New Interlocking on Pennsylvania at Harrisburg Replaces Three Old Plants

Fireproof relay cases in tower—Underground wire distribution for entire plant—9,151 lever movements in 24-hour period

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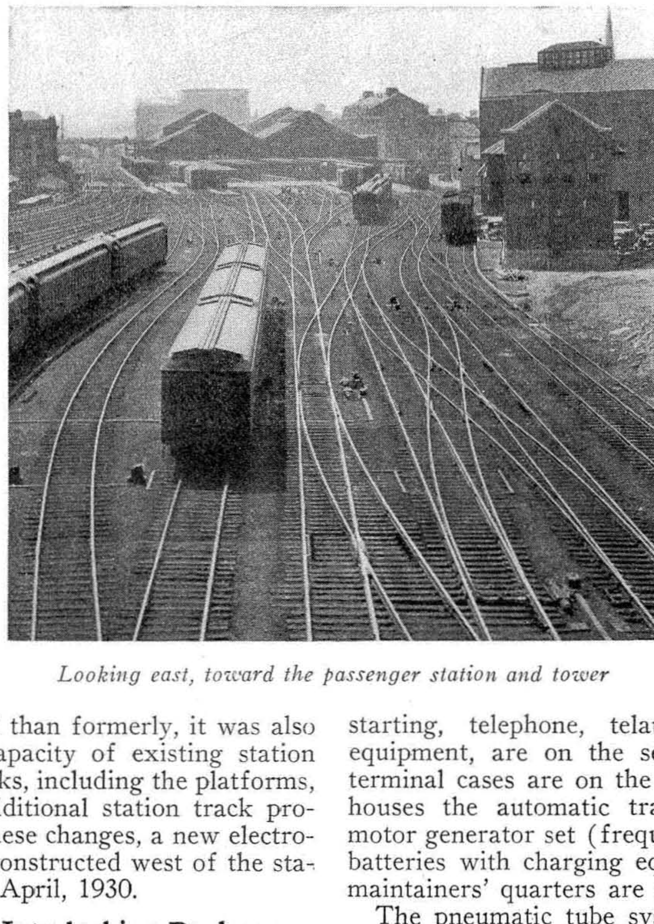
On account of increased street traffic it was necessary for the city of Harrisburg, Pa., to widen the Market street subway, which passes under the Pennsylvania's tracks near the west end of the passenger station. At about the same time the Commonwealth of Pennsylvania began the construction of a new highway bridge over the railroad tracks at State street which is approximately 1,500 ft. west of Market street, this new bridge being dedicated as a memorial to the soldiers and sailors of the World War.



Looking east, toward the passenger station and tower

These two projects required considerable rearrangement of the tracks west of the passenger station, and, as longer passenger trains are being operated than formerly, it was also necessary to increase the capacity of existing station tracks. Several of these tracks, including the platforms, were lengthened and one additional station track provided. In connection with these changes, a new electro-pneumatic interlocking was constructed west of the station and placed in service in April, 1930.

New Electro-Pneumatic Interlocking Replaces Three Mechanical Interlockings

A 115-lever, Model-14, Union Switch & Signal Company power interlocking machine was installed. Thirty-five levers operate 82 signals and one is for traffic control. Forty-nine levers operate 74 switches and 8 levers are assigned for direction selection through the station tracks. Twenty-three spare spaces in the machine are available for future growth. It is interesting to note that no slip switches or movable-point frogs are used in the track layout, which extends over a territory 3,250 ft. in length and from 3 to 14 tracks in width.

Three mechanical interlockings of 32, 50 and 56 levers, respectively, were formerly required to operate the switches and signals in the area covered by the new plant.

The track layout and signals are arranged to accomplish quick and efficient shifting of trains at the passenger station, reducing to a minimum the time required to make these movements. Considerable study was given to the construction of this interlocking, with a view of eliminating unnecessary maintenance wherever possible without sacrificing good construction and flexible operation, and at the same time keeping the installation cost as low as practicable.

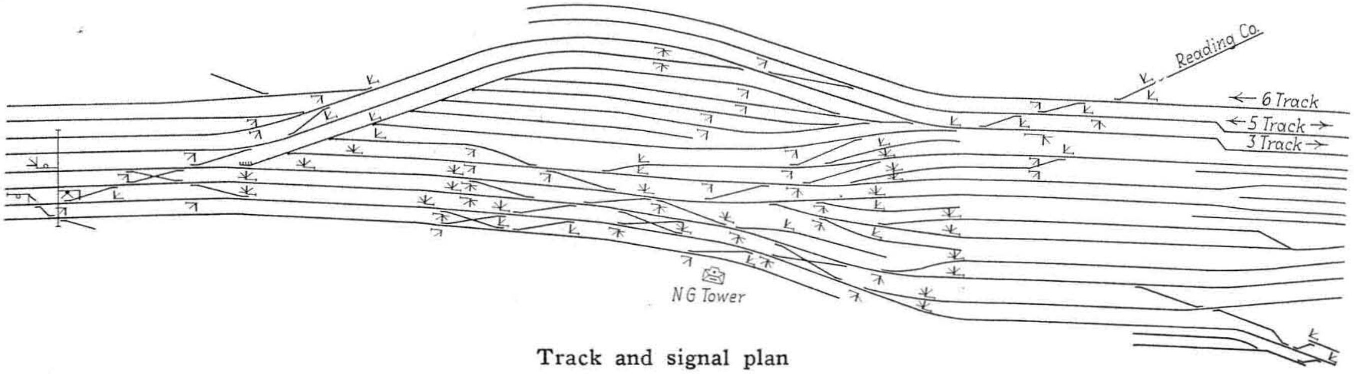
Interlocking Station and Equipment

The two-story tower, with finished basement, 27 ft. by 37 ft., is of fireproof construction, being built of brick and concrete. The interlocking machine, pneumatic tube system, train-starting, telephone, telautograph, and loud-speaker equipment, are on the second floor. The relay and terminal cases are on the first floor, and the basement houses the automatic train control switchboard and motor generator set (frequency-changer apparatus) and batteries with charging equipment for the plant. The maintainers' quarters are also located in the basement.

The pneumatic tube system was extended from the passenger station to the tower, and is used primarily for the sending of passenger train reports (train consists) from the telegraph office in the station to the tower. It is necessary for the train director to have the consists for his information in the make-up and shifting of trains at the passenger station. The "tube" is also used for transmitting any other information required in connection with the train movement. The extension of the tube system not only eliminates the necessity for messenger service between the two points, but results in a more rapid and convenient delivery of these reports.

The sending station for the telautograph system is operated from the tower, furnishing information as to arrival of trains, track assignments, etc., to the passenger station forces, the United States Mail Service Station, the Railway Express, the shifting crews and the car inspectors.

A loud-speaker system, connecting the first interlocking, about one-half mile east of the station, and the switchmen's tower at the east end of the station, with the new tower, permits the train director to announce track assignments, approach or arrival of trains to these points, simultaneously, in a quick and positive manner, eliminating the loss of time involved in individual telephone communications.



Track and signal plan

The four relay-terminal cases on the first floor are of fireproof construction, being built of 1¼-in. angle-iron and asbestos board. Joints in the angle-iron frame were welded, instead of being drilled and bolted, which resulted in a stronger and neater case and considerably reduced the cost of erection. Each case is 23 ft. long and 13 ft. high, extending from the floor to the ceiling, and contains 7 shelves. In planning the cases, it was found that to arrange them in pairs, back to back, with a space of 3 ft. between them for the wire-way and cables, would provide best use of the space available.

A platform, two feet wide, was built about seven feet above the floor and around the cases, to facilitate maintenance work with safety, as well as to permit the quick observance of the operation of the relays, without the use of portable ladders.

The usual practice of providing a large opening in the floors under the machine and relay-terminal cases for chases and cables was avoided by the use of 3½-in. fiber conduit, set vertically in the concrete floors and spaced approximately one foot apart under the machine and two feet apart from the basement to the relay cases. After all wiring had been completed, the space around the wires passing through these short ducts was filled with asbestos cement, to prevent circulation of air. In the event of a fire, there would be no draft between the basement and first floor, or between the first and second floors, through these openings.

The motor-generator set (frequency changer), with the panel board in connection therewith, feeds the 440-volt, 100-cycle train-control power line for the section west of Harrisburg. The storage batteries for the plant are floated on the main busses, being charged by copper-oxide rectifiers, which also carry the normal plant load.

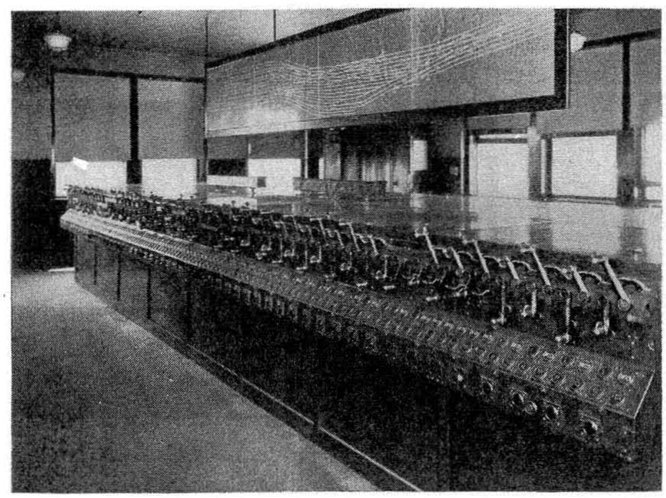
Wire Distribution

A combination underground fiber conduit system encased in concrete, which is for the telephone and signal cables, was constructed on the south side of the track layout along the entire length of the interlocking. Signal cables of from 52 to 91 conductors were run from the tower to outlying relay cases. Six relay cases are located east of, and six west of, the tower, at convenient points, to take care of groups of switches and signals. A concrete foundation supports the relay cases, a part of the foundation forming a manhole, thus permitting the cables to be run directly from the terminals of the relay case in the tower to the terminals of the outlying relay cases. Rubber-covered insulated wire was used between relay cases and switches or signals at each relay location. Cables were run from the tower to the nearest outlying relay case, and from one outlying relay case to another, thus eliminating long lengths of cable, and reducing the number of conductors between cases. This arrangement reduced to a minimum the amount of cable and wire required. Signal cable enters the east and west sides of the tower and runs directly to the relay-terminal case. In the basement of the tower these cables are supported on hangers near the ceiling.

Power Lines

A two-way wood-cut (pump log) underground conduit system was constructed on the north side of the track layout, for the 3,300-volt, 60-cycle signal power line and the 440-volt, 100-cycle automatic train control power line. Two-conductor, No. 4 rubber-covered, lead-encased cable was used for the signal power line, and two-conductor, No. 4 cambric-covered, lead-encased cable for the train control power line.

The 3,300-volt signal power-line transformers are housed in iron cases, located at convenient points throughout the interlocking. These cases are set on concrete foundations, made in the form of manholes so that lead cable can be handled from the duct line to the transformer without making short bends in the power cable.



The electro-pneumatic interlocking machine on the second floor of the tower

Signals

Signals of the position-light type were used throughout. With only two exceptions, dwarf signals, giving two, three, or four indications, were used throughout. The exceptions are the east bound home interlocking signal and the westbound automatic block signal, located at the extreme west end of the plant, which are bridge signals.

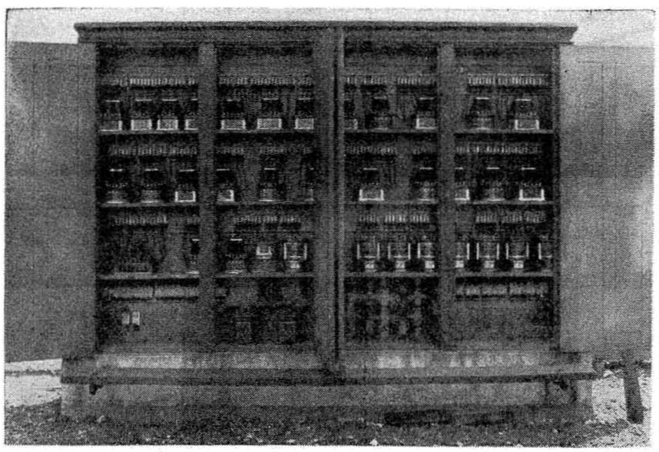
A speed restriction of 15 miles an hour is in effect within the limits of this interlocking. Therefore, dwarf signals, whose indications do not permit a speed greater than 15 miles an hour, make an ideal arrangement, as these low signals can be located at any desired point for short shifting movements, and blocks can be shortened appreciably to shorten the headway for trains entering the station.

A new scheme of time locking in connection with the signals was developed in which only three slow releases are required for the entire plant. Each release, with a stick relay for each signal lever involved, accomplishes the time locking of a certain group of signals. Two-time slow releases were used. These are mounted under the locking bed inside the case of the interlocking machine, with the handle extended to the front of the machine and directly under the indication lights, in the center of the group of signal levers it serves, thus making a very convenient arrangement.

Advance locking is in service throughout. Track circuits are so arranged that switches are released immediately after trains have cleared them, thus permitting of the safe operation of switches, as well as a quick release for other movements.

Electro-Pneumatic Switch Movements

The switches are operated by Union A-1 switch and lock movements and Type-C. P. (poppet) valves. The use of C. P. valves eliminates the necessity for quick-switches on the switch levers of the interlocking ma-



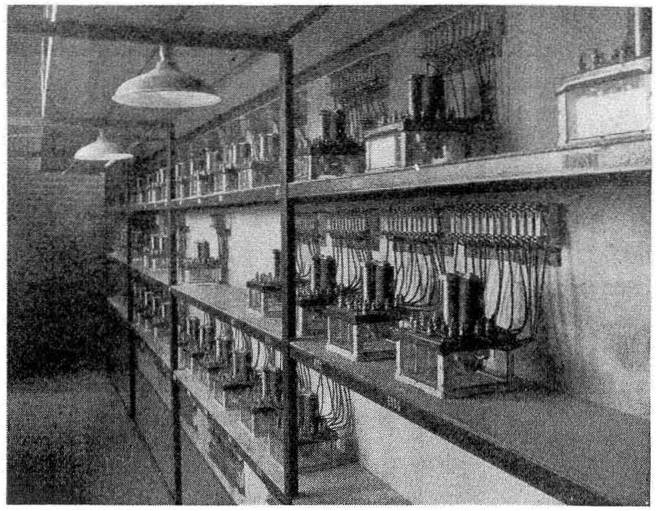
Relay case at an outlying location

chine, and permits the lever being restored to its former position in the event of a switch failure or an obstruction of the switch points.

Parallel air lines were run throughout the entire length of the interlocking, one line on the north side of the layout and the other line on the south side, with cross connections between the two lines every 400 ft. Where a cross line connects with the main air line, all air in the main air line and the cross line passes through a small tank. Air connections to the switches are taken off this cross line, and, due to the fact that all of the air in the cross lines passes through the small tanks, auxiliary reservoirs are not required at the switch movements. In the event of a collision or derailment damaging either one of the main air lines, with all switches connected to the cross lines, the gate valves can be closed on both sides of the break, thus assuring continuous air supply to all switches in the plant. Air is supplied at about 90-lb. pressure from air compressors located at the Harrisburg enginehouse. The volume of air required for each switch is adjusted by a small valve at each switch movement.

Train-Starting System and Model Board

The standard train starting system is in service between the interlocking tower and the passenger station, in which the train crew, gate attendant and tower



Relay-terminal case on first floor of tower

operator co-operate to insure that everything is in proper readiness before the signal is displayed.

The model board is merely a diagram of the tracks, switches, signals, etc., showing the number of the operating lever for each function. No working indications are given by the model, which is unusual for an interlocking of this size. Indication lights in the light cabinet below the machine levers serve the purpose of keeping the train director and the leverman advised of the location of the trains. Approach lights and lights repeating certain track sections in which no switches are located, are provided in small cabinets on the top of the machine case. This arrangement eliminated any wiring above the machine that would otherwise be necessary.

Operation

This plant has been in service seven months, and has operated very satisfactorily. The interlocking handles,

Electro-pneumatic switch movement with CP valve

daily, 48 eastbound and 54 westbound scheduled passenger trains, 9 eastbound and 10 westbound drafts, and 104 eastbound and 96 westbound light engines to and from the passenger station, as well as 23 east bound and

25 westbound freight trains, 12 eastbound and 6 westbound drafts, and 27 eastbound and 37 westbound light engines on the freight tracks, located on the north side of the plant. There is also a large number of shifting movements, in transferring cars from one train to another, placing dining cars on trains and general train make-up. Approximately 9,151 lever movements are made in a 24-hour period. With the consolidation of the former three interlockings into one plant, considerable saving resulted in the cost of operation.

The plans were prepared in the office of the superintendent of telegraph and signals, Eastern Region, and the construction work was handled by the Philadelphia division signal forces.

Specification for Signal Wires on Communication Pole Lines

Telegraph & Telephone Section, A. R. A., adopts new requirements at recent convention

A REPORT on the use of treated wood poles and a specification for attaching signal wires and cables to communication pole lines along railroads were the two items of special interest to signal department officers, which were included in the transactions of the Telegraph & Telephone Section, A.R.A., at its convention held in Toronto, Ont., September 16-19. A summary of the report on treated poles is given herewith, as is also the complete specification on signal wires.

Report on Use of Treated Poles

Information as to the number of treated and untreated poles used by certain railroads and commercial communication companies during 1929 was presented by the Committee on Outside Plants. In this report it was stated that the Burlington purchased and treated 36,601 yellow pine poles, the Great Northern purchased 14,175 treated poles, the Louisville & Nashville purchased 4,140 untreated chestnut and 17,877 treated yellow pine poles, while the Pennsylvania purchased 20,231 treated poles.

The report also included a large table giving the results of service tests of certain pole lines having treated wood poles. One of these lines, built between Norfolk, Va., and Washington, D. C., in 1897, included about 1,594 southern pine poles treated with 12 lb. of creosote to the cubic foot, by the full-cell process. About 1,232 of these poles are still in service, while only 66 have been removed on account of decay. With information as to the location of the line, number of poles, species of wood, type of treatment, and character of soil, the notes on the condition of the poles at various periodical inspections reveal interesting facts on which to establish future practices.

This report was discussed by P. J. Howe, of the Western Union Telegraph Company, who added that tests of woods in which 15 different types of preservatives had been inspected had been under way for the last two years in Panama, where the conditions are such that a one-month test is equal to a year's service in most parts of Canada and the United States. Up to June, the samples treated with creosote, zinc meta arsenite and halowax were perfect, while all others had failed.

The specification on signal wires follows:

Specification for Attaching Signal Wires and Cables to Communication Pole Lines Along Railroads

A-1 Purpose. The purpose of this specification is to provide uniform methods of attaching signal wires and cables to communication pole lines along railroads.

A-2 Scope. It is intended that this specification shall apply to the attachment to communication pole lines of railroad signal, automatic train control, battery-charging and other circuits of similar character, the voltage of which shall not exceed 550 volts between conductors, and the transmitted power of which shall not exceed 1,600 watts.

A-3. Circuits of voltage or load higher than that specified in the preceding paragraph, if attached to communication pole lines, shall comply with the requirements of the Specification for the Joint Use of Poles for Power, Communication and Signal Circuits 1-A-24.

A-4. It is recommended that all material and methods not prescribed herein, used in connection with the attachments covered in this specification, shall conform, as far as practicable, to the standards used in the general construction of the line. See Specification for the Construction of Wood Pole Lines Along Railroads for Communication Service 1-A-6.

A-5. For requirements of railroad crossings, see Specification for Telegraph, Telephone and Other Communication Wires and Cables Crossing the Tracks of Steam and Electrified Railroads 1-B-1.

A-6 Classification of Wires. For purposes of the specification, signal circuits falling within the scope of the specification are classed as follows:

Voltage	Watts	Class of Circuits
0-150	0-1600	S-2
151-250	0- 150	S-2
151-250	151-1600	S-1
251-550	0-1600	S-1.

B-1. Drawing included and referred to:
T & T 1998—Cable Guard Arm.

C-1. Class S-1 signal wires shall be carried only on crossarms used exclusively for signal wires, preferably above the highest crossarm carrying communication wires. In such cases, a minimum spacing of four feet shall be maintained between the crossarm carrying such signal wires and the highest communication crossarm. Where cooperative consideration determines that the circumstances warrant and the necessary coordinating methods are employed, one Class S-1 circuit may be placed below the communication wires on the pole line. This circuit shall be carried on the two adjacent end-pin positions at one end of the lowest through signal crossarm. This crossarm shall not be less than two feet below the lowest communication crossarm.

C-2. Class S-1 signal wires, when carried below communication wires as permitted in paragraph C-1, shall be rendered conspicuous by the use of insulators of different form or color from the others on the pole line or by stenciling "*(voltage of the circuit)* volts" on each side of the crossarm between the pins carrying the S-1 circuit, or marked "*(voltage of the circuit)* v." by means of aluminum characters. The stenciled or aluminum characters should be not less than 1½ in. high.

C-3. Class S-2 signal wires shall normally be carried on crossarms used exclusively for signal wires, although in the case of a line carrying only a single crossarm, such circuits may be placed on the same crossarm with the communication wires, providing the attachment of a second arm is impracticable.