

Trenton Electro-Mechanical Interlocking

New Plant at Busy Location on Pennsylvania
Includes Several Features of Advanced Practice

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On account of a change in the arrangement of the tracks of the Pennsylvania at Trenton, N. J., during 1913, the worn-out mechanical interlocking of 66 working levers was replaced by a U. S. & S. style P, electro-mechanical interlocking of 22 working mechanical levers and 28 working electric levers. In considering the type of interlocking to be adopted it was

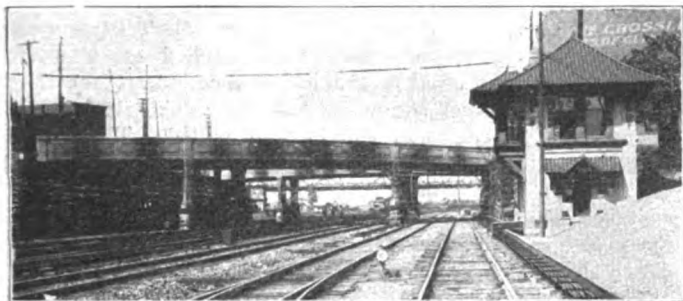


Fig. 1. Trenton Interlocking Tower and a Portion of the Plant.

found that both the installation cost and the maintenance of an electro-mechanical plant would be somewhat less than for other types. The compactness of an electro-mechanical as compared with a mechanical machine, as shown graphically in Fig. 2, was considered in connection with its operation and the space saved in the interlocking station. The factor of safety of an electro-mechanical interlocking resulting from the actual mechanical connection between a switch and the lever operating it, and the electrical safeguards which are essential in a power interlocking, applied through the electric levers, was also considered.

The machine is shown in Fig. 3. Indication lights are located below the electric levers to show which track circuits

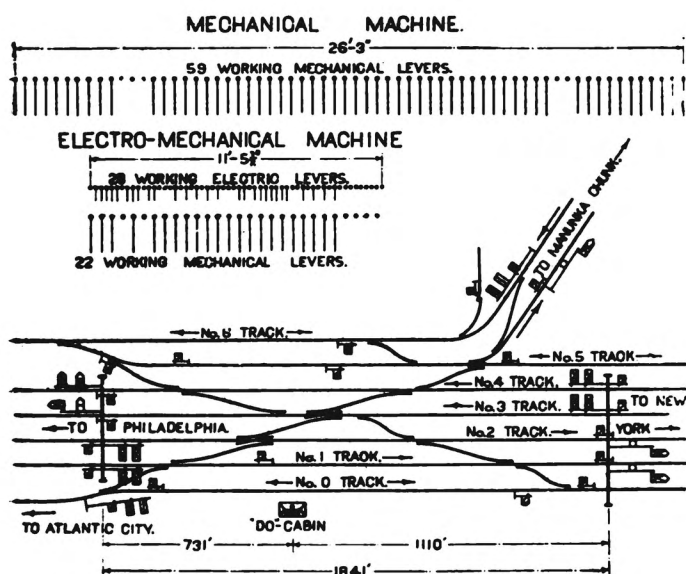


Fig. 2. Track and Signal Layout in Trenton Interlocking Plant, Showing Comparative Space Required for Mechanical and Electro-Mechanical Machines.

are occupied. A diagram showing the track layout is mounted directly over the machine and clockwork slow releases are placed at each end of the machine. Mercury slow releases are connected to levers controlling dwarf signals located close to switches.

The switches are operated through switch and lock movements, eliminating the plunger facing point locks, detector bars, their pipe connections and levers. This somewhat radical departure from general practice for mechanically-operated switches has been found safe and practicable on account of the use of the "indicating lock lever" in connection with the mechanical switch lever. As the function of the indicating lever may not be generally understood, its operation is described somewhat in detail with reference to Fig. 4.

The indicating lock lever, when normal, locks the mechanical lever normal at A; when the indicating lock lever is on center the mechanical lever can be moved and the crossover

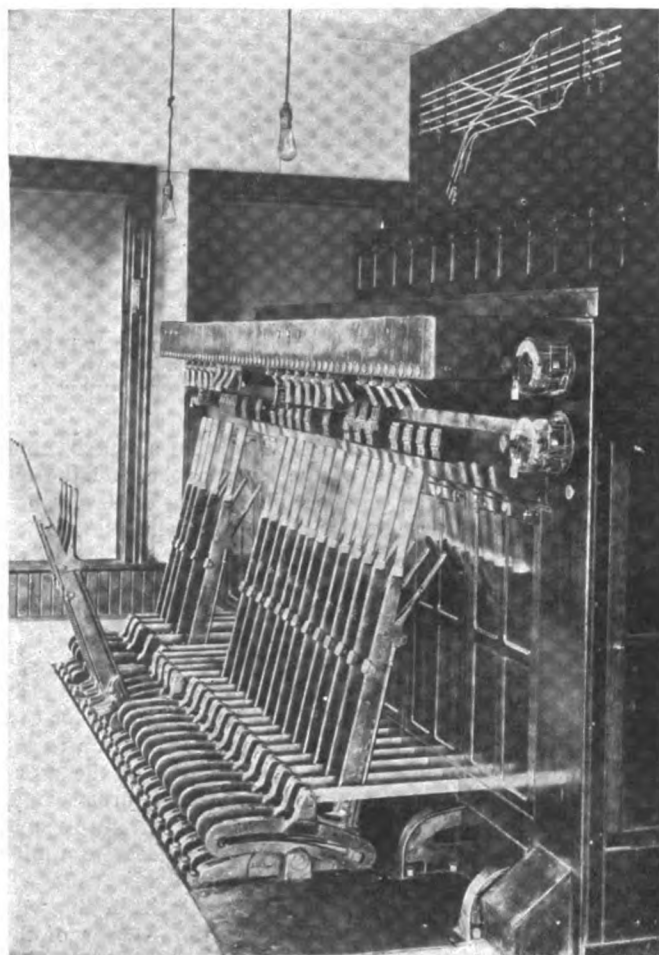


Fig. 3. Electro-Mechanical Interlocking Machine at Trenton.

operated; when the mechanical lever is reversed the indicating lock lever can be moved from center to reverse position locking the mechanical lever reversed at A, provided the crossover switches have responded to the movement of the mechanical lever, are locked, and the indication is received. If the indication is not received the indication lock lever can not be moved from its center position, and as this lever actuates the mechanical locking and unlocks signal levers only when its stroke is completed all signal levers are mechanically locked normal and a proceed signal cannot be given. The detector lock prevents the indication lock lever from being moved from either the normal or reverse positions when the track circuits controlling the crossover are occupied,

which, in turn, prevents the mechanical switch lever from being moved because it is locked at A.

It will be noted that all vital parts of the machine, namely, mechanical locking, spring combination, indication and detector locks, are actuated by the small levers, resulting in a minimum amount of wear and strain on these parts. The mechanical lever and the pipe connections are merely to transmit the power applied by the leverman to the switch. A counterweight, W, is applied to the tail levers of the mechanical levers to assist in moving the lever to the normal position. As a leverman can apply more power to move a lever to the reverse position than to the normal, it was found that the addition of the weight evened up the effort on the

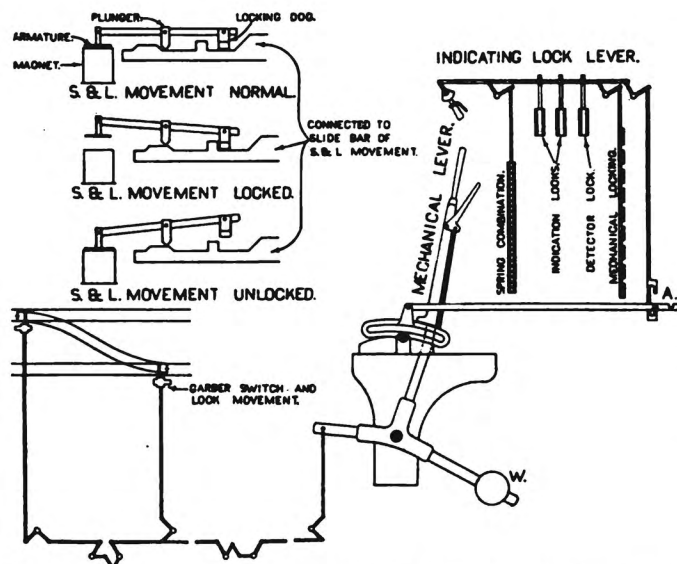


Fig. 4. Diagram Showing Operation of Indicating Lock Lever in Connection With Mechanical Lever. At Upper Left, Mechanical Movements of Electric Locks for Switch-and-Lock Movement.

part of the leverman. It was also found that a switch moves easier during the first part of the lever stroke, and the momentum gathered by the weight while moving the lever about half way helps to carry the switch to the completion of the movement and lock it. In other words, the addition of the weight smooths out the lever movement in both directions. The furthest crossover at the east end of the plant, between Nos. 1 and 0 tracks is 1,040 ft. from the machine. It is operated with one mechanical lever and is easily thrown.

The Garber switch-and-lock movement, which was designed for electro-mechanical interlockings, was used for each switch and movable-point frog. The pipe connection to this switch-and-lock movement is in the direction of the movement of the switch and is operated by a direct thrust or pull on the operating rod of the switch, instead of through an escapement crank or a motion plate. This reduces to a minimum the power required to operate the switch. A diagram showing the mechanical movements for unlocking, throwing and locking the switch is shown in Fig. 5. A view of this switch-and-lock movement is shown in Fig. 6.

In mechanical and electro-mechanical interlockings it is possible, although the probability is very remote, that something dragging from a passing train may catch the cross pipe lines and pull a switch open. On account of pipe lines crossing so many tracks at this plant it was thought best to lock electrically the facing point switches, which might be pulled open when in the normal position. An electric lock for switch and lock movements has been designed to accomplish this. The magnet is de-energized when the indicating lock lever is normal or reversed, and should the pipe line be pulled by something dragging, the first movement of the slide rod would lift the armature and the locking dog would engage the projection on the slide rod, thereby locking the switch movement against further movement. If the indicating lock lever

is on center, as is the case when the switch is to be thrown, the magnet is energized and the first movement of the slide rod would lift the locking dog, allowing the switch to be moved in the usual way.

This electric lock is very rugged. Several tests proved that the pipe line would break should it be caught and the

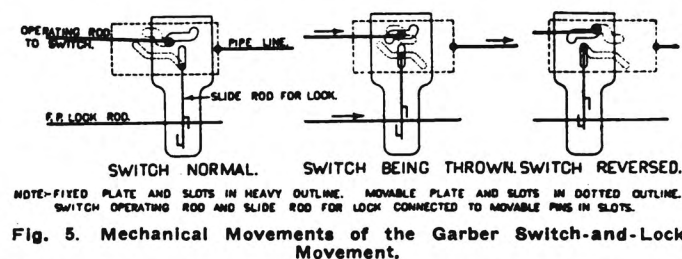


Fig. 5. Mechanical Movements of the Garber Switch-and-Lock Movement.

electric lock still hold and prevent the switch from being pulled open. The same tests were applied on a switch equipped with the usual mechanical connections to see if the plunger lock and lock rod would hold the switch closed if the operating pipe line was caught and pulled. The results showed that the front and lock rods bend and the switch can then be pulled open. These locks are only placed on switches where a track intervenes between the switch and the pipe line, and which face the normal direction of traffic. Fig. 4 shows the mechanical movements of this lock.

The electric current is obtained from the 3,300-volt, 60-cycle underground signal feeders which supply the signal system between Trenton and Holmesburg Junction, about 20 miles. The generators for this system are situated in the pumping station at Bristol, 10 miles from Trenton. Suitable transformers are placed through the interlockings to furnish current for the track circuits and lights. A 14-volt storage



Fig. 6. One of the Switch-and-Lock Movements Installed at Trenton.

battery of 150 ampere hours capacity, charged through a mercury-arc rectifier, furnishes direct current for the signals and indicators.

There are, on an average, 1,350 signal and 1,900 switch movements at this plant a day. The results of two years of service show this type of interlocking to be entirely practicable at a busy point. There are now 44 such plants in service on the Pennsylvania Railroad.

NEW REGIONAL COMMITTEE.—A new regional committee of the Railway Signal Association has been formed at Ogden, Utah, with Paul A. Bliss, signal supervisor, Southern Pacific, as chairman.

PROGRESS IN GRADE CROSSING SAFETY.—Mr. McCrea, general manager of the Long Island Railroad, thinks that the public has actually heeded the railroad's persistent warnings to cross tracks with care. There was no serious accident at a crossing for the sixty days ending August 10, the days of the heaviest automobile traffic on Long Island during the year. But one person was injured in these two months, and that only to the extent of a broken arm. But there was an appalling number of "near accidents," and he thinks that certain crossings will never be safe unless the gates are kept down and only raised when a vehicle is to cross, or unless wayfarers stop before passing over the tracks.