North Philadelphia Interlocking

Track Improvements Necessitate Replacing Old Electro-Pneumatic Plant; All-Electric Type Used

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The Pennsylvania recently made improvements through North Philadelphia by adding four tracks to its former four-track main line and increasing its station facilities, which made it necessary to extend the interlocking and signal system at this point.

An electro-pneumatic interlocking, controlling 25 switches and 31 signals west of the North Philadelphia station, was replaced by a type F electric interlocking, furnished by the Union Switch & Signal Company, controlling 41 switches and 58 signals east and west of the station. The two-arm automatic signals east to Frankford Junction and west to the Schuylkill river were changed from two-arm, lower quadrant, home and distant arms, to one-arm, three-position, upper quadrant. The automatic blocks were shortened from an average of 4,088 to 3,052 ft. to facilitate trains getting away from the congested North Philadelphia district. The distant indication was carried back two train blocks.

With signal at stop the first distant indication shows "proceed prepared to stop at next signal," and the second distant indication shows "proceed prepared to pass next signal at medium speed." Fig. 1 shows the arrangement of signals and switches in this territory.

INTERLOCKING STATION.

The interlocking station is a two-story brick building, 38 ft. by 20 ft. in outside dimensions. The roof is slate and the brick is covered with concrete, the appearance harmonizing with the concrete bridges and station surroundings.

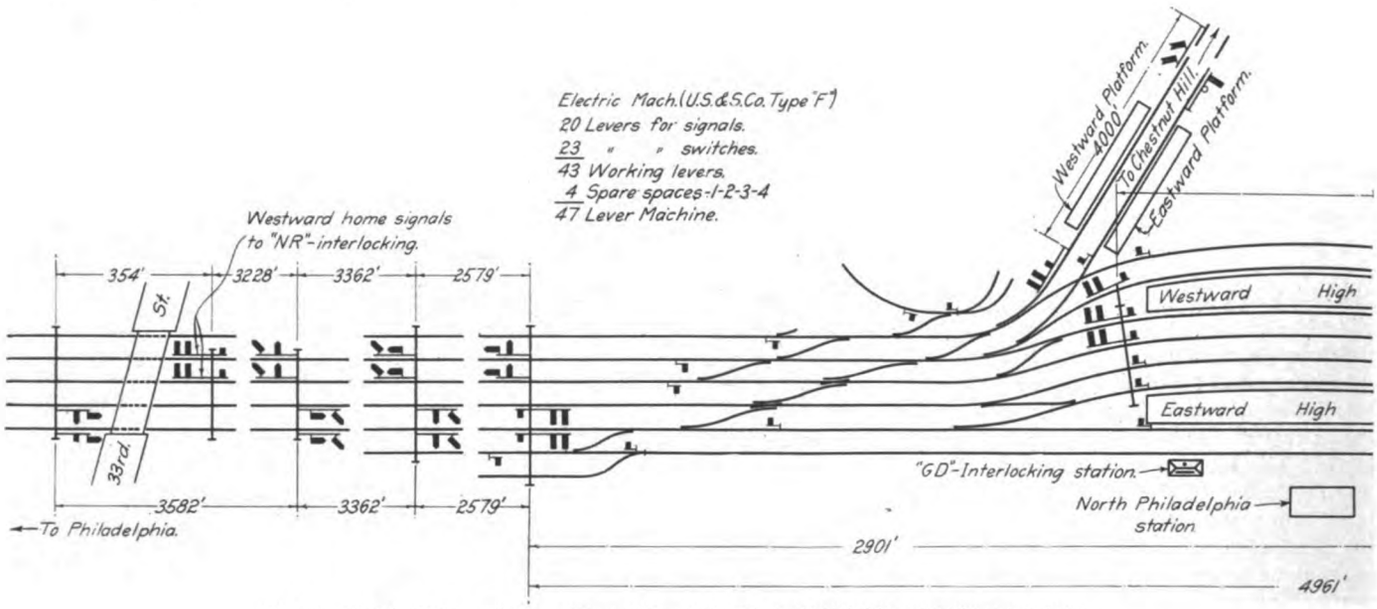

Fig. 1. Track Plan and Signal Location at North Philadelphia (Continued below).

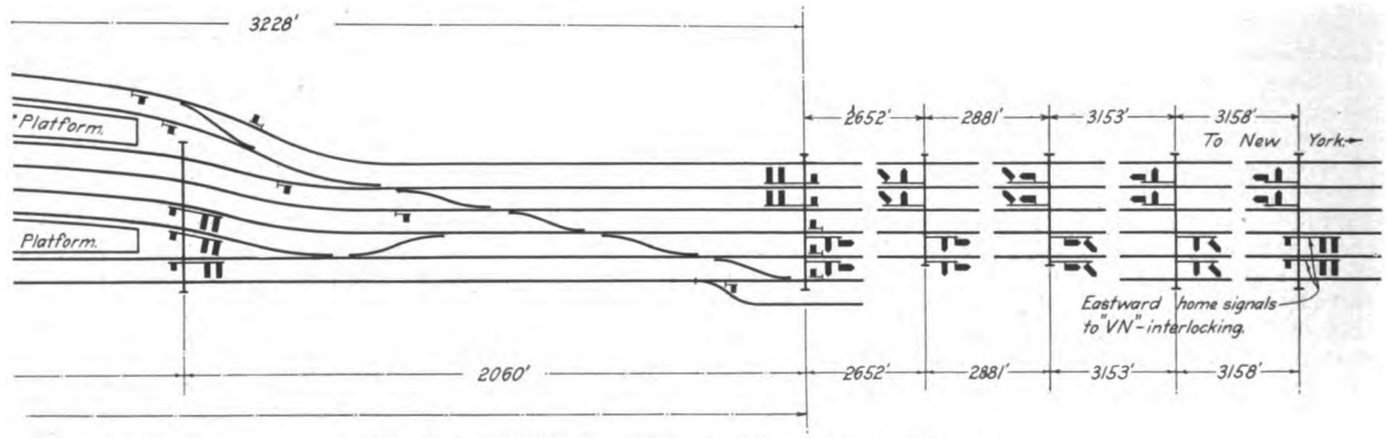

Fig. 1. Track Plan and Signal Location at North Philadelphia.*

The relay and indicator rack is built directly under the interlocking machine on the ground floor. The frame is made of angle irons riveted together. The angles are so spaced on the front of the rack that the indicators can be bolted to them, and the space between the angles is filled with asbestos board. Sheet iron shelves are provided for the relays. The wires are led into the rack back of the indicators and relays through pipe conduits in the floor, and the wiring between the indicators, relays and machine is accomplished with a minimum amount of turning and crossing. The sides and back of the rack are cov-

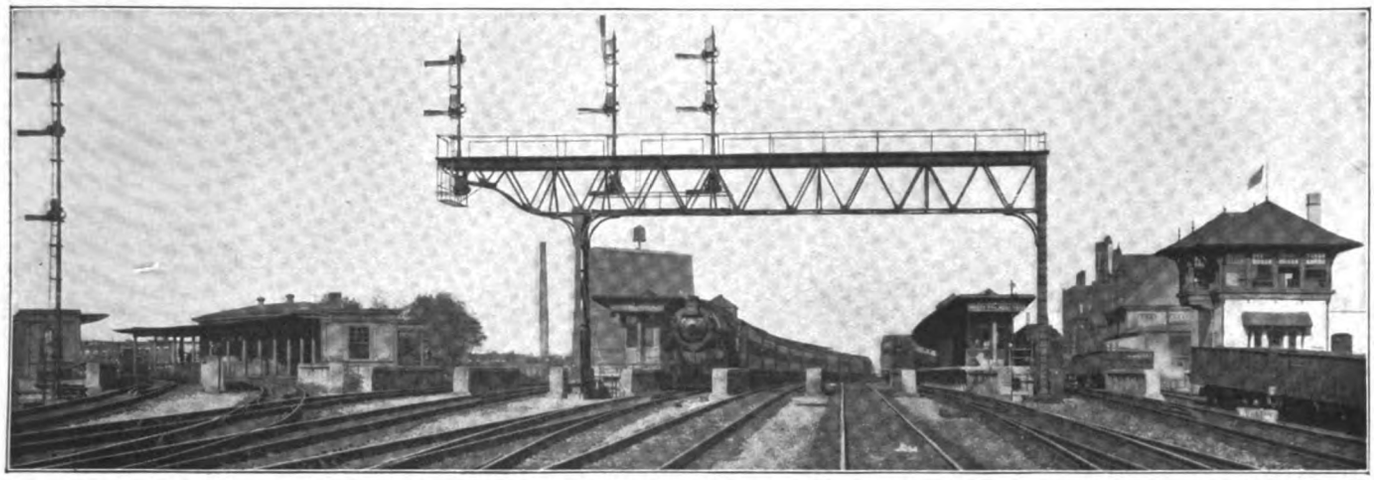

Fig. 2. North Philadelphia Passenger Station and Interlocking Plant.

ered with sheet iron. Sliding glass doors with iron frames protect the instruments from dust and dirt. A movable trolley ladder is placed in front of the indicator rack, and can be moved in position to reach any relay or indicator. This ladder is similar to those commonly seen in shoe stores.

All cables and wires from the outside of the interlocking station are terminated on R. S. A. terminals, located in a steel and asbestos rack; No. 16 B. & S. gage wires, with 1-32 in. rubber insulation, are run from this rack to the indicator rack and

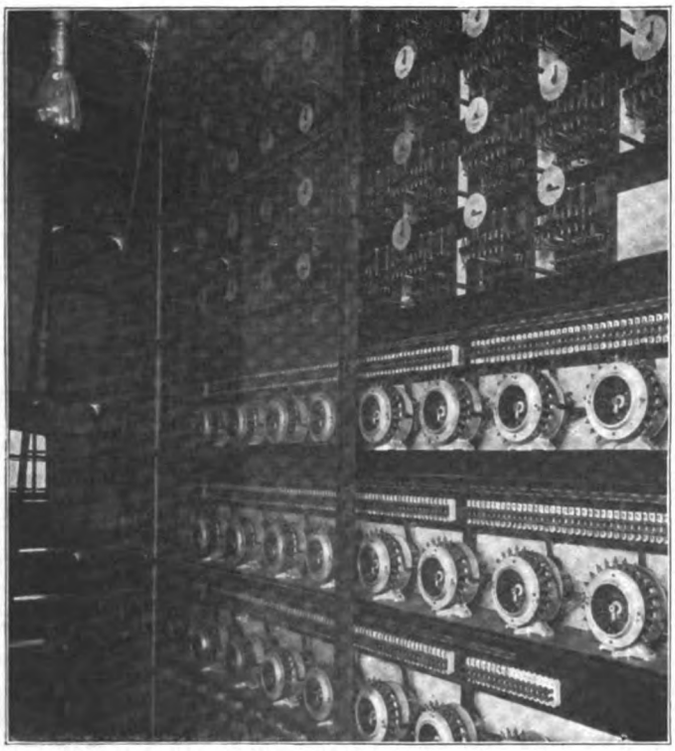

Fig. 3. Front of Relay Rack.

machine. Figs. 3 and 4 show sections of the front and the back of the indicator rack with sheet iron cover removed from back to show wiring. Fig. 8 shows the terminal rack and power boards.

INTERLOCKING MACHINE

The machine shown in Fig. 5 is of the electro-pneumatic design adapted to an electric interlocking and is known as type F. Each signal lever controls several signals by means of selection over contacts on switch levers and other devices. Both ends of a crossover are controlled by one lever. If one end is a slip, the slip and movable point frogs are included in the control of the lever. The number and distribution of levers are shown in Fig. 1. Indication lights located directly under the levers show whether the track circuits, which control the electric switch locking and the automatic feature of the signals, are occupied. The model board mounted on the machine is made of well seasoned white pine, and on the face is painted a diagram of the track layout. Electric lights on this board indicate the approach of trains and also which one of the station tracks is occupied. Clockwork slow releases, ground detector and ammeter are mounted on a cabinet over the machine. Mercury slow releases are connected to levers controlling dwarf signals which are less than 100 ft. from facing point switches. A telephone test board with cabinet is placed at one end of the machine and is mahogany finished, to correspond with the machine.

SWITCHES AND SIGNALS

The switch mechanisms are Union Switch & Signal Company B-3 electric type. The switch mechanism operates the switch through a worm gear, which is direct-connected with the operating motor through reduction gears of 25 to 1 for single switches, and 45 to 1 for slips and movable point frogs. A friction clutch is inserted in the shaft to prevent shock or damage to the motor.

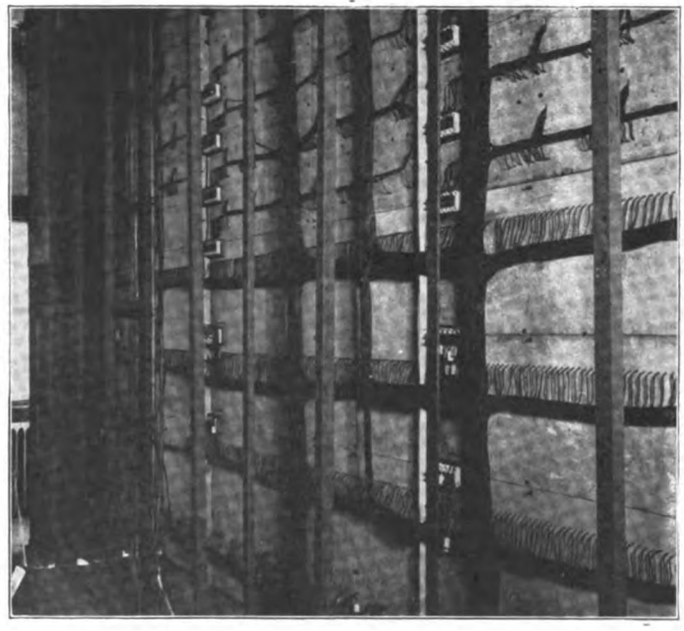

Fig. 4. Rear of Relay Rack.

A master circuit controller is mounted on a concrete foundation at each switch. This controller, operated from the interlocking machine over a two-wire pole-changing circuit, closes the contacts of the circuit to the switch motor. The shifting of

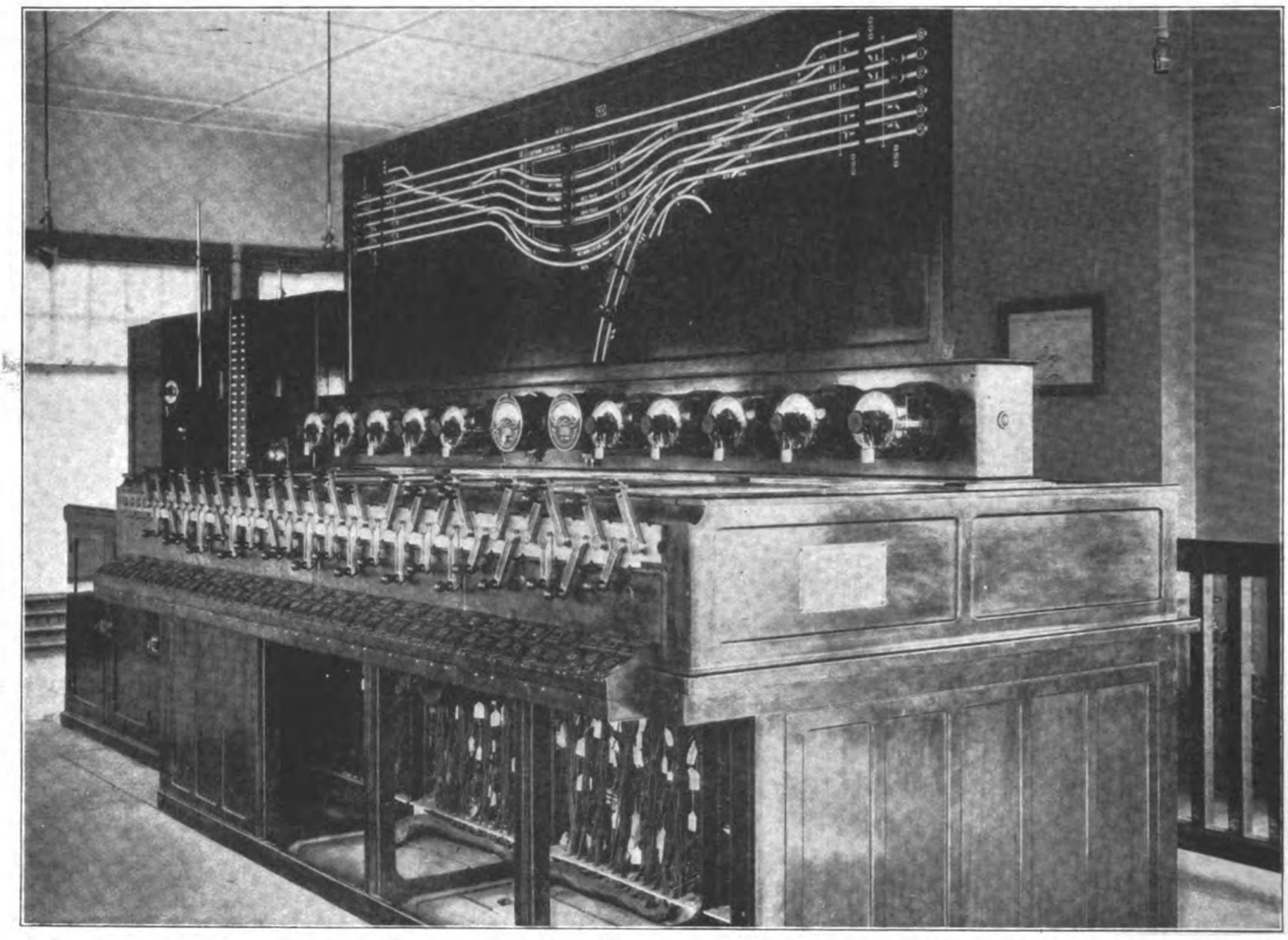

Fig. 5. View of Interlocking Machine, Model Board, Releases, Etc.

the circuit controller changes the direction of the current to the switch motor, thereby causing it to change the direction of rotation to move the switch in the desired direction.

The indication circuit was developed by the Pennsylvania signal department to eliminate the possibility of false indication. The current is alternating, and a three-position polyphase relay located in the interlocking station is operated by a pole-changing circuit controller at each switch. The circuits controlling the signals break through these polyphase relays. The circuits showing switch control and indication are shown in Fig. 6. The home signals are 110-volt d. c. motor type and the dwarf signals are solenoid type. All signals are electrically lighted, each being equipped with two 2½-watt, 12-volt Mazda bulbs, connected in multiple.

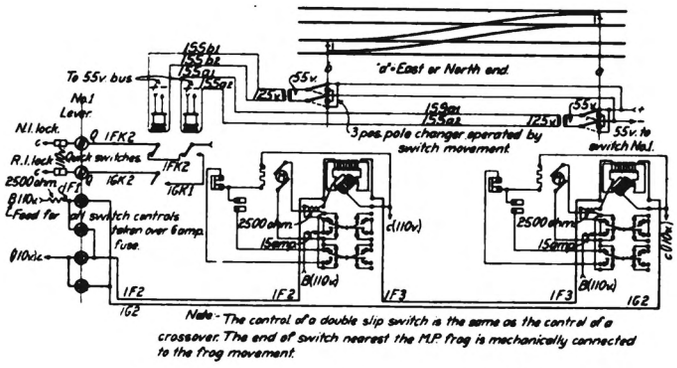

Fig. 6. Control Circuit for Electric Switch.

POWER.

The power is supplied by the Philadelphia Electric Company at 220 volts, 60 cycle, single-phase a. c. Two sets of Edison storage batteries, 100 cells each, of 300 ampere-hours capacity, supply the direct current for the signals, switch motors and indicators. These sets are charged alternately by two mercury arc rectifiers of 30 amperes d. c. capacity connected in multiple. Alternating current for the track circuits, switch indication, line circuits and electric lights is transformed from 220 to 110 volts at the interlocking station, and conducted through the plant on No. 6 feeders. It is stepped down again at transformers conveniently located throughout the plant.

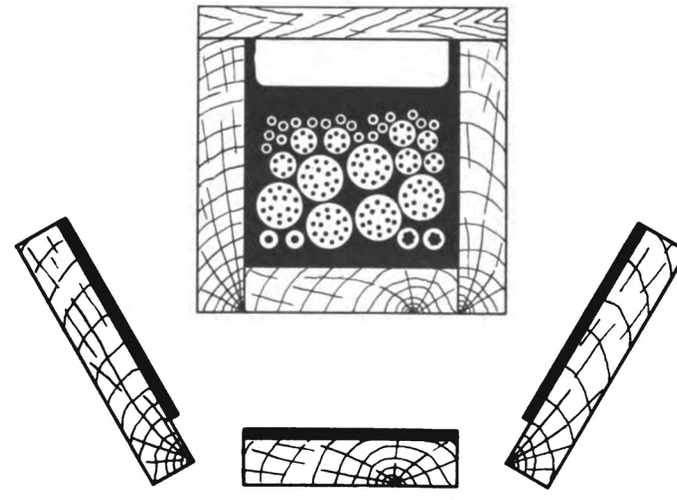

Fig. 7. Method of Pitching in Wires and Cables in Trunking.

The transformers for track circuits and lights are air cooled,

220 v. a., and have taps on the primary sides, giving 10 volts for the lights. The secondary side is for track circuits, having three taps which make it possible to get variations from 3 to 15 volts. A reactance is placed in one of the leads to the track circuit to further reduce the voltage and protect the transformer when the track is short circuited. The transformers for switch indication circuits are oil cooled and of 4 kv. a. capacity, and step down the voltage to 55 volts.

Should the current from the Philadelphia Electric Company fail, an emergency supply is obtained from a steam-driven turbo-generator located in the power house for the North Philadelphia station. This turbo-generator is a Buffalo Forge Company's turbine of 8 h. p. capacity, direct connected to a General Electric 5 kv. a. alternating current generator.

WIRES AND WIRE CONDUITS.

A novel feature is the method of installing the wires underground. It was decided to place them in cypress wood conduits and surround the wires with R. S. A. Parolite (petroleum asphaltum) to protect the insulation and guard against damage by rats and mice. To make certain of a layer between the sides and bottom of the conduit and the cables, the boards were covered with a layer of Parolite ⅜ in. thick before the conduit was built. Cables and wires were then laid in, and Parolite heated to about 200 deg. F. was poured in until the wires were covered. Tests show that the hot preservative thoroughly unites

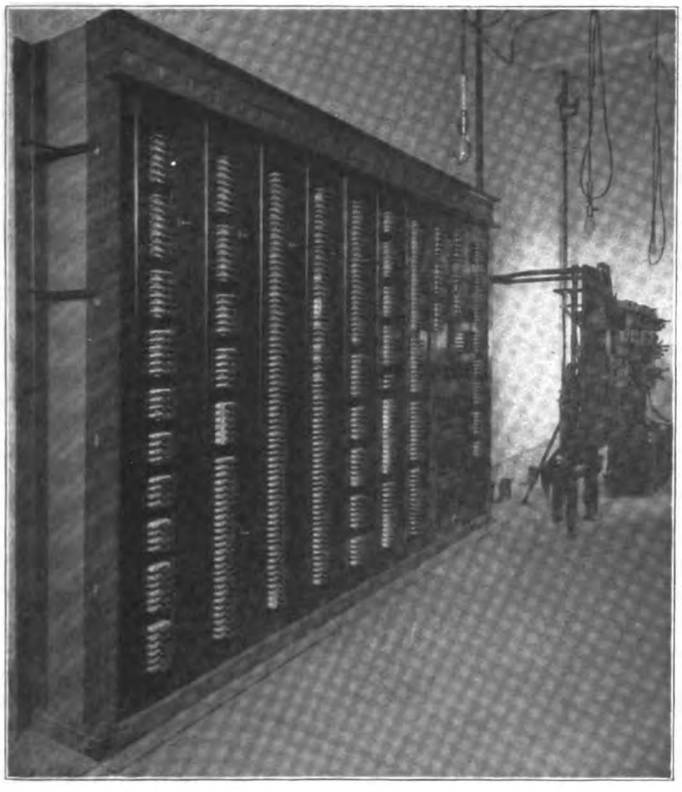

Fig. 8. Terminal Rack and Power Boards.

with the cold layer previously applied to the boards, and seals the layers on the sides and bottom together. Thermometers were placed in the kettles when heating the material to make sure that the temperature did not get too high, the maximum being 250 deg. F. Fig. 7 is a cross-section showing the conduit, with cable wires embedded in Parolite.

GENERAL.

The interlocking is completely equipped with approach, route and electric switch locking. To accomplish this, together with the control of switches and signals, required 208 miles of insulated wire outside the interlocking station, most of it made up in cables: inside the interlocking station, 47,000 ft. of insulated wire was used. The circuits contain 2,900 contacts arranged to make and break in a predetermined manner to control the switches, signals and various electrical instruments. It is nearly a mile from the farthest east to the farthest west inter-

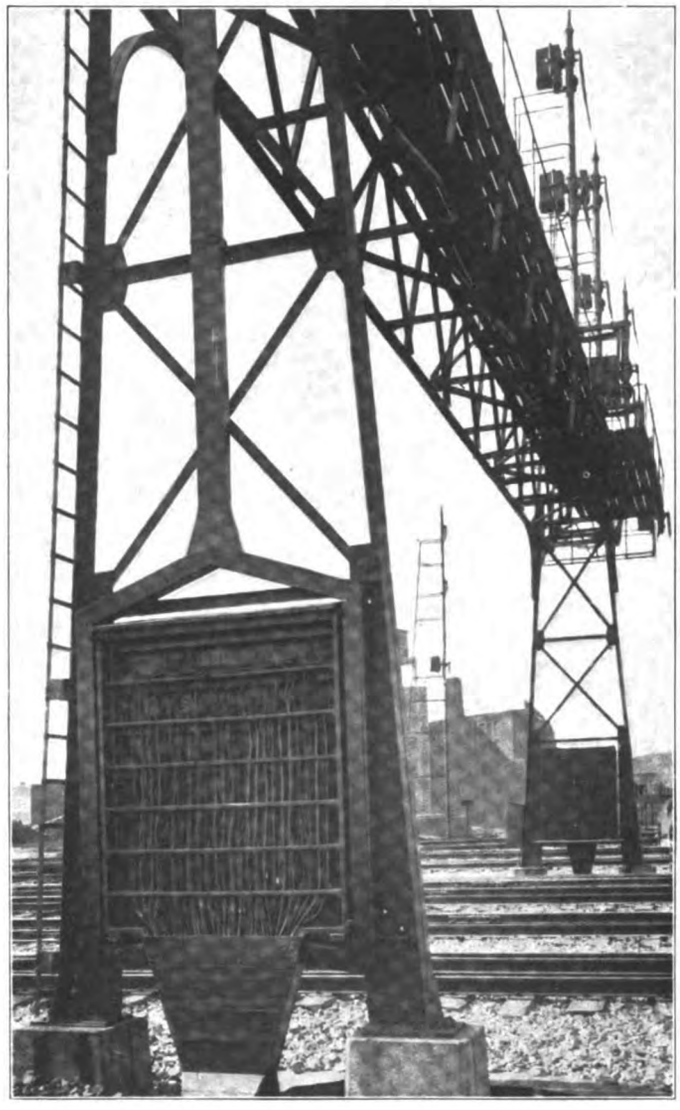

Fig. 9. Rear of Relay Box with Back Removed, Showing Arrangement of Wires and Cables.

locked switch, and most of the train movements must be handled by observing the indication lights in the interlocker.

The installation was made by the New York division forces of the Pennsylvania, with plans furnished by the signal engineer.

A Bill to Further Railway Construction in Argentina.—A bill recently presented by the public works committee of the Argentine senate proposes to authorize railways to undertake or continue under the most economical conditions possible, with due regard to security of traffic, branch lines already approved or to be approved. The project would permit postponement of construction of stations and other permanent equipment and employment of used or lighter materials than those prescribed for main lines. Facilities for operating such lines would also be granted, such as stopping between stations, observance of only such measures of safety as are necessary to meet local requirements, and extension of delays for carrying passengers and merchandise. The project would also suspend periods stipulated for surveys and construction of lines already authorized until such time as the executive power considers the financial situation normal. The difficulty of securing capital has made railway extension impracticable in most instances, and in a number of cases additional delays have already been granted by the government for the construction of lines.