Roy F. Pulz

American Railway Signaling Principles and Practices

CHAPTER XVII

Mechanical and Electro-Mechanical Interlocking

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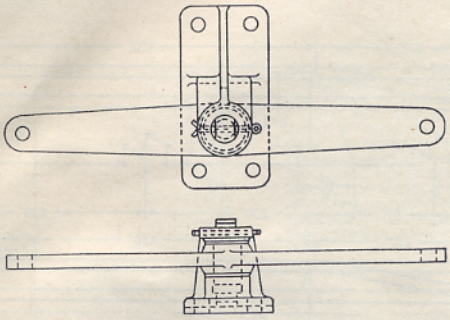

Fig. 59.
Straight-Arm Compensator.

Facing point lock.

The Signal Section, A.R.A., defines Facing Point Lock as: A mechanical lock for a switch, derail or a movable point frog, comprising a plunger which engages a lock rod attached to the switch points to lock the switch or other operated unit in its normal and/or reverse position.

The facing point lock is generally used in mechanical interlocking to insure that the switch points are properly secured against the stock rails. The use of the facing point lock in mechanical interlocking requires two levers for each switch, derail or movable point frog. One lever is employed to throw the switch and the other to operate the facing point lock. The locking of the switch is accomplished, in either the normal or reverse position of the switch, by a plunger engaging in a groove or hole cut in the lock rod which is actuated by the switch points. To operate the switch to the reverse position the plunger of the lock is withdrawn from the normal groove in the lock rod by operation of the facing point lock lever in the interlocking machine. The switch may then be operated by moving the switch lever to the reverse position and the plunger of the lock brought into engagement with the reverse groove in the lock rod by again manipulating the facing point lock lever to the reverse position.

There are two types of plungers in general use, a 1-inch circular and a 2-inch by ¾ inch rectangular. When the circular plunger is used, horizontal holes in the lock rod are provided through which the plunger passes to effect the locking. When the rectangular plunger is used, corresponding grooves are cut in the top edge of the lock rods through which the plunger passes.

The main lock rod carries the groove or hole for locking the switch in the normal position and the adjustable locking piece is slotted so that the plunger may pass through it and engage the groove. In the same manner the adjustable locking piece carries the groove or hole for locking the switch in the reverse position and the main lock rod is slotted in this position to permit the plunger to pass through. The adjustable locking piece affords a means of adjusting for any variation in the throw of a switch.

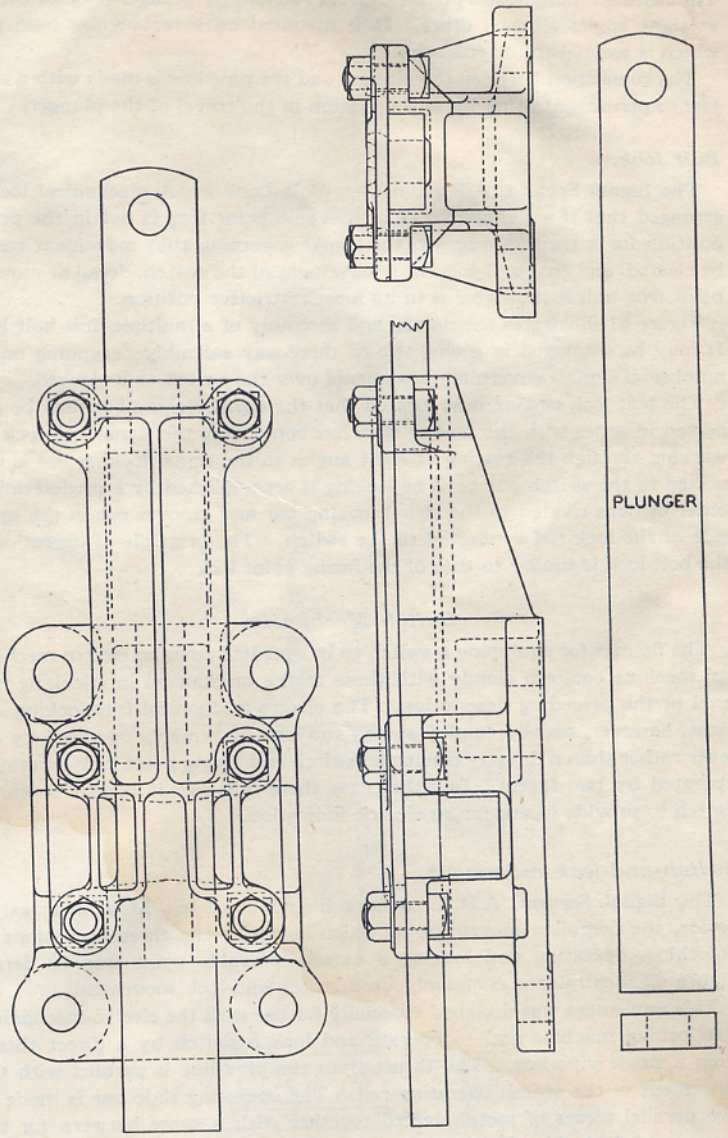

Fig. 60.
Plunger Lock.

Figure 60 illustrates the plunger lock casting and the rectangular plunger. The casting is designed to permit the lock rod and the plunger to enter the lock at right angles to each other. It is mounted on a rectangular base plate which is secured to the cross-ties.

The connection between the plunger and the pipe line is made with a screw jaw to permit adjusting for any variation in the travel of the plunger.

Bolt lock.

The Signal Section, A.R.A., defines Bolt Lock as: A mechanical lock so arranged that if a switch, derail or movable point frog is not in the proper position for a train movement, the signal governing that movement cannot be cleared, and that will prevent a movement of the switch, derail or movable point frog unless the signal is in its most restrictive position.

Figure 61 illustrates the details and assembly of a multiple-unit bolt lock. It may be employed in a one, two or three-way assembly depending on the number of signals governing movements over the switch to be locked.

The bolt lock casting is so located that the signal locking bar may be connected in series with the pipe or wire line controlling the signal. A lock rod working through the casting at right angles to the signal locking bar is connected to the switch point. The locking is accomplished by a predetermined order of dogs riveted to the signal locking bar and grooves cut in the upper side of the lock rod connected to the switch. The principle of operation of the bolt lock is similar to that of the facing point lock.

Switch Mechanism

The fittings for equipping a switch to be operated from an electro-mechanical machine conform closely with those of the mechanical interlocking covered in the preceding description. The electro-mechanical interlocking systems, however, usually employ switch-and-lock movements operated by one lever rather than a directly connected switch and facing point lock separately operated by two levers. In either case there is a circuit controller at the switch to provide means for an electric indication.

Switch-and-lock movement.

The Signal Section, A.R.A., defines Switch-and-Lock Movement as: A device, the complete movement of which performs the three operations of unlocking, operating and locking a switch, movable point frog or derail. Figure 62 illustrates a commonly used switch-and-lock movement.

This movement was designed especially for use with the electro-mechanical interlocking machine and to operate and lock a switch by a direct thrust from a single pipe line. The thrust from the pipe line is parallel with the movement of the switch operating rod. The operating slide bar is made of two parallel pieces of metal riveted together with a space between for the entrance of the locking bar. Cam slots are cut in the motion plate and guides are cast in the top and bottom stationary parts of the frame in such a way that the first portion of the movement of the motion plate actuates a slide

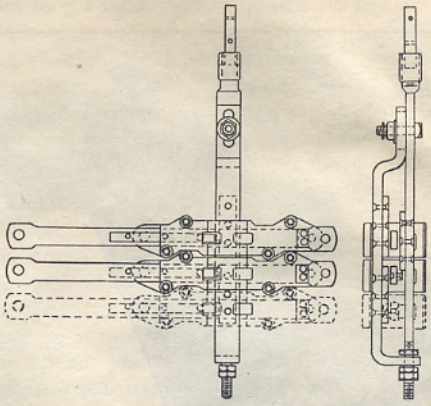

Fig. 61.
Multiple Unit Bolt Lock.

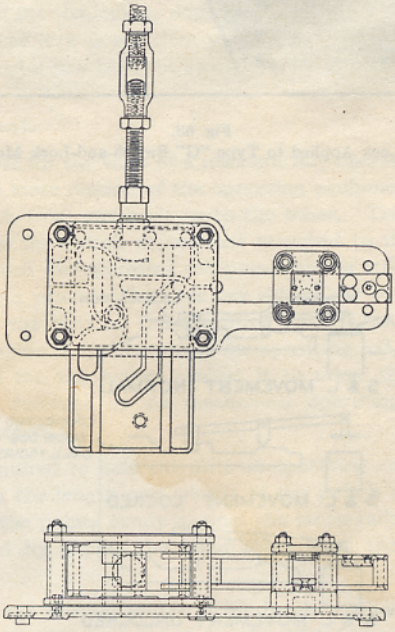

Fig. 62.
Type "G" Switch-and-Lock Movement.

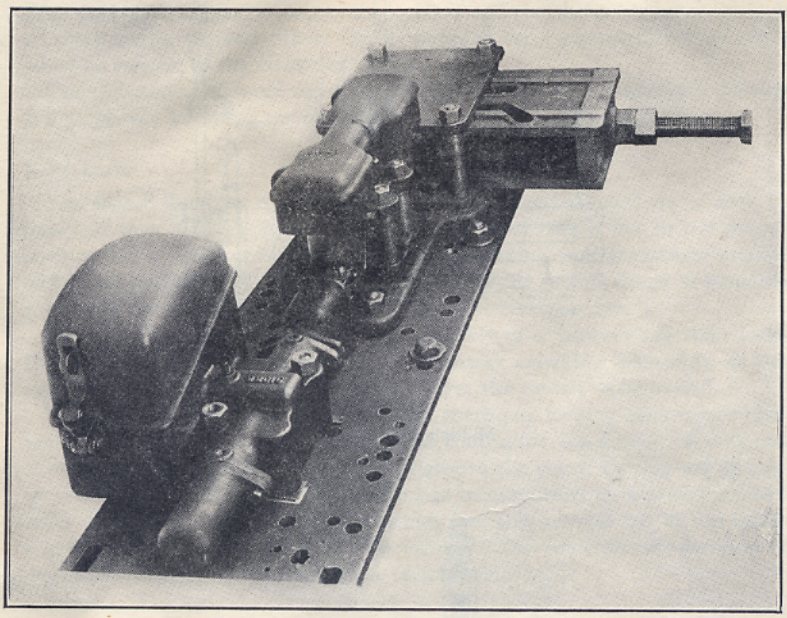

Fig. 63.
Electric Lock Applied to Type "G" Switch-and-Lock Movement.

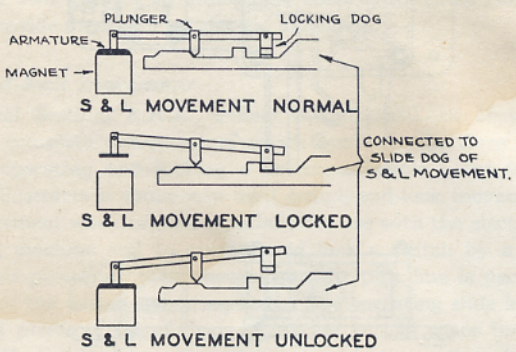

Fig. 64.
Diagram Showing the Operation of Electric Lock Applied to Type "G" Switch-and-Lock Movement.

bar at right angles to the throw rod to unlock the switch, and at the same time move the pin holding the end of the throw rod to one side, thus placing it in the operating position. The middle portion of the stroke operates the switch, but does not effect the slide bar, while the last portion of the stroke moves the pin holding the end of the throw rod out of the operating position and locks the switch in the usual manner. Thus the sequence of operation is the same as in other types of switch-and-lock movements. The movement is equipped with an indication box of the same type as used with certain power interlockings.

In some cases an electric lock, as shown in Fig. 63, is applied to switch-and-lock movements which operate facing point switches, especially when the mechanical pipe connections pass under adjacent tracks and there is a possibility of dragging equipment catching the lateral pipe connections and pulling the switch open. Figure 64 illustrates the operation of this lock. The magnet is de-energized when the indicating lock lever is normal or reverse and should the pipe line be pulled by dragging equipment, 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 against further movement. If the indicating lock lever is on center, as is the case when the switch is to be operated, the magnet is energized and the first movement of the slide rod would lift the locking dog, allowing the switch to be operated in the usual way. The lock is sufficiently rugged so that should the pipe line become disconnected it will hold the switch points in place.

Switch adjustment.

In order to adjust for the wear of a mechanically-operated switch it is customary to provide more motion of the operating equipment than is required to move the switch from one position to the other. This excess of motion is taken care of in the switch adjustment attached to the head rod of the switch through which the operating rod passes and is attached as illustrated in Fig. 65. Space is provided between one side of the switch adjustment on the head rod and the nuts on the operating rod. This space is consumed during the first portion of the motion of the operating rod through the switch adjustment before the nut comes against it to move the switch. As lost motion gradually develops in the mechanical operating connections, this excess motion decreases.

The pressure required to hold the nuts on operating rod against the head rod will vary with the length and weight of the switch points but must be sufficient to keep the points firmly against the stock rails. This pressure is usually determined by prying the point away from the stock rail with a small bar.

After adjusting the normal switch point firmly against the stock rail by use of the adjustment on the operating rod, which brings the groove on the lock rod nearly in line with the plunger of the lock, the lock rod is shifted so that the plunger will engage with the groove in the lock rod, thus permitting

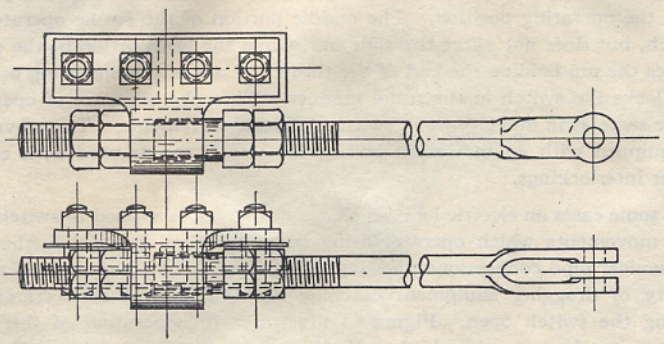

Fig. 65.
Switch Adjustment.

locking the switch in the normal position; the lock rod is then tightened. The same operation is repeated with the switch in the reverse position, with the exception that the adjustable portion of the lock rod is moved until the plunger of the lock engages with the groove of the lock rod, thus permitting locking the switch in the reverse position. After tightening all nuts the adjustment is complete.

Signal

The mechanical signals of an interlocking plant are of the semaphore type, operated by pipe or wire lines. Those operated by pipe lines are known as pipe-connected signals and are illustrated in Fig. 66.

A crank is located at the bottom of the signal mast connected to the pipe line which is operated by the signal lever in the interlocking machine. Pipe-connected signals usually require one pipe line for each working arm and wire-connected signals usually require two wire lines for each working arm. In some instances a selector is used which permits operating more than one arm from each pipe or wire line. Figure 67 illustrates a pipe selector.

All appliances are secured to the mast by clamps. The up-and-down connections on the mast are of 1-inch pipe connected to the spectacle casting of the signal with a solid jaw and pin and connected to the crank at the bottom of the mast by a screw jaw. Signals are generally equipped with counterweights to return them to the normal position in case the pipe or wire lines should fail. For a signal mast equipped with more than one arm a multiple arrangement of cranks and up-and-down rods is employed.

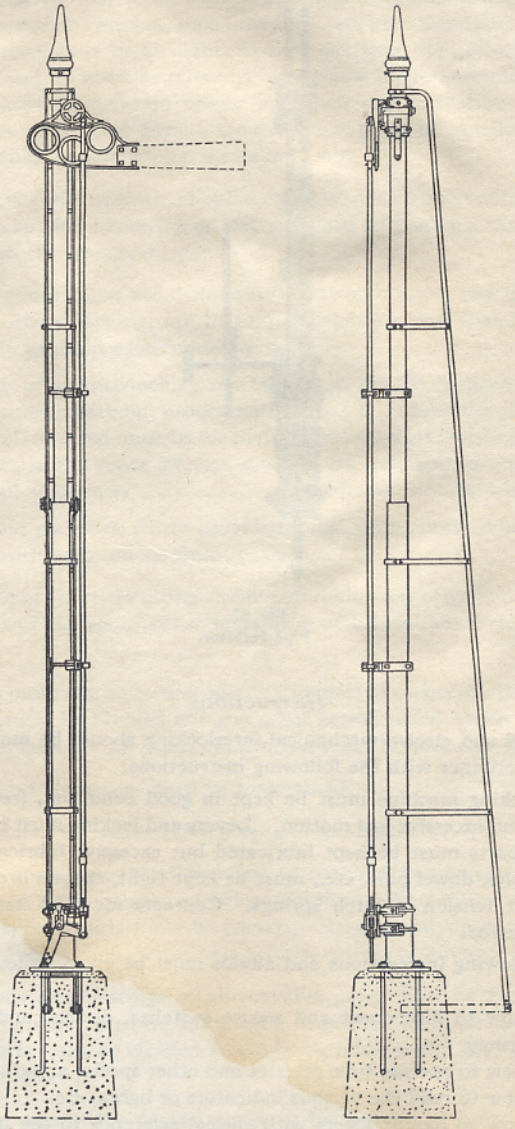

Fig. 66.
Mechanical Signal.