

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.

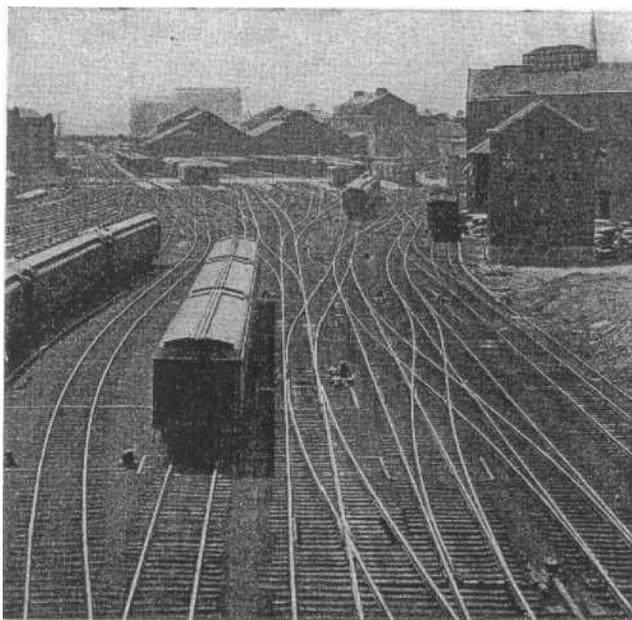
These two projects required considerable rearrangement of the tracks west of the passenger station, and, as longer passenger trains are being operated than formerly, it was also necessary to increase the capacity of existing station tracks. Several of these tracks, including the platforms, were lengthened 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 accom-



Looking east, toward the passenger station and tower

plish 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

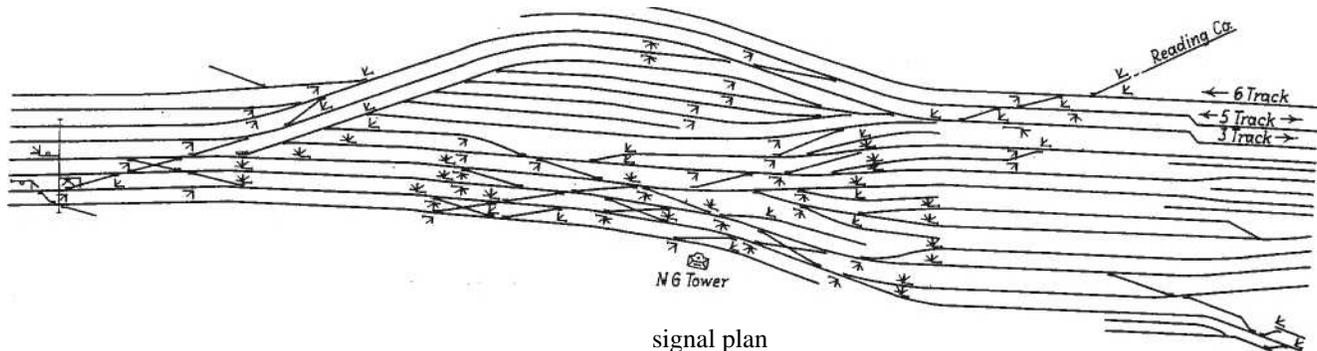
starting, telephone, telautograph, and loud-speaker equipment, are on the second floor. The relay and terminal cases are on the first floor, and the basement houses the automatic train control switchboard and motor generator set (frequency-changer apparatus) and batteries with charging equipment for 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,

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



signal plan

eliminating the loss of time involved in individual telephone communications.

The four relay-terminal cases on the first floor are of fireproof construction, being built of 1 y4-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 3y2-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

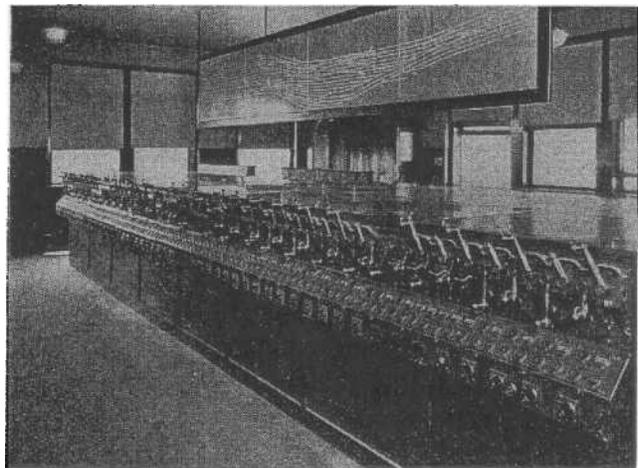
A combination underground fiber conduit system encased in concrete, which is for the telephone and signal cables, was constructed on the south side of the track layout along the entire length of the interlocking. Signal cables of from 52 to 91 conductors were run from the tower to outlying relay cases. 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

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



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

that lead cable can be handled from the duct line to the transformer without making short bends in the power cable.

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.

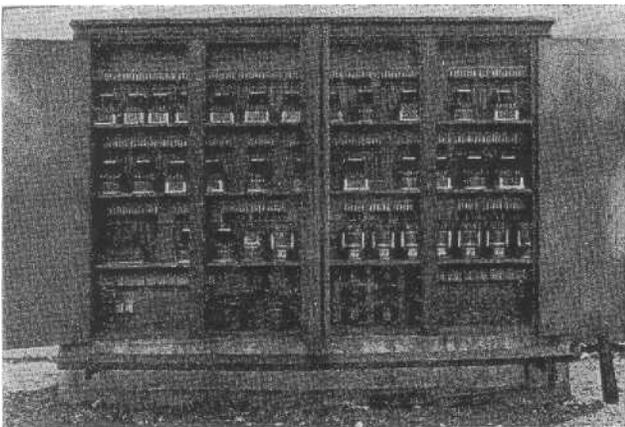
A speed restriction of 15 miles an hour is in effect within the limits of this interlocking. Therefore, dwarf signals, whose indications do not permit a speed greater than 15 miles an hour, make an ideal arrangement, as these low signals can be located at any desired point for short shifting movements,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

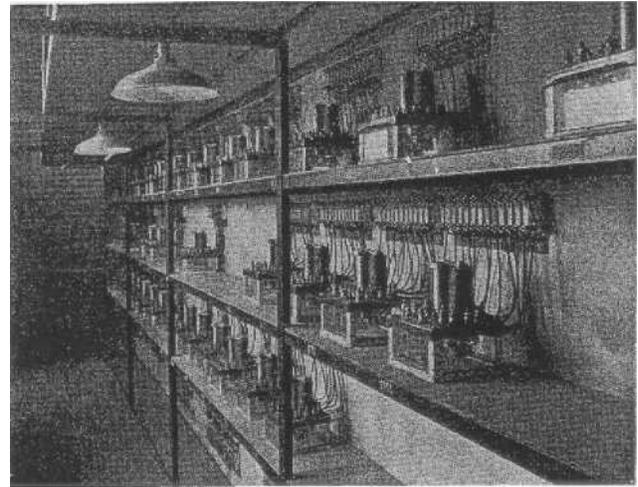
chine, and permits the lever being restored to its former position in the event of a switch failure or an obstruction of the switch points.

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



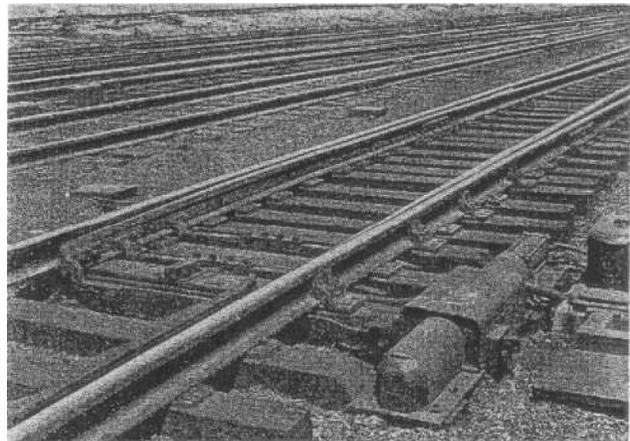
Relay-terminal case on first floor of tower

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.