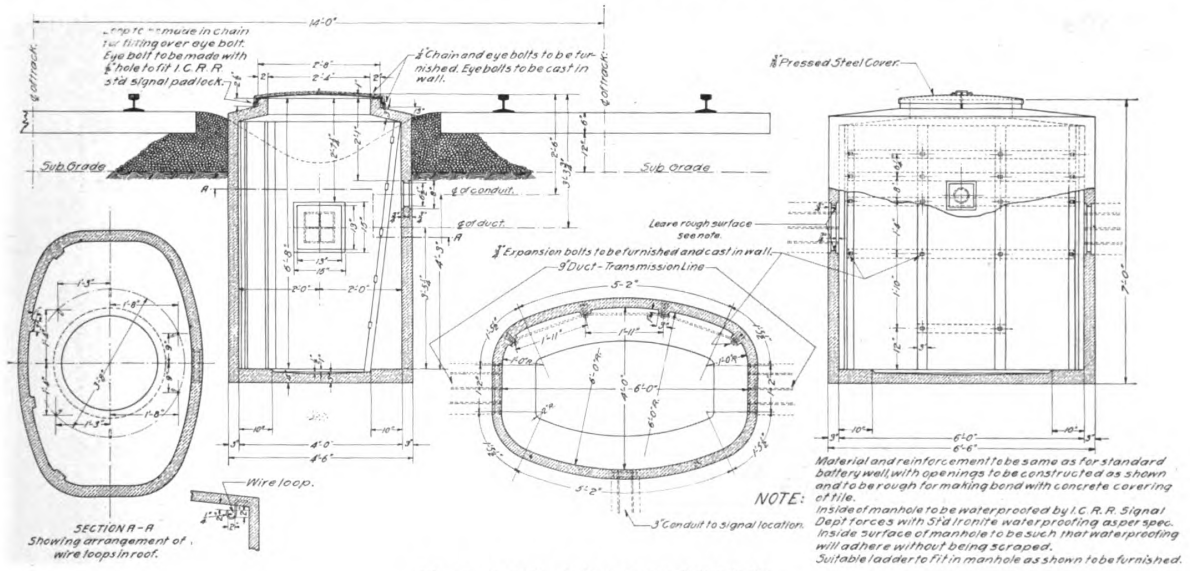

Fig. 5. Details of One Type of Manhole.

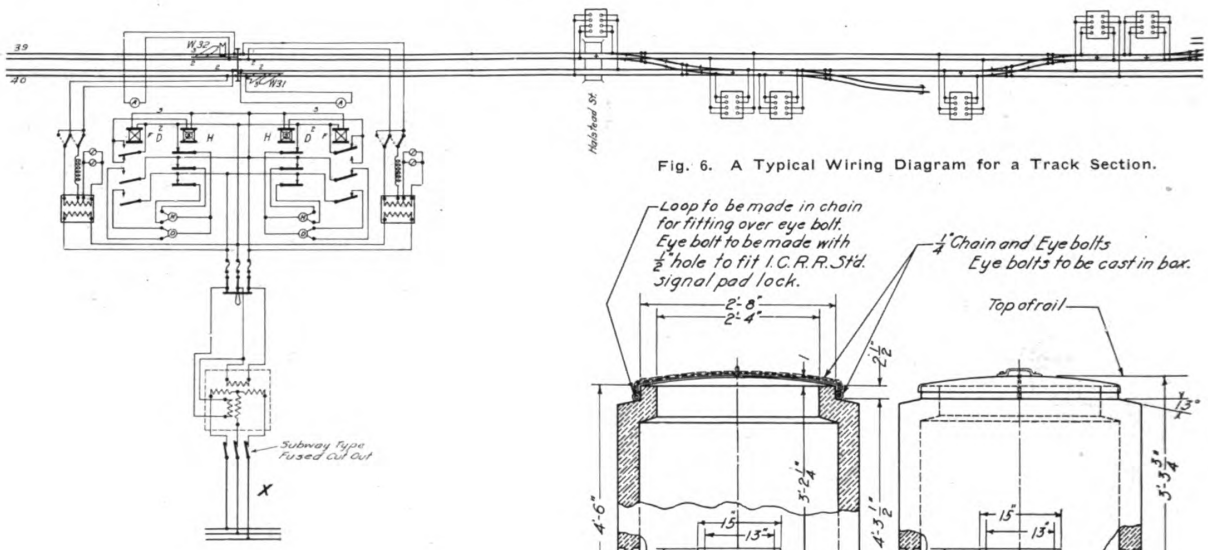

Fig. 6. A Typical Wiring Diagram for a Track Section.

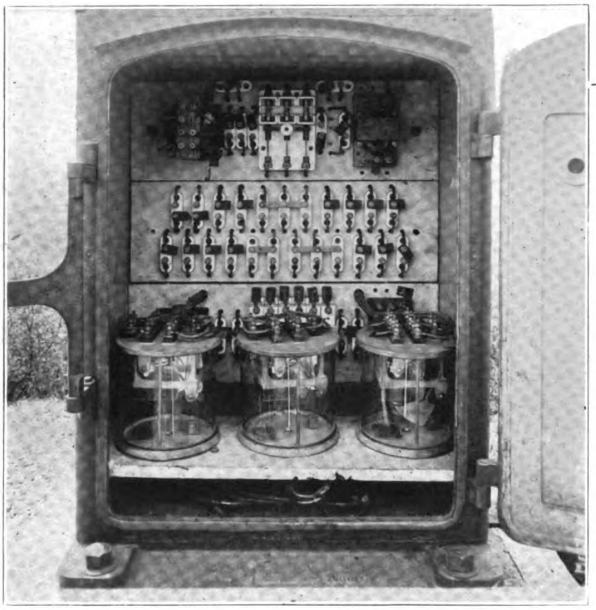

Fig. 7. Illustrating the Method Used in Wiring the Relay Case.

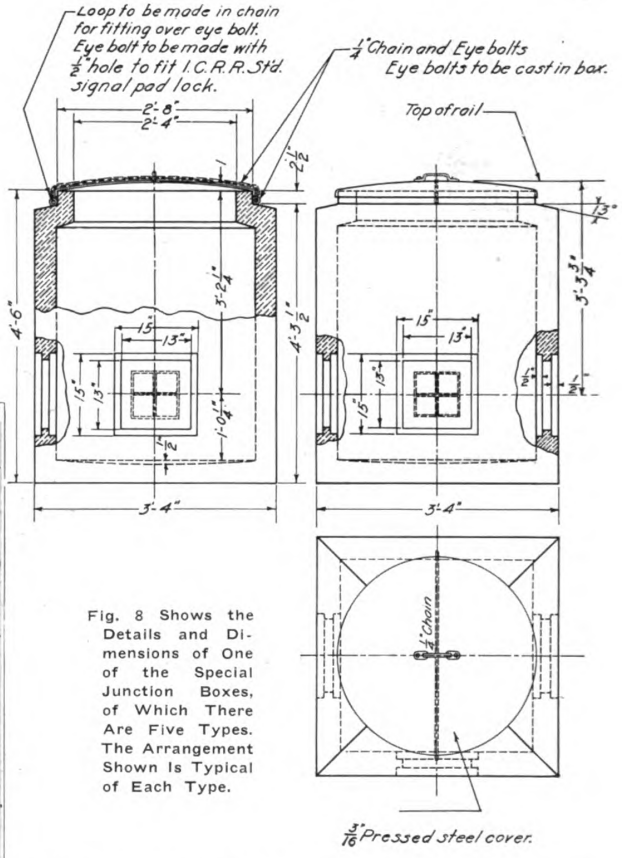

Fig. 8 Shows the Details and Dimensions of One of the Special Junction Boxes, of Which There Are Five Types. The Arrangement Shown Is Typical of Each Type.

cast and conveyed to their proper location and set. The manholes are elliptical. Details and dimensions are shown in Fig. 5, and the arrangement of cable junctions and transformer within is shown in Fig. 3. Fig. 8 is typical of the junction boxes, of which there are five "types" differing only in the arrangement of outlets.

Where the line crosses the Sanitary District Canal and the Chicago River, armored submarine cable is used. This is

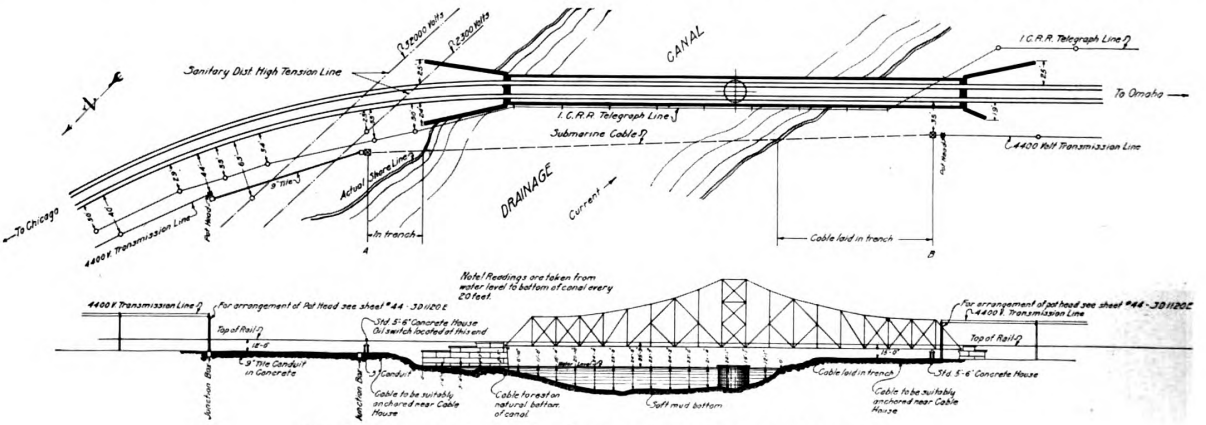

Fig. 9. How the Cable Was Carried Across the Drainage Canal.

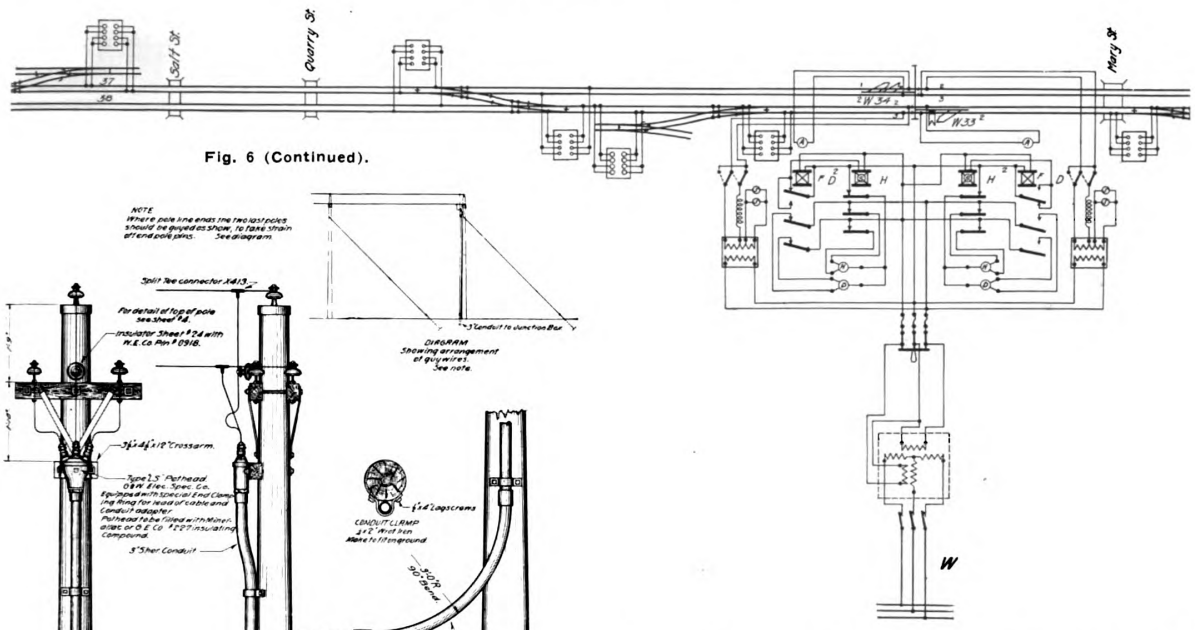

Fig. 6 (Continued).

Fig. 10. Showing a Typical Cable Inlet to a Pothead.

Okonite, three-conductor, stranded copper wire, with 6/32-in. rubber insulation, jute filled with 3/32-in. lead sheath and standard submarine armoring.

Fig. 9 illustrates the method of crossing the Sanitary District canal. Concrete cable houses are located at each side of the canal. These were purchased ready cast.

The signals, 60 in all, are Union Style "B" and Style "T," operated by two-phase induction motors. They are two-arm, home and distant, 60-degree, lower quadrant. The slots are single phase. One of the signal bridges is shown in Fig. 1. The control apparatus is sheltered in a wooden box attached to the bridge legs. The ground signals have double cases at the base of the pole, which contain the bottom-post mechanism and the relays. Fig. 14 shows the interior of both cases at a location, and Fig. 7 shows a relay case only. Detailed

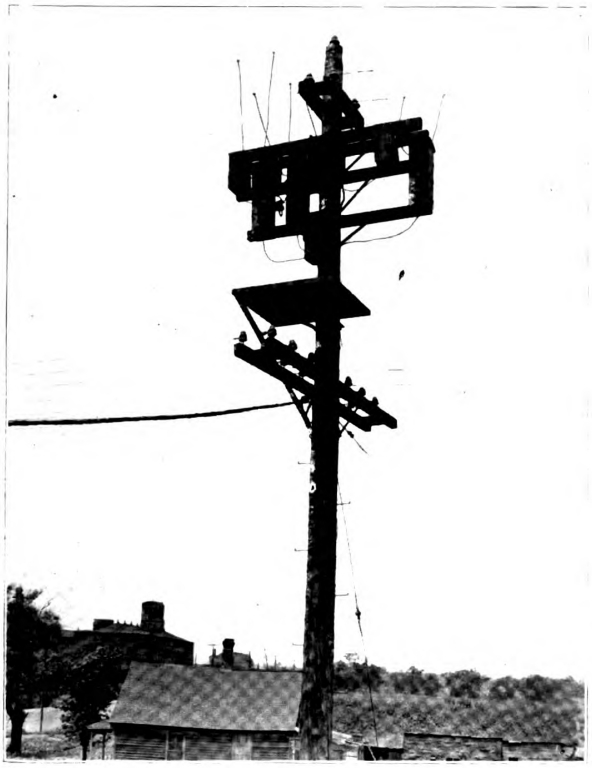

Fig. 11. Showing a Transformer on One of the Main Poles.

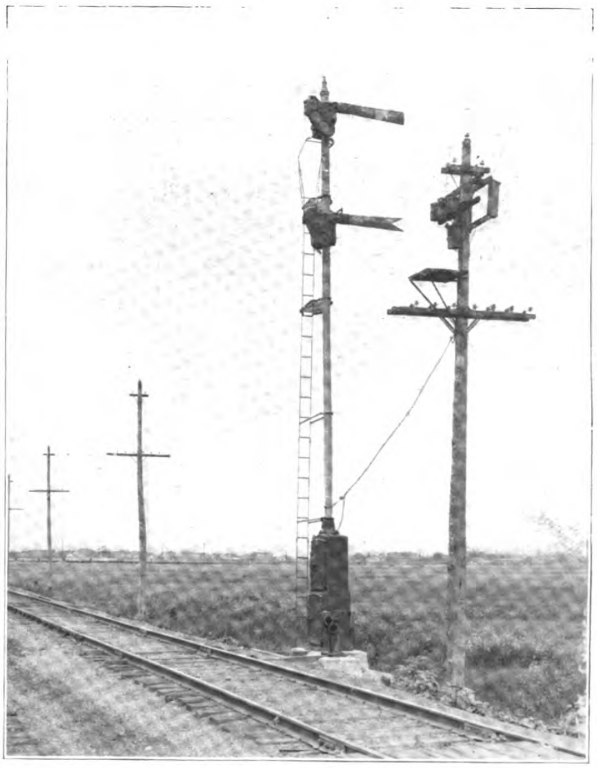

Fig. 12. Showing a Ground Signal Location and a Transformer Pole.

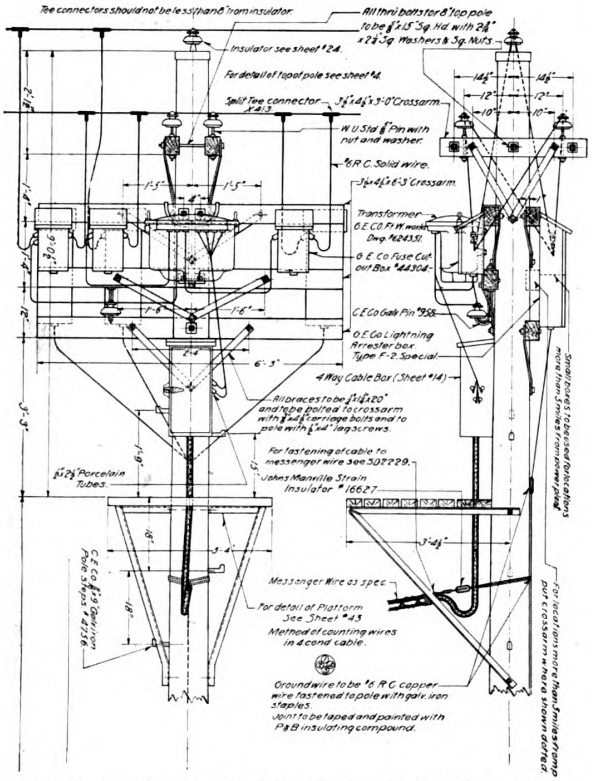

Fig. 13. Details of a Signal Transformer Pole and Connections.

wiring plans were made for each location, showing the exact position of all apparatus and the arrangement of all wires.

The signals are controlled by vane type relays. These, in turn, are controlled by three-position galvanometer track relays, except in special instances. Each track circuit is fed by a separate air-cooled transformer, the primary of which is connected to one 110-volt phase and the secondary of which is provided with taps providing 3, 5, 7, 10, 12 or 15 volts. The primary has a tap which feeds the signal lights. Each cast-iron signal lamp case contains two standard Mazda signal lamps connected in multiple. The flow of current to an occupied track section is limited by an impedance which also gives proper phase relation between the winding of the galvanometer relay when the section is unoccupied. This impedance is provided with taps and has an air gap in the magnetic circuit, so that various impedances may be obtained but a fairly constant impedance be maintained at any adjustment, despite current fluctuations. The pole changer is connected in the secondary circuit of the track transformer between the transformer and the track.

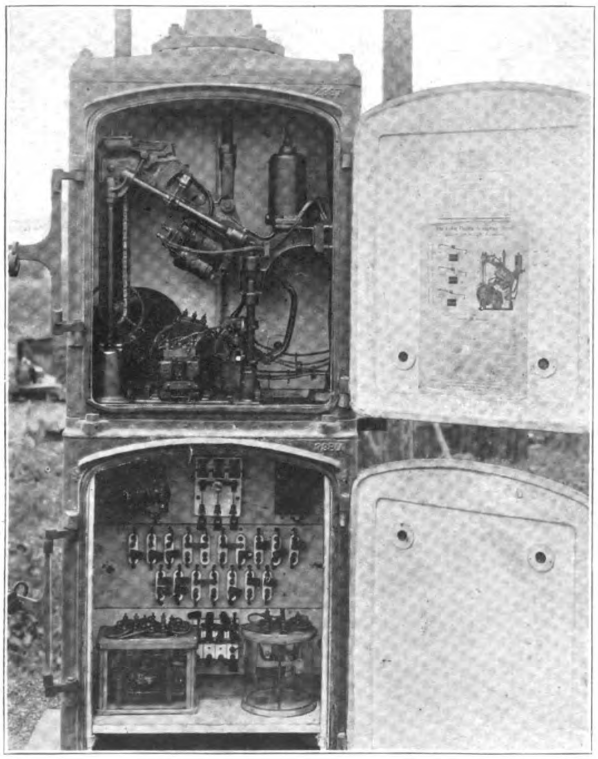

Fig. 14. Illustrating the Relay and Mechanism Case Wiring.

Where there are very short track circuits, as at crossing bell locations, vane type track relays are used. These being two-position require line wires for the signal controls. Fig. 6 shows a typical wiring diagram for one block.

In connection with the automatic signaling it was necessary to provide route locking through the interlocking plants, and a slate panel was installed at the Hawthorne Junction.

SIMMEN CAB SIGNAL SYSTEM ON A NEW ELECTRIC RAILWAY.

The Nashville-Gallatin Interurban Railway recently completed and put in service a new 1200-volt D. C. interurban line between Nashville and Gallatin, Tenn., a distance of 27 miles. The new line traverses a densely populated and picturesque district northeast of Nashville; except in a few places is built on a private right-of-way which runs parallel to the old Gallatin turnpike, passing through what is known as the "blue-grass" district of Tennessee; and is equipped throughout with the Simmen system of signals, the installation being described by the "Electric Railway Journal" as follows:

"The third-rail installations provide protection for east-bound and west-bound train movements with a home and distant rail for each siding. Switchboxes are installed at each turnout and automatically give a danger indication in the motorman's cab in case a switch is left open. A ten-lever dispatcher's board and auxiliary equipment are installed in the Hendersonville terminal station. The dispatcher's office equipment includes the storage battery on the main signal control circuits and a small motor-generator set for recharging the storage battery. The motor-generator set is a type K Holtzer-Cabot, with 1-3-hp. motor, rated at 4-amp., 190-volt, 60-cycle and 1,750 r.p.m.

"An unusual feature in this installation of the Simmen system of signaling is that a telephone plug is provided in the relay box in the motorman's cab. This makes it possible for the dispatcher to talk to the motorman by way of the signal circuit, the third rail and third-rail shoe. The third-rail shoe also is a departure from the original design in that it is not fixed, but is what is termed a revolving shoe. The original design of the third-rail shoe being fixed, it was found after a period of service that the pressure on the third rails would wear a groove in the sliding contact surface. The new shoe is set lightly off the center of the third rail. This tends to revolve when it comes in contact, and this action spreads the wear over the entire surface.

"After four months' service on the lines of the Indianapolis & Cincinnati Traction Company, it has been found that this type of shoe shows no appreciable wear, and it is believed that this difficulty has been entirely overcome."

BOILING AN IRON OR STEEL ARTICLE in a gallon of water to which has been added four ounces of phosphoric acid and one ounce of iron filings will give it a black, non-corroding coating.