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.

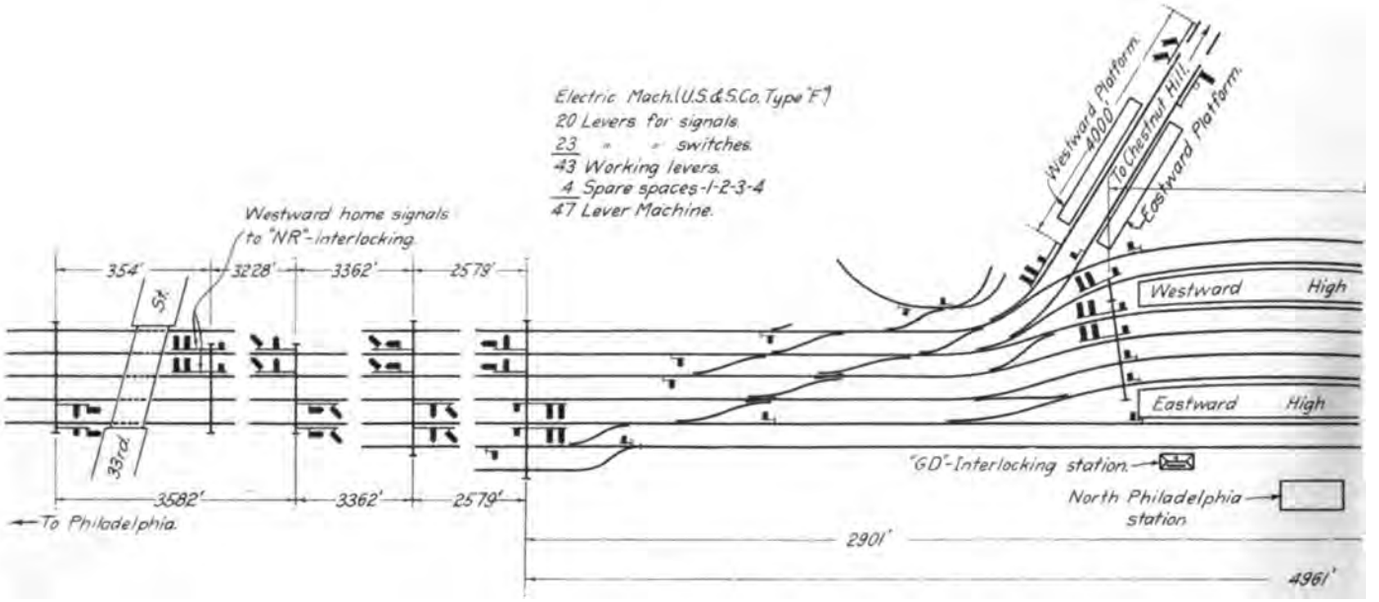

Fig. 1. Track Plan and Signal Location at North Philadelphia (Continued below).

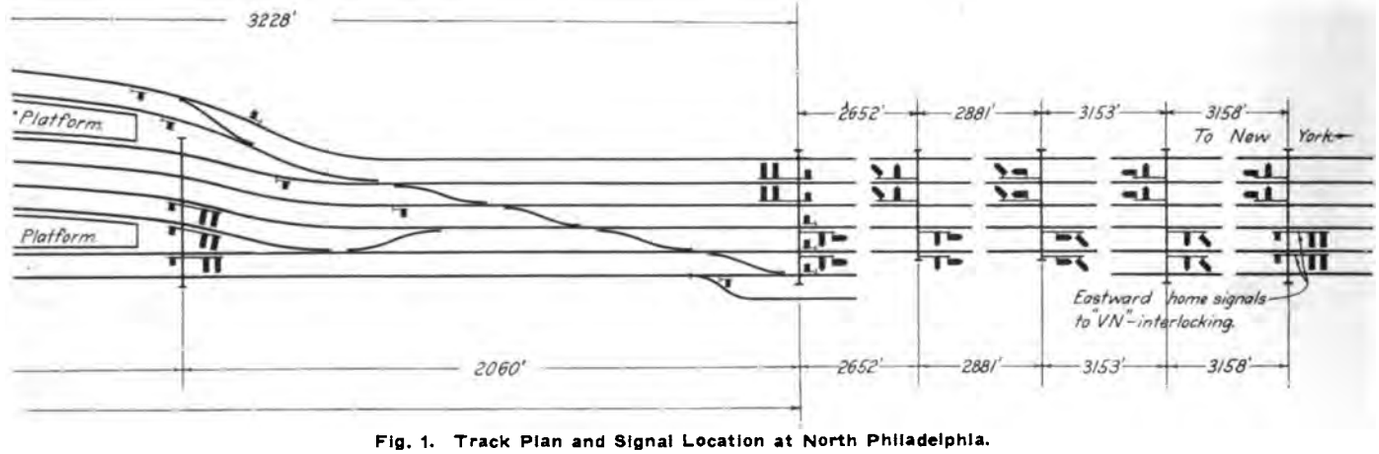

Fig. 1. Track Plan and Signal Location at North Philadelphia.

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-

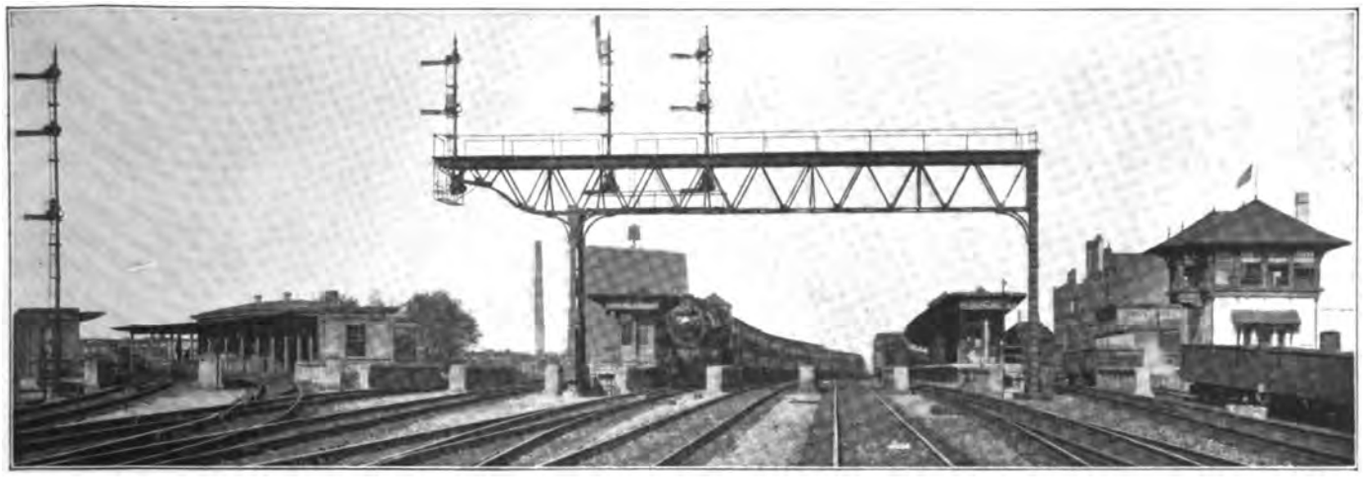

Fig. 2. North Philadelphia Passenger Station and Interlocking Plant.

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

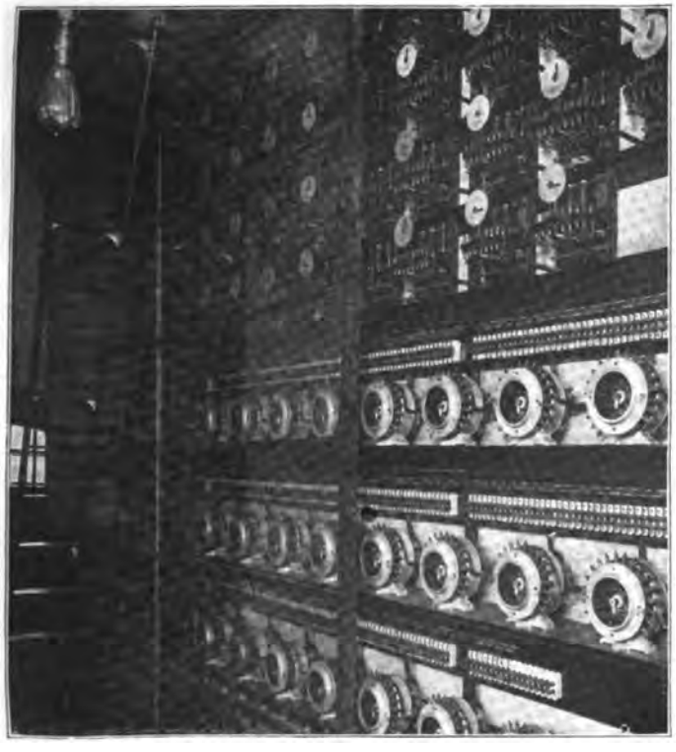

Fig. 3. Front of Relay Rack.

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.

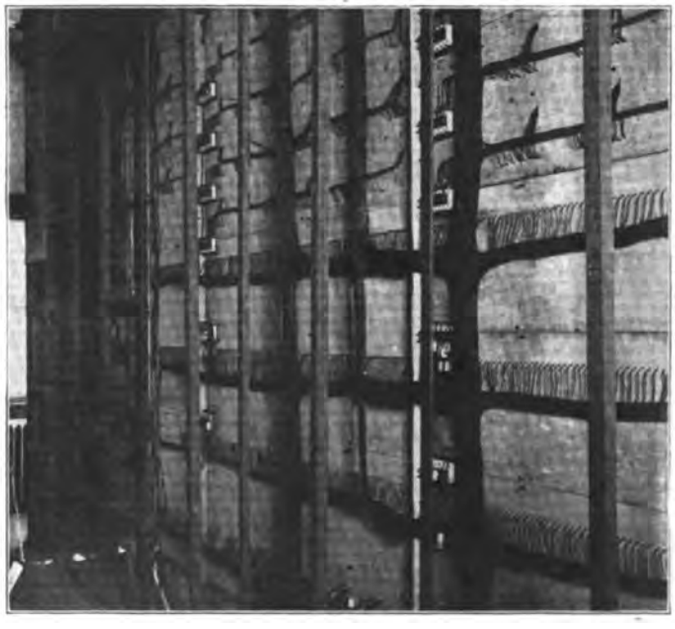

Fig. 4. Rear of Relay Rack.

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

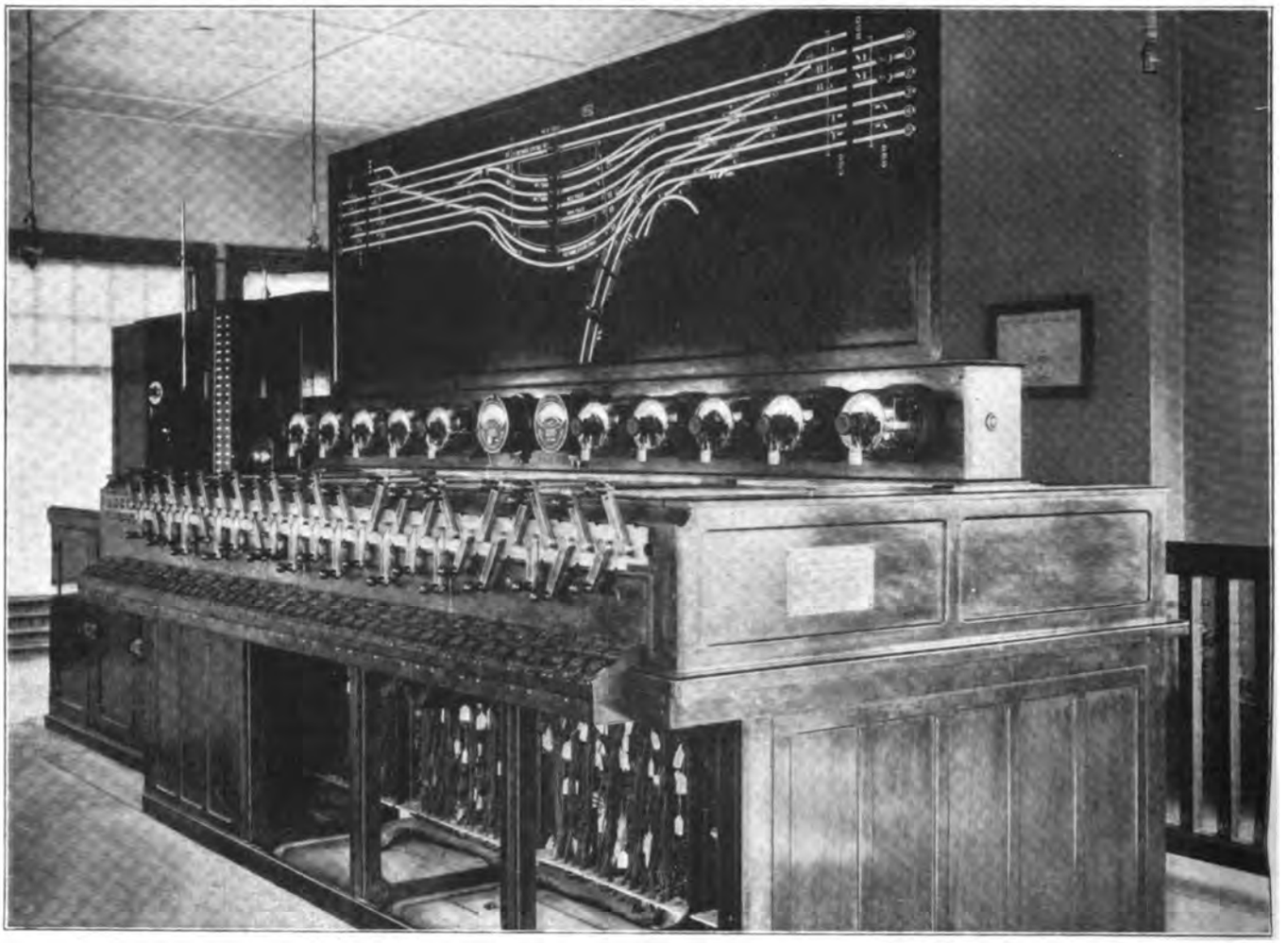

Fig. 5. View of Interlocking Machine, Model Board, Releases, Etc.

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.

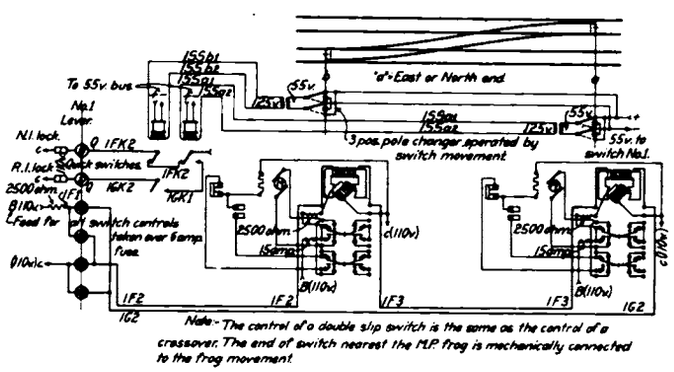

Fig. 6. Control Circuit for Electric Switch.

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.

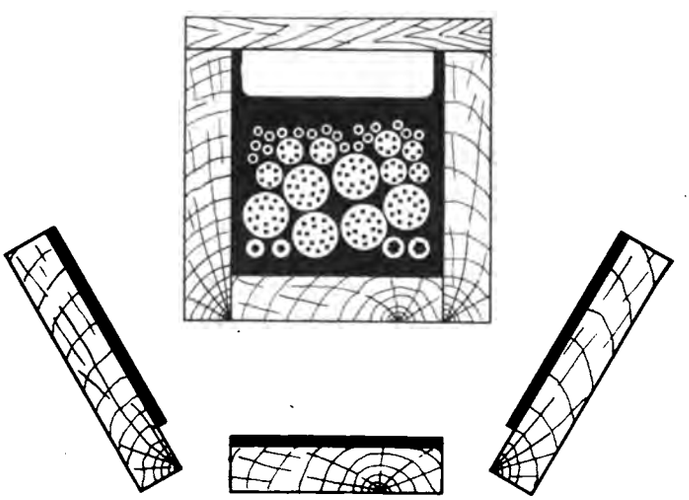

Fig. 7. Method of Pitching in Wires and Cables in Trunking.

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

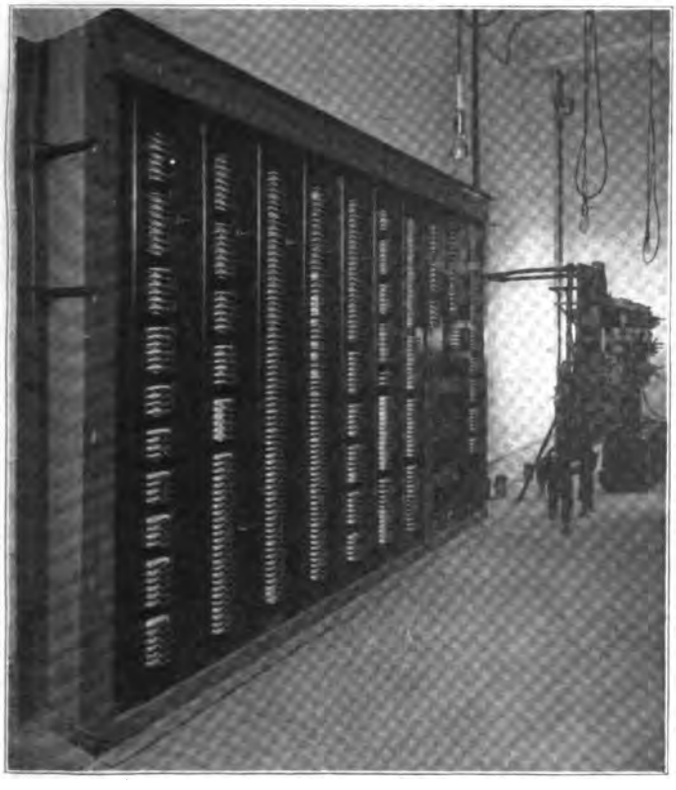

Fig. 8. Terminal Rack and Power Boards.

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.

TRAIN ACCIDENTS IN DECEMBER, 1914*

The following is a list of the most notable train accidents that occurred on railways of the United States in the month of December, 1914:

COLLISIONS.

Date.	Road.	Place.	Kind of accident.	Kind of train.	Kil'd.	Inj'd.
9.	Phila. & Reading...	Royersford	xc	P. & F.	2	2
24.	Southern Pacific....	Imlay, Nev ...	rc	P. & P.	0	16
26.	Pere Marquette... K. L. S. & C.....	Hartford, Mich.	xc	F. & P.	0	6

DERAILMENTS.

Date.	Road.	Place.	Cause of derailment.	Kind of train.	Kil'd.	Inj'd.
10.	St. L. & S. F.....	Joplin	.....	P.	0	19
13.	C., R. I. & P.....	Northfield	b. rail	P.	1	22
17.	B. & O.....	Weston, W. Va.	.....	F.	0	2
17.	Western Maryland..	Thomas, W. Va.	runaway	F.	1	3
18.	Southern.....	Jetersville	d. track	P.	1	20
19.	Pennsylvania.....	Dotter	ms	P.	0	3
19.	Western & Atlantic.	Emerson	.....	P.	2	9
26.	Gulf C. & S. F.....	Blum	b. rail	P.	0	2

The trains in collision at Royersford, Pa., on the 9th were the Williamsport express and a freight train headed in the same direction. The freight was moving out of a side track to the main line, and its locomotive was struck by that of the passenger. Both locomotives were overturned. Both enginemen were killed and two other employees were injured. This collision occurred in the night. The men in charge of the freight assumed that the passenger train had passed by when in fact the train which had passed was another; and it appears that they moved their train from the siding to the main track in the face of an indication in the switch indicator showing that the main track was occupied by an approaching train.

The trains in collision at Imlay, Nev., on the 24th were the first and second sections of westbound passenger No. 19. The second section ran into the rear of the first, and eight passengers in the observation car of the leading train were injured. The collision was due to disregard of distant and home automatic block signals. Besides this the engineman did not have his train under control as he entered the yard, and the flagman of the leading train used neither torpedoes nor fusees.

At the crossing in Hartford, Mich., on the evening of December 26 a freight train of the Pere Marquette ran into a passenger train of the Kalamazoo, Lake Shore & Chicago, and the rear car of the passenger train was overturned and fell down a bank. Six passengers were injured.

The train derailed near Joplin, Mo., on the morning of the tenth was westbound passenger No. 9; three passenger cars were ditched. Seventeen passengers and two trainmen were injured.

The train derailed near Northfield, Minn., on the 13th was southbound passenger No. 68; and five cars fell down a bank. One passenger was killed and twenty passengers and two trainmen were injured. The cause of the derailment was a broken rail.

The train derailed near Weston, W. Va., on the 17th was an eastbound freight and 27 cars were wrecked. Two trainmen were injured. The train became uncontrollable on a steep descending grade because of trouble with the air brakes on account of intense cold weather, and the locomotive ran off the track at a curve.

The train derailed at Thomas, W. Va., on the night of December 17 was a westbound freight and the locomotive and 10 cars fell down a bank. The train became uncontrollable on a steep descending grade and the locomotive jumped the track at a curve. One brakeman was killed and the engineman and two other trainmen were injured. It appears that on this grade, which is 3 per cent, the rule is to limit the speed by the use of the hand brakes; that this was not effectively done, and that in addition to this the engineman lost control of the air, presumably by a slow leak.

The train derailed near Jetersville, Va., on the 18th was southbound passenger No. 13, which, however, was running backward, having exchanged passengers with a northbound train because of a blockade on the road. The locomotive of No. 13 was running backward, and the tender was the first vehicle to leave the track. One passenger was killed and 13 passengers and seven trainmen were injured. The immediate cause of the derailment was a soft spot in the road bed.

The train derailed at Dotter, Pa., on the 19th was northbound passenger No. 73 and the baggage car and mail car were overturned. Three trainmen were injured. The cause of the derailment was a misplaced switch and failure to flag. Work train Extra 6323 took the siding at Dotter to clear for train No. 73. The conductor instructed his brakeman to go ahead and couple the locomotive onto some cars, stating that he would attend to the main track switch. This conductor reported his train clear of the main track with switch closed and locked before actually doing so, it being his intention to do this afterwards. He continued his conversation with the operator relative to the work he intended doing after No. 73 had passed, and allowed No. 73 to run into the open switch. On account of the weather conditions, the engineman and fireman of No. 73 failed to notice the position of the main track switch target.

The train derailed near Emerson, Ga., on the 19th was southbound passenger No. 93, and the locomotive and two cars fell down a bank. Two firemen were killed and three trainmen and six mail clerks were injured. The cause of the derailment was a loose rail.

The train derailed near Blum, Tex., on the morning of the 26th, was passenger No. 16, and five cars left the rails. Two passengers were injured. The cause of the accident was a broken rail.

Electric Roads.—Of the accidents to electric cars reported in December, two were notable, one at Leith, Pa., where a trolley car with 54 passengers was overturned in a creek (15 persons injured), and the other in New York, where, in a rear collision of passenger trains on the Sixth avenue elevated line, December 9, one passenger and one trainman were killed and 15 or more passengers were injured.

Canada.—In a rear collision of freight trains of the Wabash, on the Grand Trunk, at Darling Road, Ont., December 10, three trainmen were killed.

*Abbreviations and marks used in Accident List.
rc, Rear collision—bc, Butting collision——xc, Other collisions——b, Broken——d, Defective—unf, Unforeseen obstruction—unx, Unexplained——derail, Open derailing switch—ms, Misplaced switch——acc. obst., Accidental obstruction——malice, Malicious obstruction of track, etc.——boiler, Explosion of locomotive on road——fire, Cars burned while running——P. or Pass., Passenger train—F. or Ft., Freight train (including empty engines, work trains, etc.)——Asterisk, Wreck wholly or partly destroyed by fire——Dagger, One or more passengers killed.

REPORT ON A. G. S. DERAILMENT

The Interstate Commerce Commission has issued a report on the derailment on the Alabama Great Southern, near Livingston, Ala., September 18, in which 10 persons were killed and 40 injured, and the cause is found to be as given in the earlier report, which was printed in *The Signal Engineer*, December, page 374—malicious misplacement of a switch. Running at about 50 miles an hour, at three o'clock in the morning, northbound passenger train No. 2 encountered a facing point switch set for a siding, and the locomotive and the first four cars of the train were wrecked. The engineman saw the switch light change from clear to red only a short distance before reaching it. A freight train had used the switch only a short time previous, and there is no question that the switch was purposely misplaced, but the report says nothing as to whether there is a clue to the perpetrator of the crime. The men on the freight train, waiting a few miles south of the switch, saw an automatic signal change two or three times from one position to the other, which changes were caused undoubtedly by movements of the switch. In the wooden passenger car in the train, three out of the seven passengers occupying the car were killed, and in a steel underframe car five out of fifteen were killed, and the inspector questions whether the steel underframe type, in a case like this, affords materially greater safety to passengers than does a wooden coach.