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American Railway Signaling
Principles and Practices

SIGNAL DEPARTMENT.

CHAPTER XVII

Mechanical and Electro-Mechanical
Interlocking

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Unit electric lever.

Immediately after the development of electro-mechanical interlocking machines, it was recognized that a number of advantages would be gained by combining miniature electric levers with the existing mechanical interlocking frames so that the locking between mechanical and electric levers could be accomplished in the standard mechanical locking bed. This resulted in the introduction of various types of machines, of which the one shown in Fig. 12 has been most generally used. It is, therefore, possible to add electric levers to existing mechanical interlocking frames and, under many circumstances, more than double the possible number of operative units, without adding to the floor space in the interlocking station.

The combination consists of an S. & F. machine, above the locking bed of which electric levers are supported and arranged as shown in Fig. 12. The electric levers are made in individual units, spaced 5 inch centers, thus providing for the same number of units as there are mechanical levers and spaces. The units are mounted on supporting frames of four and eight-lever sections or multiples thereof and may be located on any part of or extend the full length of the machine. Each electric unit consists of two main parts: the master unit and the circuit controller. The master unit is that part which is mounted directly upon the supporting frame and includes a lever, lever shaft, and one, two or three magnets, also a latch circuit controller, stick push button or, if desired, a time release. These are shown in Fig. 13. The circuit controllers are furnished with either 12 contacts in the horizontal position or 24 in the vertical position, with a 16 contact extension to the latter when necessary. When but one magnet is required the 12 horizontal contacts may be mounted inside the master units as shown in Fig. 14. When two or three magnets are used, the 12 horizontal contacts are bolted to the end of the master unit as shown in Fig. 15, the 24 vertical contacts being mounted in a similar manner as shown in Fig. 16, each of which is provided with a coupling. The controllers shown in Figs. 14 and 15 are interchangeable. The master unit, the horizontal controller and the vertical controller are each provided with an individual cover. A cylinder lock on the master lever unit cover secures all covers in place.

Electric levers are connected to the locking bed by means of crank arms on the lever shafts and adjustable connecting rods, the latter extending down through the locking brackets as shown between bars 10 and 11 or 22 and 23, to crank arms on the mechanical locking shafts, or to loose sleeve drivers rotating on split journals supported by the mechanical locking shafts. The last mentioned arrangement permits a locking bar to be operated without affecting the function of the shaft supporting the driver. The loose sleeve drivers are made in various lengths so that a selection of locking bars may be obtained. In a 40-bar bed, 20 bars may be operated by the rack type driver and 38 bars by the jaw type driver.

Each electric lever is capable of controlling any unit which can be controlled from an electric or electro-pneumatic interlocking machine, or it may be used as an indication lever for a mechanically-operated switch, or for

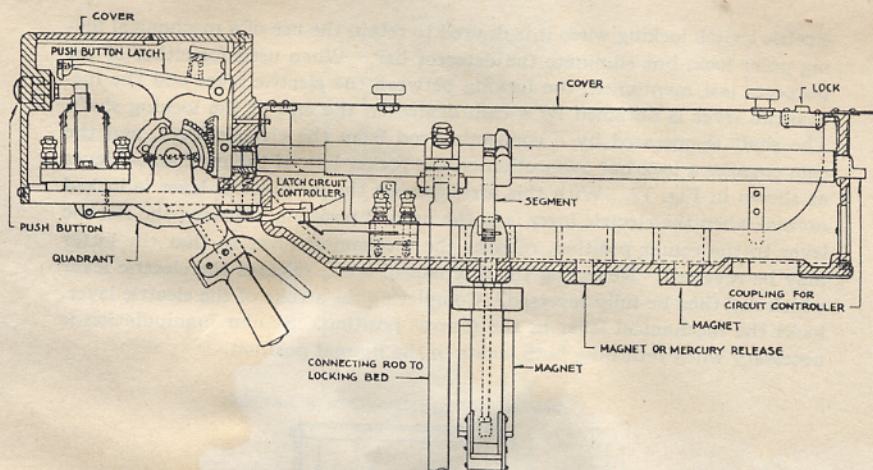


Fig. 13.
Master Unit.

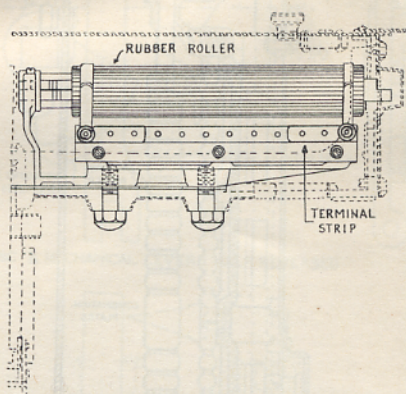


Fig. 14.
Horizontal Circuit Controller Mounted Inside the Master Unit.

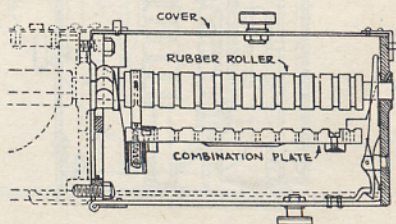


Fig. 15.
Horizontal Circuit Controller Bolted to the End of Master Unit.

electric switch locking when it is desired to retain the use of a mechanical facing point lock, but eliminate the detector bar. When used for either of the purposes last mentioned, the locking between the electric lever and the mechanical lever is obtained by a cam device on the end of the locking shaft. The shaft is operated by a connecting rod from the electric lever, and the cam engages a lock bar connection on the rocker link of the mechanical lever as shown in Fig. 17. With this arrangement the mechanical lever is locked normal when the electric lever is in the normal position. Moving the electric lever to the center position, releases the mechanical lever so that the latter may be reversed. Reversing the mechanical lever, releases the electric lever which can then be fully reversed. Completing the stroke of the electric lever, locks the mechanical lever in the reverse position. Similar manipulation is necessary when returning both levers to the normal position.

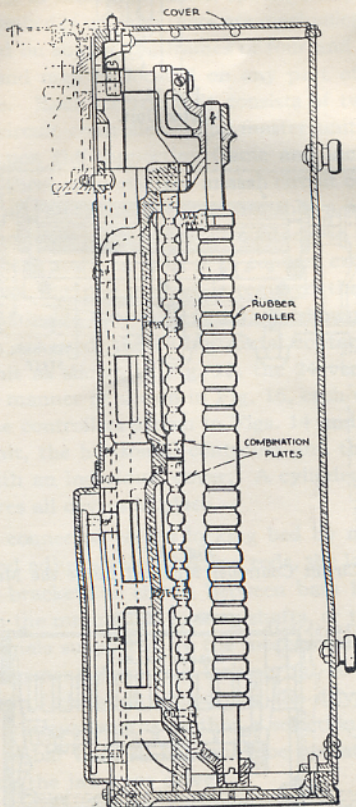
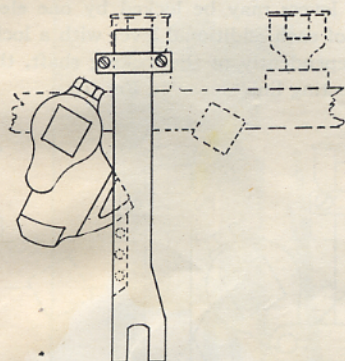
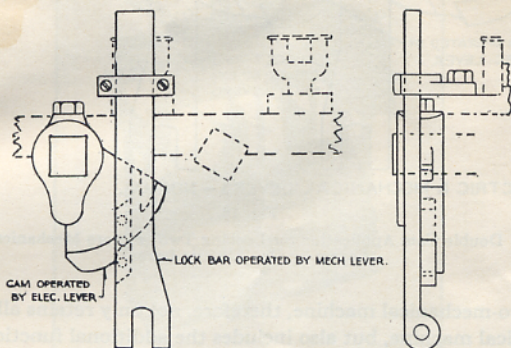


Fig. 16.

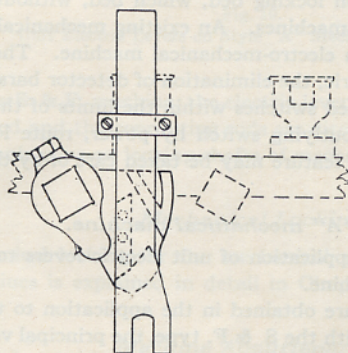
Vertical Circuit Controller Mounted on the End of Master Unit.



ELECTRIC & MECHANICAL LEVERS NORMAL



ELECTRIC & MECHANICAL LEVERS HALF REVERSED

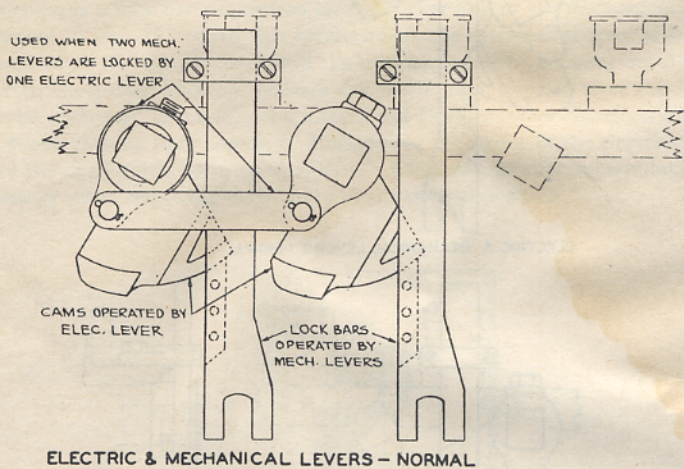


ELECTRIC & MECHANICAL LEVERS REVERSED

Fig. 17.

Cam Locking between Electric and Mechanical Lever.

Two or more mechanical levers may be locked by one electric lever by equipping the locking shaft of each additional lever with a locking cam supported by but operated independently of the locking shaft, the cams being joined together by the connecting link shown in Fig. 18.



ELECTRIC & MECHANICAL LEVERS - NORMAL

Fig. 18.

Double Cam Application for Locking Two or More Mechanical Levers by One Electric Lever.

The electro-mechanical machine, therefore, not only retains all the functions of a mechanical machine, but also includes the additional functions of a power machine, combining the two in such a way that the interlocking of all levers is accomplished in a common locking bed, which bed, without change, is a standard part of all S. & F. machines. An existing mechanical machine can be readily converted into an electro-mechanical machine. The replacing of mechanical signals with electric, the elimination of detector bars, the addition of one or more power-operated switches within the limits of the interlocking plant, the operation of an outlying switch by power, route locking, traffic control, or any other special feature may be taken care of by the addition of unit electric levers.

Unit electric lever, Style "A" mechanical machine.

Figure 19 illustrates the application of unit electric levers to a Style "A" mechanical interlocking machine.

The same general results are obtained in the application to the Style "A" machine as were obtained with the S. & F. type, the principal variation being in the method of locking between mechanical and electric levers. The mechanical locking bed of the Style "A" machine being vertical and located below the floor level at the front of the machine necessitates the use of crank arms to transmit the proper motion from the electric levers to the locking bars,

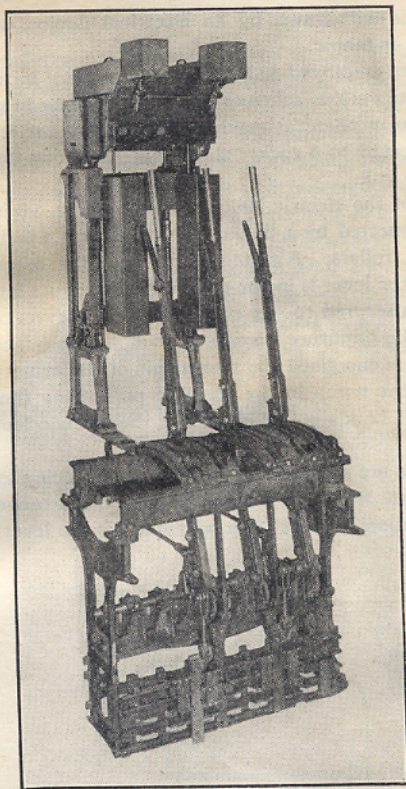


Fig. 19.
Unit Electric Levers on Style "A" Mechanical Machine.

whereas in the S. & F. machine, the electric levers are mounted directly above the locking bed and the connecting rods are direct connected between electric levers and crank arms on locking shafts of mechanical levers.

Mechanical Locking

The mechanical locking for the mechanical and electro-mechanical interlocking machines is explained in detail in Chapter XVI—Interlocking.

Machine Appurtenances

Electric lock.

The Signal Section, A.R.A., defines Electric Lock as: A device to prevent or restrict the movement of a lever, a switch or a drawbridge, unless the

locking member is withdrawn by an electrical device, such as an electromagnet, solenoid, or motor.

Electric locks are employed as a safeguard and may be applied to meet the requirements of the various schemes of electric locking in general use. They may be applied to mechanical machines in various ways; Fig. 20 shows an electric lock connected to a rocker shaft; Fig. 21 shows an electric lock connected to a rocker link.

The operation of the electric lock as shown in Fig. 20 is as follows: The rocker shaft is connected by a link to the crank arm which operates the segment and contact rollers. A notch is cut into the segment to admit the locking dog when the lever is in the position in which its latch is to be locked. The locking dog is secured to one end of a locking lever, to the other end of which is secured the armature suspended over the pole faces of the magnet. When the magnet is energized the movement of the armature withdraws the locking dog from the notch in the segment permitting the lever latch to be operated. Contact bands on roller permit the electric lock to be used as a circuit controller.

The same results are obtained with the electric lock shown in Fig. 21 by driving the segment from the rocker link. This arrangement provides a more direct connection to the device operated by the lever latch.

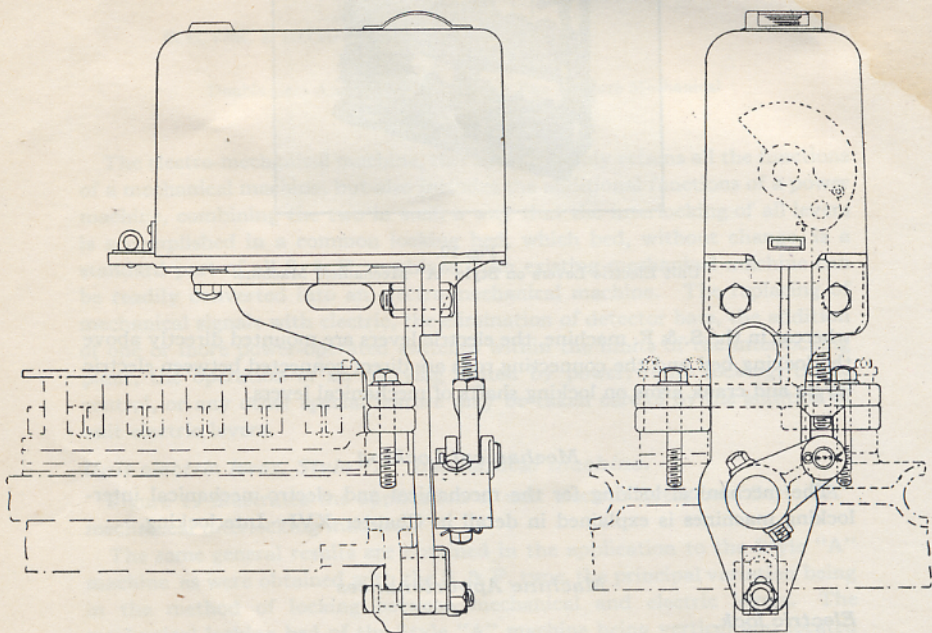


Fig. 20.
Electric Lock on Rocker Shaft, S. & F. Machine.

Forced drop electric lock.

The forced drop feature, as applied to the electric lock, insures that the lever is locked when the magnets are de-energized. The mechanism consists of a locking piece operated by a solenoid magnet as illustrated in Fig. 22, a locking slide bar and crank, and a rack and pinion movement to operate a rotary circuit controller. The movement of the slide bar mechanically forces down the locking member. This type of lock is designed for mounting below the floor and may be applied to an S. & F. machine as shown in Fig. 23, and to a Style "A" machine as shown in Fig. 24. Provision is made for locking the latch in the various positions of the latch and lever by changing the locking stops and guide bars. This type of forced drop electric lock may be equipped with adjustable rotary circuit controllers in tiers of six contacts each. The number of tiers that may be used is limited only by the space available below the floor.

Another type of forced drop electric lock is illustrated in Fig. 25. This type of lock is arranged so that it may be mounted above the locking bed or

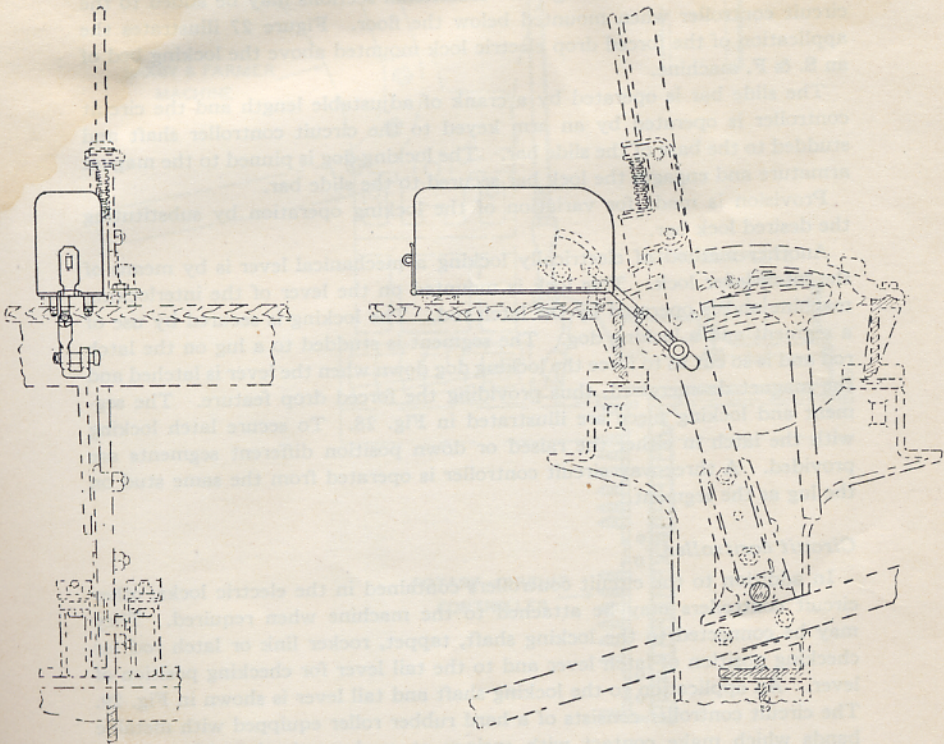


Fig. 21.
Electric Lock on Rocker Link, Style "A" Lever.

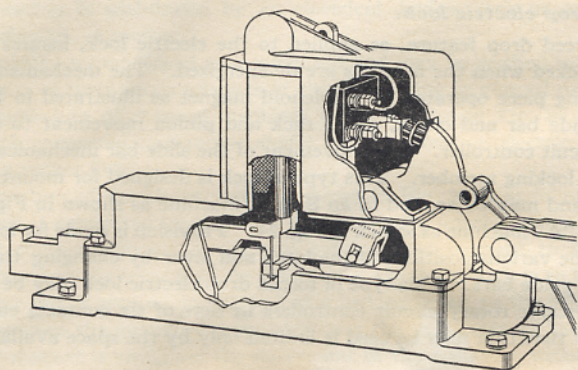


Fig. 22.
Forced Drop Electric Lock.

below the floor similar to Fig. 26. Additional sections may be added to the circuit controller when mounted below the floor. Figure 27 illustrates the application of the forced drop electric lock mounted above the locking bed of an S. & F. machine.

The slide bar is operated by a crank of adjustable length and the circuit controller is operated by an arm keyed to the circuit controller shaft and studded to the base of the slide bar. The locking dog is pinned to the magnet armature and engages the lock bar secured to the slide bar.

Provision is made for variation of the locking operation by substituting the desired lock bar.

Another method of electrically locking a mechanical lever is by means of the latch lever lock. This lock is mounted on the lever of the interlocking machine and is operated by the latch rod. The locking is secured by use of a segment and a locking dog. The segment is studded to a lug on the latch rod and is so cut as to force the locking dog down when the lever is latched and the magnet de-energized, thus providing the forced drop feature. The segment and locking piece are illustrated in Fig. 28. To secure latch locking with the latch in either the raised or down position different segments are provided. A three-way circuit controller is operated from the same stud on the lug as the segment.

Circuit controller.

In addition to the circuit controllers contained in the electric locks, other circuit controllers may be attached to the machine when required. They may be connected to the locking shaft, tappet, rocker link or latch rod for checking position of latch lever and to the tail lever for checking position of lever. An application to the locking shaft and tail lever is shown in Fig. 29. The circuit controller consists of a hard rubber roller equipped with metallic bands which make contact with springs at predetermined positions of the lever or lever latch.