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American Railway Signaling Principles and Practices

CHAPTER XVII

Mechanical and Electro-Mechanical Interlocking

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Interlocking Station

The Standard Code of the American Railway Association defines Interlocking Station as: A place from which an interlocking plant is operated.

The design of an interlocking station varies to meet local conditions and is constructed of any of the standard building materials. Figures 1, 2 and 3 are typical of stations in general use. Within the interlocking station is housed the machine and equipment necessary for the efficient operation of the interlocking plant, such as track model or diagram, indicators, annunciators, bells, releases, relays, batteries, etc. The circuits for this equipment are explained in detail in Chapter XX—Interlocking Circuits.

The general practice is to locate the building centrally with reference to the functions to be operated which also permits the signalman to have the best view possible of the interlocking layout.

Fig. 1.
Frame Interlocking Station.

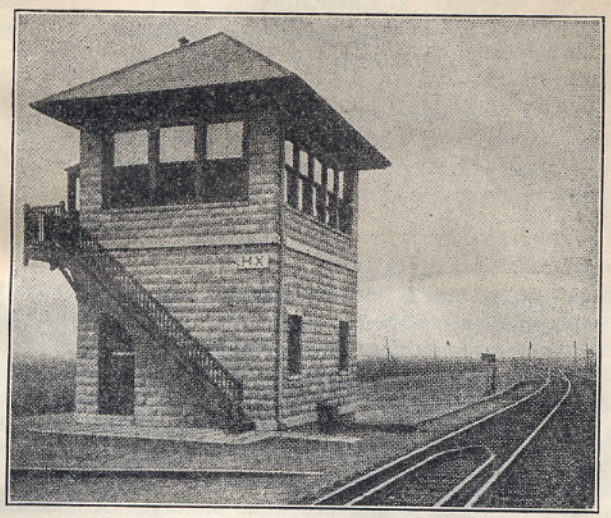

Fig. 2.
Cement Block Interlocking Station.

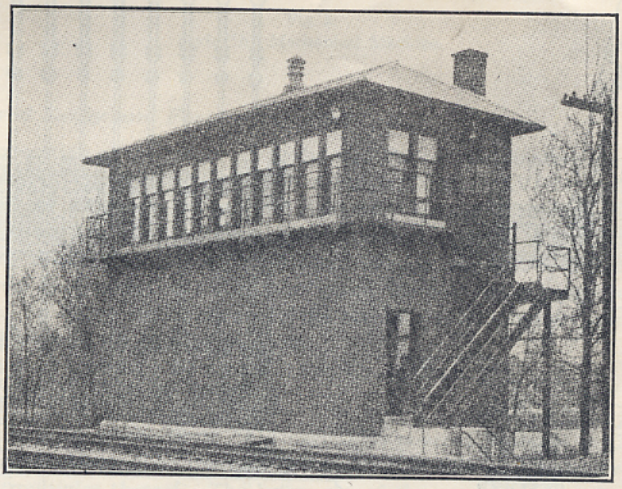

Fig. 3.
Brick Interlocking Station.

Machine

Signal Section, American Railway Association, specifications for mechanical and electro-mechanical interlockings cover the following types of machines:

Mechanical interlocking machine, S. & F. locking.
Mechanical interlocking machine, Style "A" locking.
Electro-mechanical interlocking machine, S. & F. miniature locking.
Electro-mechanical interlocking machine, vertical locking.
Electro-mechanical interlocking machine, unit electric levers, S. & F. locking.

Mechanical machine.

The Signal Section, A.R.A., defines Mechanical Interlocking Machine as: An interlocking machine designed to operate the units mechanically although some of the units may be controlled and operated electrically.

There are two types of mechanical machines in general use known as the improved Saxby and Farmer machine illustrated in Fig. 4, and the Style "A" machine illustrated in Fig. 5. It will be seen from a study of these figures that many parts of the machines are similar and that the principal difference is in the arrangement of the mechanical locking. The Saxby and Farmer machine has a horizontal locking bed while the Style "A" machine has a vertical locking bed.

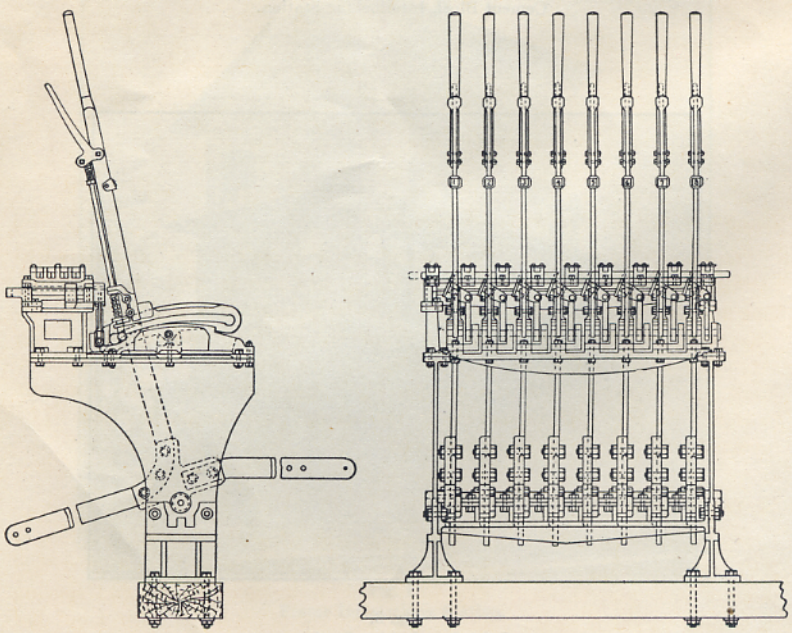

Fig. 4.
Improved Saxby & Farmer Mechanical Machine.

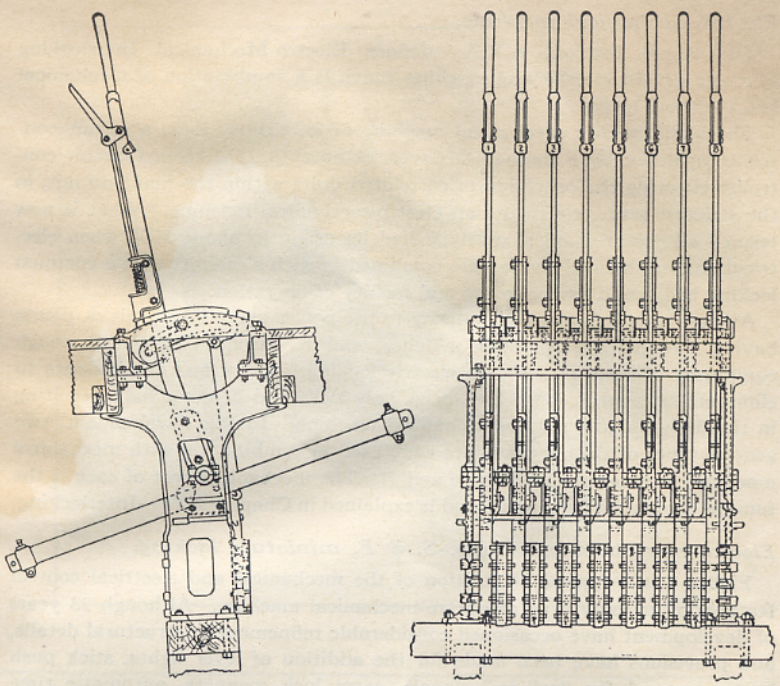

Fig. 5.
Style "A" Mechanical Machine.

Improved Saxby and Farmer machine.

The operation of the improved Saxby and Farmer (hereinafter referred to as "S. & F.") machine is covered in detail in Chapter XVI—Interlocking The machine is furnished in four and eight-lever sections or multiples thereof. The levers are 5 feet 10⅛ inches long from center of fulcrum to end of handle, extending about 4 feet above the floor. They are spaced 5 inch centers Each lever is equipped with a number plate, the numbering being from left to right. In Fig. 4 the levers are in the normal position and are said to be reversed when in the opposite position.

Style "A" machine.

The operation of the Style "A" machine is covered in detail in Chapter XVI—Interlocking. The machine is furnished in four and eight-lever sections or multiples thereof. The levers are of the same length and spacing as is used in the S. & F. machine. Each lever is equipped with a number plate, the numbering being from left to right.

Electro-mechanical machine.

The Signal Section, A.R.A., defines Electro-Mechanical Interlocking Machine as: An interlocking machine which is a combination of mechanical and electrical levers.

The addition to a mechanical machine of an electric lock, a circuit controller operated by a mechanical lever, or an entirely detached circuit controller effecting the operation of correlated units within the plant do not, in the strictest sense, constitute an electro-mechanical machine. What is now termed electro-mechanical machine had its origin in about 1909 when electrical and mechanical levers were combined in such a manner that a common locking bed would assure safety and facility of operation.

At that time there was a tendency to use power-operated signals at plants having mechanically-operated switches, and to provide for the thorough equipment of these plants with electric locking. There was also a desire to eliminate separate facing point locks, bolt locks and detector bars, resulting in the design of the electro-mechanical machine. In this development, two general types of electric machines were used in combination with mechanical machines as illustrated in Figs. 6 and 7. The mechanical part of each is the same as shown in Figs. 4 and 5 and is explained in Chapter XVI—Interlocking.

Electro-mechanical machine, S. & F. miniature locking.

Figure 8 is a typical illustration of the mechanical and electrical control features of an early type of electro-mechanical machine. Although 23 years of development have occasioned considerable refinement in structural details, and provisions have been made for the addition of lever lights, stick push button control for "call-on" signals, extra lock magnets, automatic time releases, etc., the original principles are retained in the present day designs.

The characteristic feature which makes this type of machine particularly applicable to the requirements is the mechanical locking device between each mechanical switch lever and the electric type lever located directly above. The latter, as shown in Fig. 9, locks the switch lever in both normal and reverse positions. The lock consists of a horizontal rod connected to the rocker link on the mechanical lever, with notches cut in it in such a manner that it is securely locked by a vertical rod connected to the electric lever. The electric lever is equipped for electric locking and thus cannot be manipulated unless the track circuits included in control of the sectional or route locking of the switch are unoccupied. When it is operated to the middle position, the mechanical lever is unlocked and can be reversed. Before the stroke of the electric lever can be completed, an electrical indication must be received, through contacts on the mechanical switch-and-lock movements, insuring that the switch points have completed their movement and are locked. Completion of the stroke of the electric lever then locks the mechanical switch lever in its new position and the interlocking provided between the electric levers thus establishes the necessary safeguard against improper lever manipulation.

The machine, as shown in Fig. 6, consists of a standard S. & F. machine, excepting the rocker links and locking bed, these being replaced by special

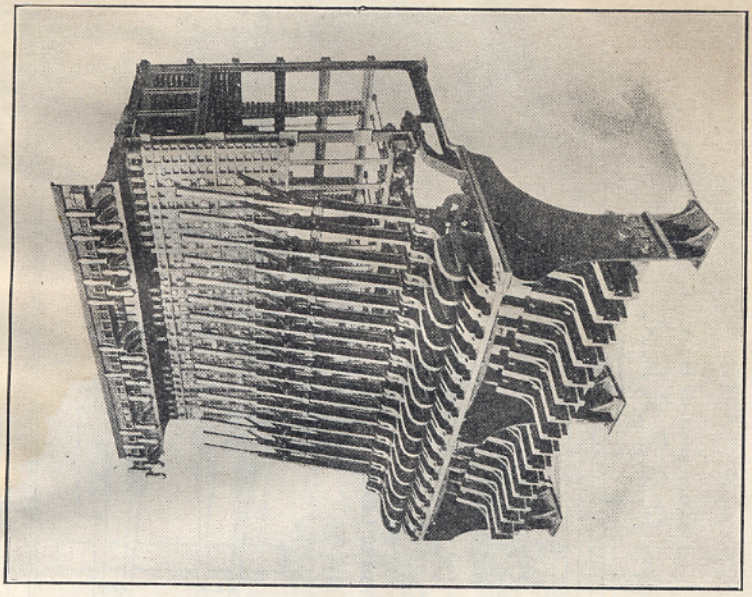

Fig. 7.
Model 2B Electro-Mechanical Machine.

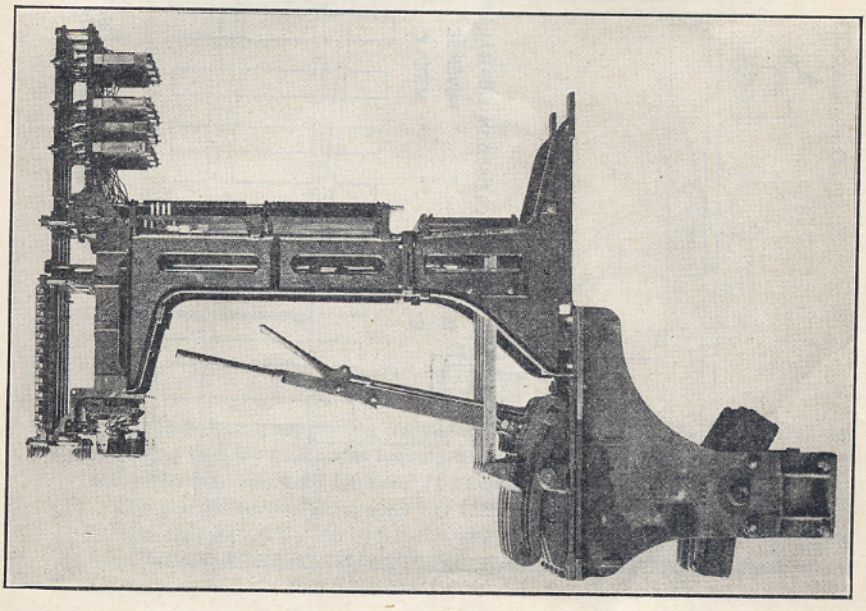

Fig. 6.
Electro-Mechanical Machine, Style P-5.

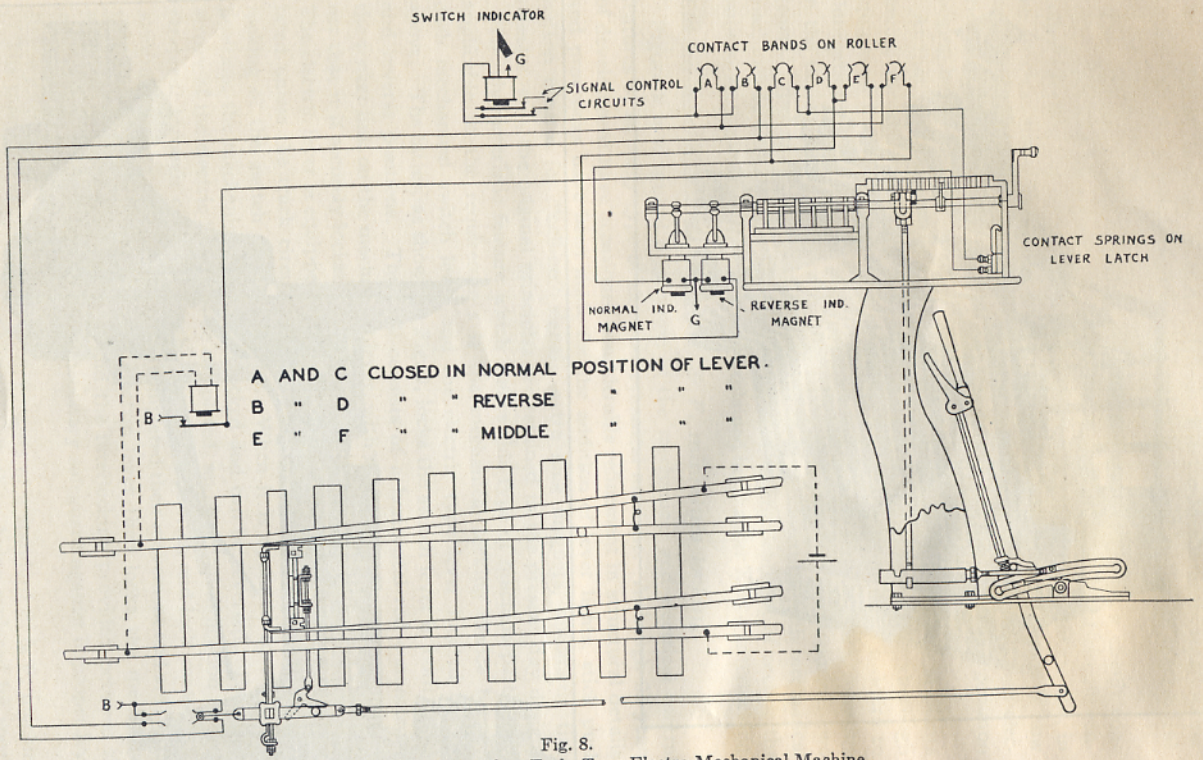

Fig. 8.
Control Features of an Early Type Electro-Mechanical Machine.

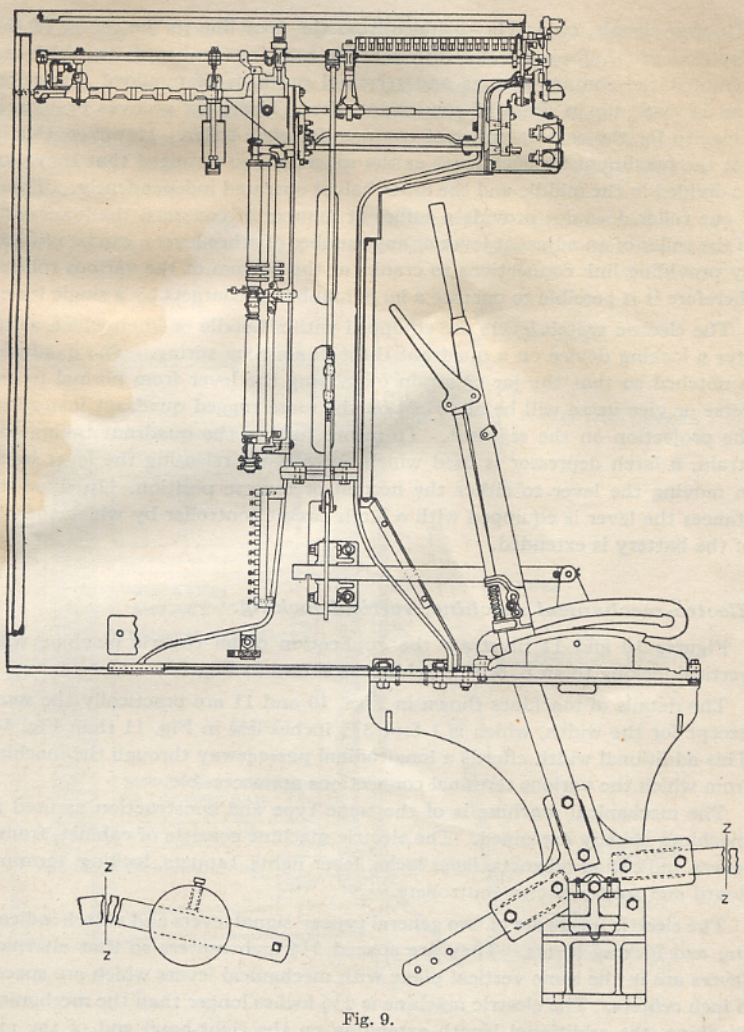

Fig. 9.
P-5 Electro-Mechanical Machine.

rocker links and a supporting frame for the electric units. The frame includes a locking bed for miniature locking between electric levers only. A locking bed of 18 way brackets (36 bars) is furnished on all sizes of machines.

The electric levers are spaced 2½ inch centers, and the mechanical levers 5 inch centers. The electric lever which mechanically locks a mechanical lever is located directly above it, and usually is numbered the same as the mechanical lever. The intermediate electric levers are used for the control

of power signals, etc. The distance from the floor line to the center of the electric lever shafts is 5 feet 3 inches. The combination board, on which are mounted the contact springs and terminal posts, is of moulded insulation and is made up in units of convenient size. Thirty-six grooves provide a capacity for the same number of contacts for each roller. However, this is not the maximum for each lever as the rollers are so arranged that they can be divided in the middle and the lower halves operated independently. Thus, if one roller does not provide a sufficient number of contacts, the lower half of the roller of an adjacent lever or any number of other levers, can be utilized by providing link connections to cranks at the bottom of the various rollers, therefore it is possible to operate a large number of contacts by a single lever.

The electric switch levers are equipped with a handle or knob which actuates a locking device on a quadrant through a strong spring. The quadrant is notched so that the jar or strain of moving the lever from normal to reverse or vice versa will be absorbed on the more rugged quadrant instead of the projection on the segment. To insure further the quadrant taking the strain, a latch depressor is used which necessitates releasing the lever latch in moving the lever to either the normal or reverse position. In some instances the lever is equipped with a latch circuit controller by which the life of the battery is extended.

Electro-mechanical machine, vertical locking.

Figures 10 and 11 illustrate the application of an electric machine with vertical locking to an S. & F. machine, as shown in Fig. 7.

The details of machines shown in Figs. 10 and 11 are practically the same except for the width, which is 1 foot 3¾ inches less in Fig. 11 than Fig. 10. This additional width affords a longitudinal passageway through the machine from which the various terminal connections are accessible.

The mechanical machine is of the same type and construction as used in machines already explained. The electric machine consists of cabinet, frame, levers, indication magnets, lever locks, lever lights, tappets, locking, terminal board and rotary circuit controllers.

The electric levers are of two general types: signal levers and switch indicating and locking levers. They are spaced 2½ inch centers so that alternate levers are in the same vertical plane with mechanical levers which are spaced 5 inch centers. The electric machine is 2½ inches longer than the mechanical machine, the additional length extending on the right-hand end of the mechanical machine. The number of electric lever spaces is double that of the mechanical lever spaces.

The rotary circuit controllers are made in tiers, each tier having 6 contacts, with a total capacity of 5 tiers or 30 contacts for each circuit controller. The individual contacts may be arranged to open or close a circuit at any position in the stroke of the lever. By means of a crank operated by its lever, each tier of circuit controller contacts actuated by a mechanical lever is revolved through 60 degrees, and each tier of circuit controller contacts actu-

ated by an electric lever is revolved 90 degrees. When electric and mechanical levers are in the same vertical plane, either lever may be arranged to operate all contacts, or the former may be arranged to operate the upper tier of contacts, and the latter the lower tier, independently of each other. The tiers of contacts in one space may also be arranged to operate with one or more tiers of contacts in adjacent spaces, thus making available a large number of contacts.

The mechanical locking is vertical as in the electric machine and the tappets are actuated by means of a cam slot in the respective electric and me-

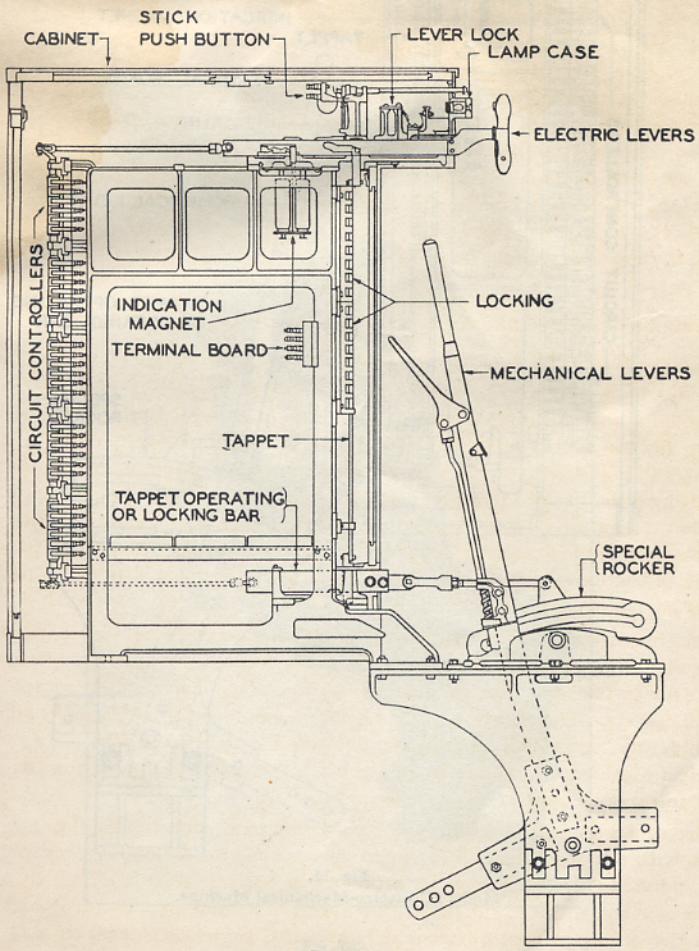

Fig. 10.
Model 2B Electro-Mechanical Machine.

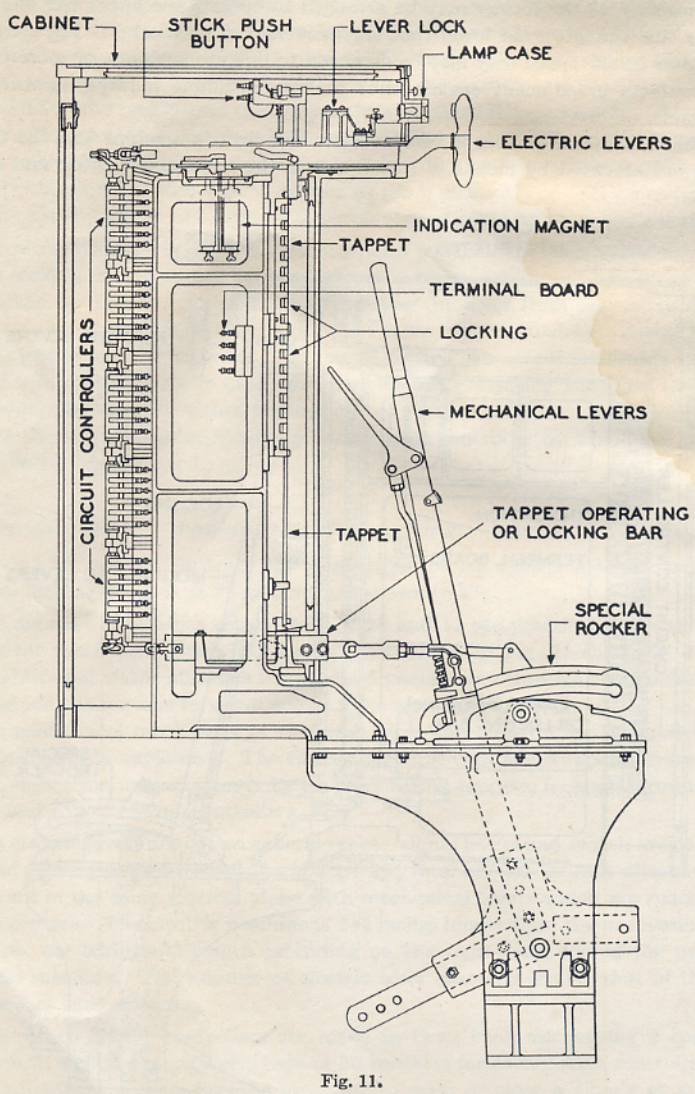

Fig. 11.
Model 2C Electro-Mechanical Machine.

chanical lever locking bars. Provision is made for either the electric or mechanical levers to operate the locking. This is explained in detail in Chapter XVI—Interlocking.

Referring to Fig. 10, it will be seen that the mechanical lever does not actuate the mechanical locking, but is bolt-locked by the electric lever. The mechanical lever shown in Fig. 11 has the locking bar equipped with a cam slot and tappet and actuates the locking. Thus, by the proper application of cam slots with accompanying tappets to electric and mechanical levers it is possible to obtain the same flexibility of locking as shown in electro-mechanical machines previously described in this chapter.

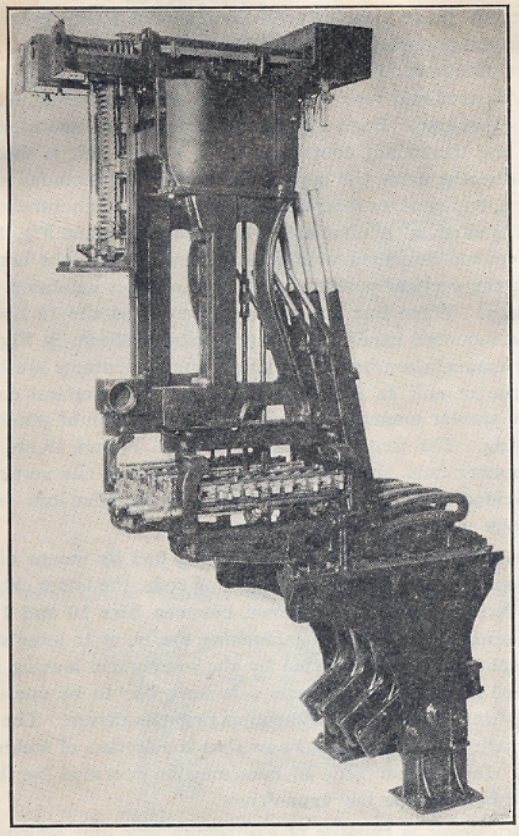

Fig. 12.
Unit Electric Levers.