The Multiple Unit Electric Interlocking Machine

A Description of the Design and Operation of this Latest Development in ALL ELECTRIC INTERLOCKING

THE SIGNAL ENGINEER for June, 1909, contained a description of the multiple unit interlocking machine of the Union Switch & Signal Company, which has been put out within the past two years. The machine described was installed at Sterling, Ohio, at the crossing of the Erie and Baltimore & Ohio railroads, and has 73 working levers in an 88-lever frame. A track plan of the layout at this point appeared on Page 14 of the issue above mentioned.

Before taking up the detailed description of the machine and its construction it might be well to review briefly the general design of the plant at Sterling in order that a complete idea may be obtained of the working of the interlocking controlled by the multiple unit machine.

The ground apparatus used with the new machine is very similar to that which has been furnished by the Union Switch & Signal Company for some time past. The switch lock movement is the same in all respects, except in the construction of the motor armature which has two independent series of coils which connect to the commutator. The two sets of coils are in series during the movement of the switch and act jointly as a motor to drive the mechanism. At the end of the movement the driving current is switched over to one set of coils

Fig. 1.

and this raises the potential of the two sets in series so that a higher potential is produced at the motor than exists at the battery. This sends a current toward the positive pole of the battery through one coil of the indication apparatus which is referred to below. The other coil of the indication magnet is energized by the motor current. The indication apparatus comprises a polarized magnet without permanent magnets, the polarization being effected by the driving current to the motor passing through one of the magnet coils. The other coil must at the same time have current in a certain direction relative to the driving current in order that the magnetism may be such as to actuate the latch. This coil is also connected to the positive side of the battery and the current must flow towards the positive pole of the battery to be in the right direction to energize the magnet. The purpose of the two sets of coils on the motor armature is to cause the current to flow in opposition to the battery. The counter electro-motive force of the motor when running light is nearly equal

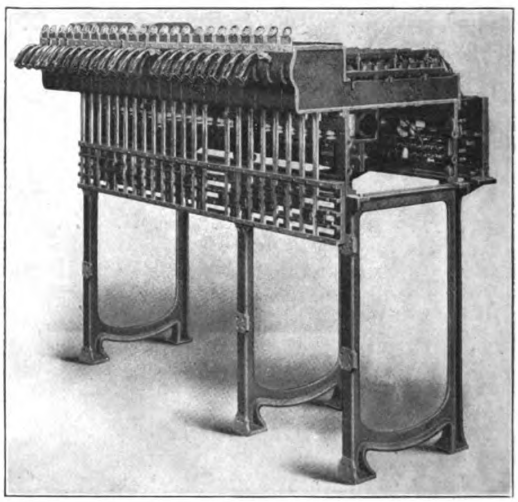

Fig. 2.

to the electro-motive force of the sources of the current. When the motor is driven through one set of coils on the armature the counter electromotive force in this set is nearly equal to that of the battery. And since the other set of coils is rotating at the same speed in the same magnetic field, its counter electromotive force is the same as that in the set driving the motor. The sum of the two e. m. f's then is nearly double that of the battery and this results at the moment of the closing of the indication circuit in raising the potential at the motor, which, flowing in a direction opposite to that in which the current should come from the battery, overbalances the battery current. The protection which this arrangement affords against false indications is explained in the article previously published in these columns. The dwarf signal used with this machine is actuated by a solenoid and the indication is known as battery indication. This is also explained at greater length in the previous article. The indication for the high signal is the same as that for switches.

The interlocking machine receives its name from the fact that each lever is an independent unit in itself and may be removed from the machine by taking out one screw. The lever movements are novel, the first being a longitudinal movement which actuates the mechanical interlocking in the machine. The medial movement is a movement in the arc of a circle to operate the circuit controllers on the circuits of the functions. The final movement is a longitudinal movement and takes place only after the indication has been received and results in the release of a certain mechanical locking. This movement is automatic and is made by a spring. It is accom-

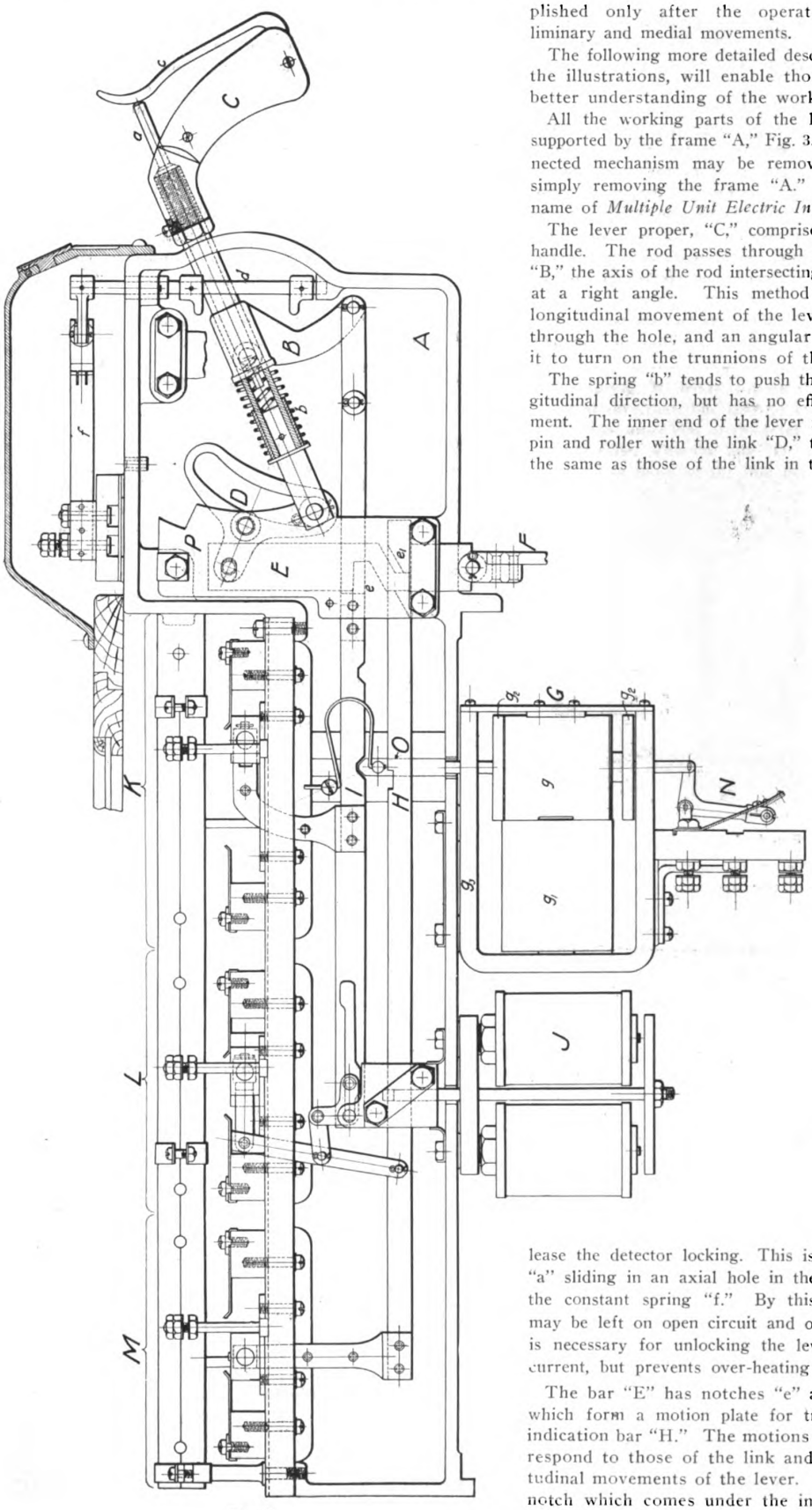

Fig. 3.

plished only after the operator has made the preliminary and medial movements.

The following more detailed description, in connection with the illustrations, will enable those interested to obtain a better understanding of the working of the machine.

All the working parts of the lever are attached to and supported by the frame "A," Fig. 3. The lever and all its connected mechanism may be removed from the machine by simply removing the frame "A." From this it derives its name of *Multiple Unit Electric Interlocking Machine.*

The lever proper, "C," comprises a rod provided with a handle. The rod passes through a hole in a pivoted lever, "B," the axis of the rod intersecting the axle of the trunnions at a right angle. This method of supporting permits a longitudinal movement of the lever by allowing it to slide through the hole, and an angular movement by permitting it to turn on the trunnions of the lever "B."

The spring "b" tends to push the lever inwardly in a longitudinal direction, but has no effect on its angular movement. The inner end of the lever is connected by means of a pin and roller with the link "D," the functions of which are the same as those of the link in the well-known mechanical machine. A shouldered plate "P," attached to the frame "A," makes it necessary to pull the lever out to the full extent of its longitudinal movement before a rotational movement can be made. The longitudinal movement turns the link on its pivot and through the bar "E" moves the tappet bar "F," which effects the mechanical locking. The rotational movement has no effect on the link as the roller moves freely in the slot of the link which is then concentric with the trunnions on which the lever turns. The final inward longitudinal movement produced by the spring "b" moves the link and the tappet still further in the same direction and effects the release of certain mechanical locking.

The thumb latch "c" is for the purpose of closing the circuit of the magnet "J" to release the detector locking. This is effected through the rod "a" sliding in an axial hole in the lever, the shaft "d" and the constant spring "f." By this means, the magnet "J" may be left on open circuit and only put in circuit when it is necessary for unlocking the lever. This not only saves current, but prevents over-heating of this magnet.

The bar "E" has notches "e" and "e'" cut in its edges, which form a motion plate for transmitting motion to the indication bar "H." The motions of the indication bar correspond to those of the link and, therefore, to the longitudinal movements of the lever. The indication bar has a notch which comes under the indication latch "O" when the bar is in its middle position.

The latch drops into the notch at the end of the preliminary longitudinal movement of the lever and locks the lever against final movement until the latch is lifted by the indication magnet.

To insure that the latch drops into the notch, a cam formed on the bar "I" will force it down if it does not drop by gravity. The bar "I" is connected to the lever "B" which is moved by the rotational movement of the lever, during which movement the indication bar remains stationary. Two "V" shaped notches are cut in the under side of the bar "I," one of these notches coming over the latch in either of the extreme positions of this bar. The uncut part of the bar between the notches forms the cam which forces the indication latch down.

The indication magnet "G" comprises two energizing coils "g" and "g_1." The coil "g" is enclosed within an iron tube

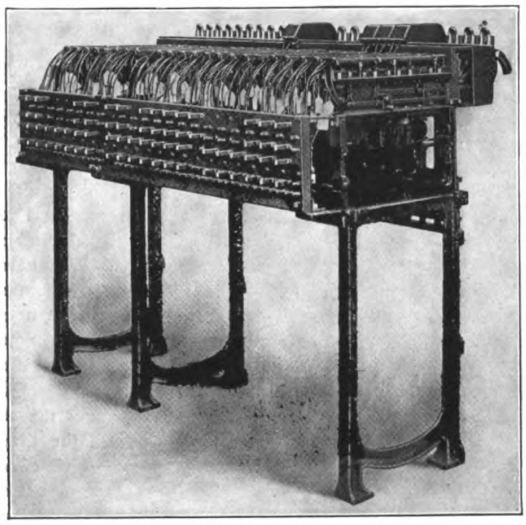

Fig. 4.

or shell which forms one pole of the magnet energized by the coil "g_1." The other pole of the magnet resides at the two ends of the yoke "g_2." Within the coil "g" and free to move in a vertical direction is an iron core having a flat iron disk attached to each end. These disks are the poles of another magnet energized by the coil "g." If the direction of the current in the coil "g" is such as to make the upper disk a north pole and the lower disk a south pole, and the direction of the current in the coil "g_1" is such as to make the shell a north pole and the ends of the yoke south poles, the movable core will be pushed upwardly, but, if the current in either coil is reversed, the core will be held down.

The coil "g" consists of a few turns of heavy wire and is energized by the operating current of the switch motor. The coil "g_1" has a large number of turns of wire and is energized by the indication current. The operating current through the coil "g_1" has always the same direction.

During the movement of the switch, a small current flows from the battery, through the coil "g_1" to the motor, but this is in a direction to hold the movable core down. After the switch movement is completed, and the driving current is switched over to one set of armature coils, current flows back in the opposite direction through the coil "g_1," and the core and indication latch are lifted.

The controller "K" comprises four contact springs, two fixed rails, and two movable blocks. This controller is operated by the rotational movement of the lever and controls the operating circuits to the motor. In one of its positions, one of the operating wires is put in connection with the positive of the battery through the low resistance indication coil "g" and the other operating wire is connected to positive of battery through the high resistance indication coil "g_1." The current in the latter circuit is too greatly limited by the high resistance to have any effect on the motor which is governed by the much stronger current in the former. In the opposite position of the controller these connections are reversed.

The controller "L" is similar in construction to the controller "K," but it is actuated by the preliminary and final movements of the lever. Its purpose is to close the motor stopping circuit and open the indication circuit when the lever movement is completed. The stopping circuit is also taken through the controller "N," actuated by the indication magnet. The purpose of this is to close the stopping circuit only when it is needed and leave it normally open.

The controller "M" is a special and forms no part of the interlocking proper. By means of it, two circuits may be closed in either position of the lever.

The signal lever is similar to the switch lever, but it has an indication only in the normal position.

TELEPHONE TRAIN DISPATCHING IN THE SOUTH.

Railroads in the South have recently been very active in adopting the telephone method of handling the movement of trains. The Southern Railway has purchased equipment for the installation of telephones and selectors on a portion of its line, and it is reported that the equipment of the other divisions on this road will soon follow.

The Chesapeake & Ohio has completed the installation of similar equipment on the Cincinnati Division and expects to have installed within a short time equipment for handling train movements by telephone on three of its other divisions.

The Norfolk & Western Railroad has equipped a large portion of its line with telephones, and plans to cover its entire system as soon as possible.

The Seaboard Air Line has installed the telephone on two of its divisions, and reports that the operation of telephones for handling train movements is so satisfactory that the extension of the service is being considered.

The Atlantic Coast Line has for some weeks been handling train movements on one division by this method and plans to extend the service on other important divisions as soon as construction work can be completed.

An interesting feature of the installation of telephones for train dispatching on the Georgia Railroad is the carrying of apparatus on each train so that in case of a wreck or breakdown communication may be had with the dispatcher or nearest train operator by simply cutting the direct wire in on a train instrument. This scheme is so eminently practicable with the telephone that its extensive adoption is expected.

By reason of the use of improved signaling devices and modern methods of controlling train operation the proportion of fatalities is constantly decreasing. According to figures presented by the Interstate Commerce Commission they were, during the period from 1888 to 1897 as 1 to 45,300,000, while from 1897 to date, they have been as 1 to 54,900,000. This shows a gain in ratio of over twenty per cent.

It is understood that considerable signal work will be undertaken by the Panama Railroad Company during the next two years. The signaling will be required in connection with the relocated line of the Panama R. R.

At a recent conference of representatives of the Brotherhood of Locomotive Engineers with the New York State Public Service Commission the Commission was informed that the signal lights on railroads within the state were not always bright enough. An investigation of this matter was promised.

It is understood that this investigation will include an inquiry into possible means of improving present practice in general with respect to night signal indications.