G. B. SMITH.

ELECTROMAGNETIC SWITCH MECHANISM.

APPLICATION FILED JAN. 26, 1915.

1,279,168. Patented Sept. 17, 1918.

3 SHEETS—SHEET 1.

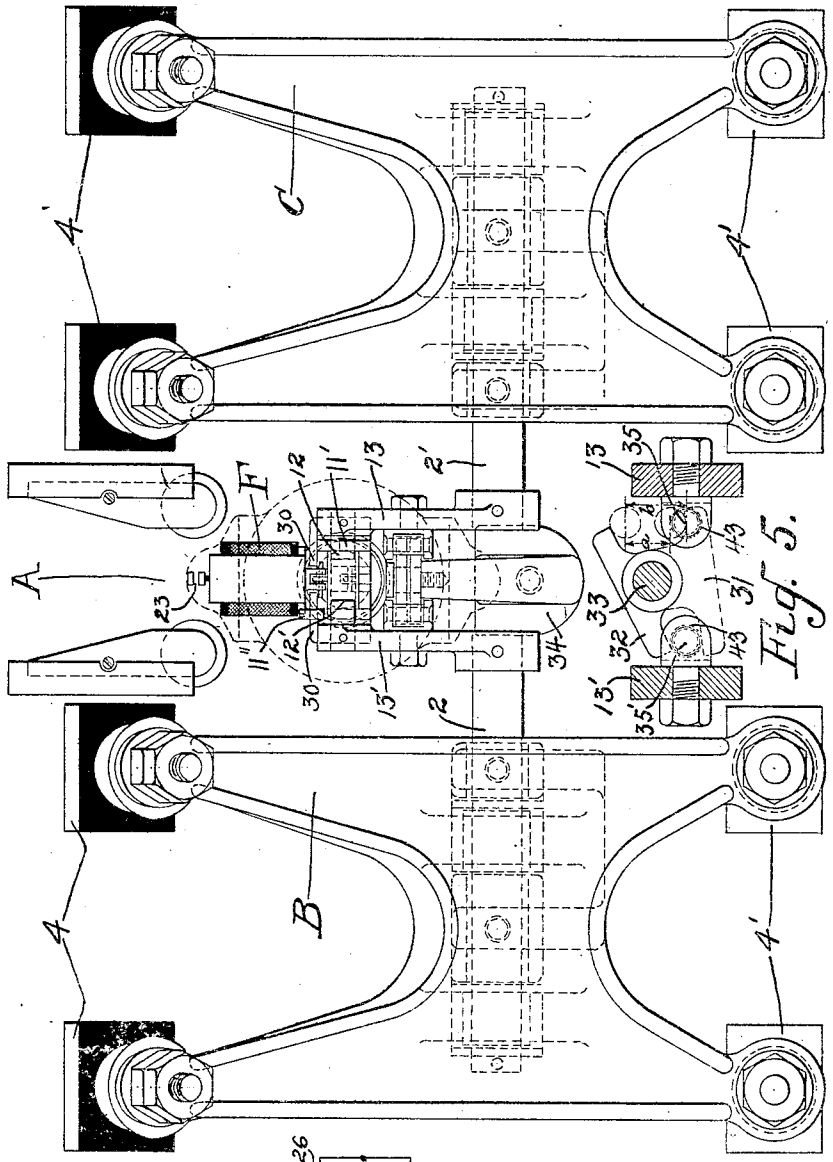


Fig. 1.

Fig. 5.

Fig. 6.

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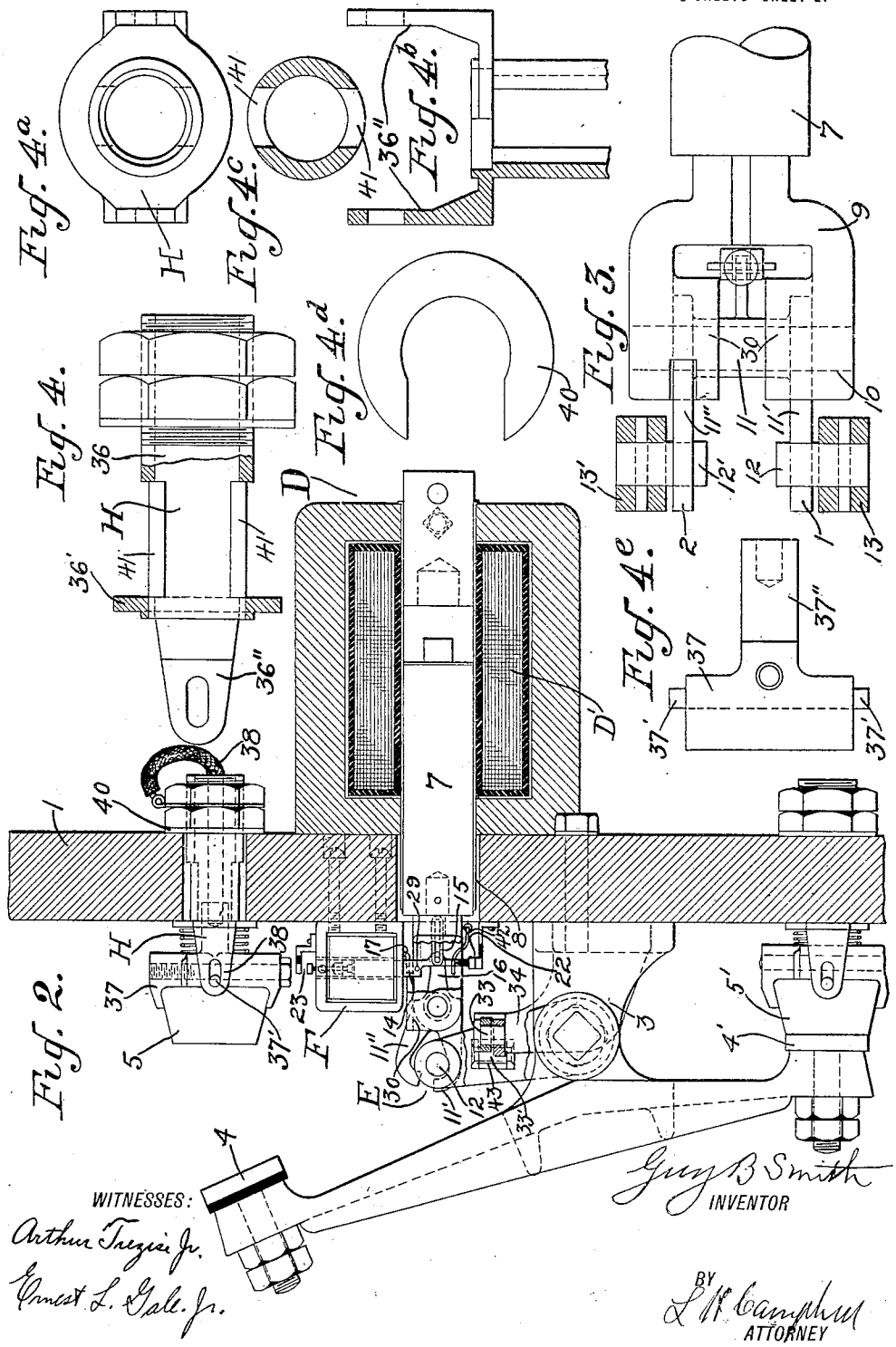
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 7.

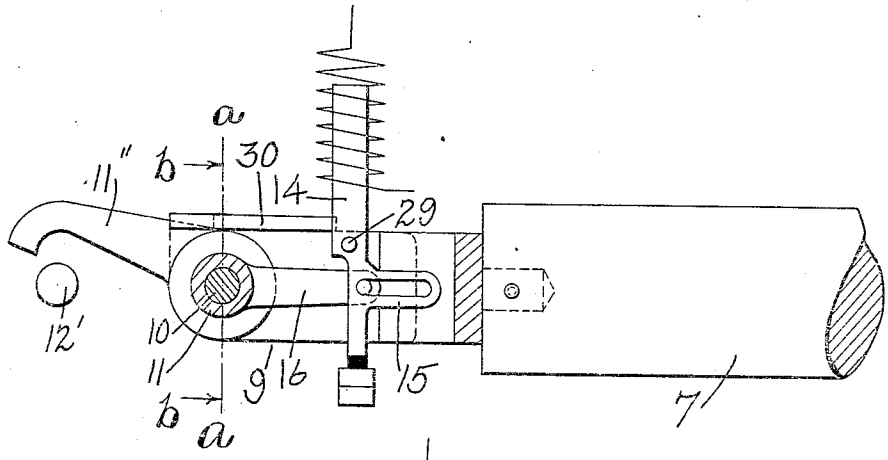
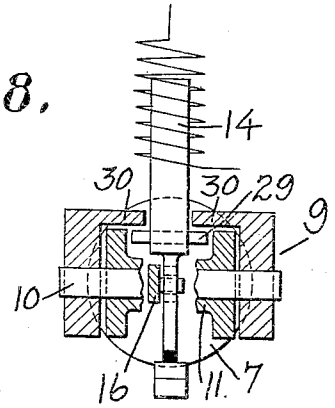


Fig. 8.



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UNITED STATES PATENT OFFICE.

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ELECTROMAGNETIC SWITCH MECHANISM.

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To all whom it may concern:

Be it known that I, GUY B. SMITH, a citizen of the United States, residing in New York, in the county of New York and State of New York, have invented a new and useful Improvement in Electromagnetic Switch Mechanism, of which the following is a specification.

My invention relates to improvements in electromagnetic switch mechanism, and more particularly to the type commonly known as reversing switches, such for example as are used in controlling the reversal of electric elevator motors and the like.

One of the objects of the invention is to provide switch apparatus of the above-noted character, comprising a pair of switches, together with simple and positive means for effecting the operation thereof singularly and selectively by means of a single operating magnet.

Other objects are in the provision of certain detailed parts which are of an improved construction, the same being clearly set forth hereinafter in the accompanying specification and appended claims.

In the accompanying drawings, Figure 1 is a front elevational view of reversing switch mechanism arranged in accordance with my invention; Fig. 2 is a side elevational view of the switch mechanism with certain parts in section; Fig. 3 is a plan view partly in section of certain parts shown in Figs. 1 and 2; Figs. 4, 4^a, 4^b, 4^c, 4^d and 4^e, illustrate various parts of a contact holder of an improved construction; Fig. 5 is a part sectional plan view of a device which in function acts as a mechanical hold-down, and also as a bottom contact controlling device; Fig. 6 illustrates diagrammatically a method for controlling the operation of the reversing switch mechanism, by means of a car switch; Fig. 7 is a sectional elevation through the longitudinal center of Fig. 3, with certain parts broken away; Fig. 8 is a sectional view of Fig. 7, taken on the line *a*—*a* in the direction of the arrows *b*—*b*.

The switch mechanism as a unit, which I will designate by the reference letter A, may be suitably mounted on a slate 1. The switch mechanism comprises a pair of switch arms B, C, fixed on the rocker shafts 2, 2′, respectively, the latter being supported in bearings 3 bolted to the slate 1. There are carried by each of the switch arms two sets of contacts, termed the upper and lower contacts, designated by the reference numerals 4, 4′, respectively, one set of each arm being insulated therefrom. The upper and lower contacts are adapted to co-act with fixed contacts 5, 5′, respectively, the latter contacts being supported on the plate 1 by means of contact holders see Fig. 4, embodying novel features of construction and arrangement of parts which will be more fully set forth hereinafter.

The switch arms B and C are adapted to be operated singularly by means of an electromagent D, through the intermediary of the electromechanical mechanism E, by means of which a selective operation of the switch arms is effected. The electromagnet is of the well known solenoid type, and may be mounted on the rear of the slate 1. The armature 7 of the electromagnet is movable in a horizontal plane, and extends through an opening 8 provided therefor in the slate. A bifurcated member 9 is suitably attached to one end of the magnet armature the same being provided with a pin 10 which pivotally supports a bar 11, comprising two reversibly hooked arms 11′, 11″. The hooked arm 11′ is adapted to hook onto a pin 12 carried by an arm 13 fixed on the rocker shaft 2′, and in this manner form a connection between the switch arm C and the magnet armature 7. This connection is illustrated in Fig. 2. The rocker shaft 2 associated with the switch arm B is likewise provided with an arm 13′ carrying a pin 12′, the latter being adapted to be hooked by the arm 11″. Now it will be noted that the hooked arms are arranged so as to engage their respective pins singularly, that is to say, with the hooked arm 11′ hooked onto its pin 12, the arm 11″ will be out of hooking engagement with its respective pin, or vice versa, with the arm 11″ hooked onto

its pin. In this manner the switch arms are singularly connected to the armature of the electromagnet for operation thereby.

In the way of selectively controlling the operation of the switch arms by means of the electromagnet D, there is associated with the bar 11, a pilot magnet F, which is fixed on the front of the slate 1. This magnet is of a well known construction, and its armature 14 is operatively connected to the bar through a slot and pin connection 15. The pin is carried by a rearwardly extending arm 16 on the bar, and the slotted member is fixed to or may form a part of the armature 14. A stop member 17, limits the movement of the armature 14 to its unattracted position, but permits free movement thereof upwardly to its attracted position.

With this arrangement of parts, the weight of the armature 14 when in its unattracted position keeps the arm 11′ in locking engagement with the pin 12, thus forming a connection between the switch arm C and the armature 7. If it is so desired, any suitable form of spring 42, may be provided to assist the armature in carrying out its function above set forth. Now by sending an electric current through the winding of the electromagnet D, the operation of the switch arm C is effected, thereby closing its associated top contacts, and opening the bottom contacts. In this operation, the switch arm B of course remains open, with its associated bottom contacts closed. Upon cutting off the current supply to the said winding, the switch arm C will open itself by gravity, and again close its bottom contacts.

Now upon sending a current through the winding of the pilot magnet F, the latter will operate its armature 14 to attracted position, thereby actuating the bar 11 so that the arm 11″ hooks onto the pin 12′, and moving the arm 11′ out of hooking engagement with the pin 12. In this instance the operation of the switch arm B is effected, upon sending an electric current through the winding of the electromagnet D, thereby closing its associated top contacts and opening the bottom contacts, the switch arm C in this instance remaining open with its associated bottom contacts closed. In the operation of the switch arm B, it will be noted that the provision of the slot and pin connection 15 enables the armature 14 to hold the arms 11″, 11′ in hooking engagement with the pins 12′ and 12 during the movements of the armature 7 to attracted and unattracted positions.

Contacts 22 and 23 are controlled by the pilot magnet, the contacts 22 being normally closed when the armature 14 is in its unattracted position as shown in Fig. 2, and the contacts 23 being normally open, but closed when the armature 14 is in its attracted position. These contacts each control an independent circuit for the winding D′ as will be hereinafter pointed out in connection with the system of circuits illustrated in Fig. 6.

In Fig. 6 I have illustrated a system of electrical circuits controllable from a car switch S, for effecting a particular sequence of operation between the electromagnet D′ and the pilot magnet F. The car switch may be of any well known type and in this instance comprises a pivoted hand lever 16, provided with a contact segment 17, normally engaging fixed contacts 18, which may be termed supply contacts since both are electrically connected to a positive conductor of the supply mains, designated + and —. Now by moving the hand lever toward the right hand, a circuit is established for the winding of the electromagnet D, which circuit may be traced from the supply contacts to contact 19, by way of the segment 17, wire 20, contacts 22, wire 21, winding D′, and thence to the — line. The winding of the electromagnet D now being energized effects the operation of the switch arm C as heretofore described, the switch arm B remaining open. By returning the hand lever to its center position, the circuit for the winding D′ is thus broken, and the switch arm C will now open by gravity.

By moving the hand lever toward the left hand, a circuit is established for the winding F′ of the pilot magnet, which circuit may be traced from the supply contacts to contact 24 by way of the segment 17, wire 25, winding F′, and thence to the —line by way of wire 26. The winding F′ now being energized effects the operation of the bar 11, thereby operatively connecting the switch arm B with the armature of the electromagnet D. The operation of the pilot magnet now opens the contacts 22 and closes the contacts 23, which establishes a circuit for the winding D′; this circuit may be traced from the junction 25′ to the winding D′, by way of wire 27, contacts 23, wire 28, and thence to the — line. Now with this arrangement, it will be pointed out that the connection between the armature 7 and the switch arm B is assured, before the operation of the electromagnet D′ can be effected. The winding of the electromagnet D′ now being energized effects the operation of the switch arm B, the switch arm C in this instance being open. By returning the hand lever to the center position, the circuit for both the windings D′ and F′ is thus broken and the switch arm B will open by gravity.

Now here an important feature of the invention is to be pointed out, which comprises the provision of means arranged so that when one of the switch arms is in closed position, a subsequent operation of the other

switch cannot be effected by throwing the hand lever quickly from one operated position to the other operated position, until all the parts comprising the switch mechanism are returned to their normal position. In the way of accomplishing this result, there is carried by the armature 14, a pin such as 29, which is adapted when the switch arm C is operated, or in other words with the armature 14 in its unattracted position, to attain a position underneath the ledges 30 formed on the member 9. Now, it will be seen that the armature 14 is thus locked in its unattracted position when the switch C is operated, and is so maintained until the said switch arm is opened. In this manner the operation of the switch B is prevented in case the hand lever is quickly thrown from the right to the left hand operative position, since the contacts 23 are locked open and cannot be closed until the switch B is opened, or in other words until the ledge rides off the pin 29. Furthermore this arrangement insures the return of the bar 11 to its normal position before it can be actuated by the electromagnet D', and if so actuated as for example by holding the lever in its right hand operative position will be in such position as properly to hook onto the pin 12'.

In the operation of the switch B by the electromagnet D, the armature 14 of the pilot magnet will move to its attracted position, thus moving the pin 29 above the ledge, and in this manner when the switch B is operated the armature 14 is locked in its attracted position, and is so maintained until the said switch is opened. In this manner the operation of the switch C is prevented in case the hand lever is thrown quickly from the left to the right hand operative positions, since the contacts 22 are locked open and cannot be closed until the switch C is opened, or in other words until the ledge 30 rides from under the pin 29, and at which time the armature 14 may drop to its unattracted position and the arm 11' will therefore be in a position to properly hook onto the pin 12.

In the way now of explaining another feature of my invention, it will be noted that thus far it is explained and will be understood that with the switch arms B and C open, or in normal position as shown in Fig. 2, their bottom contacts are intended to be closed. In certain systems of electrical control for elevator motors, particularly, it is necessary upon the opening of each switch, to prevent its bottom contacts from being made, the idea being to keep the same slightly released until the other switch is closed, whereupon the bottom contacts of the above mentioned switch are closed. Fig. 5 shows a pair of walking beams, 31 and 32, the beam 31 having for its function, to effect the desired result above set forth, and the beam 32 serving as a mechanical hold-down. The beams 31 and 32 are supported by means of a stud 33 on a bracket 34 fixed to the slate. Posts 35, 35', having rollers 43, are fixed to the arms 13, 13', and are positioned between the walking beams in the manner shown. Now in the operation of these coacting parts, we will assume the switch C is closed. In this operation the walking beam 31 permits the switch arm B to close its bottom contacts with the stud 35' attaining the position as indicated in Fig. 5.

The stud 35 being movable with the switch arm C, actuates the walking beam 32 to the position as indicated in Fig. 5, the action thereof being to force the switch arm B closed, thus insuring firm electrical engagement between the bottom contacts, which is very desirable. The movement of the switch C upon opening, is limited by the walking beam 31, which movement in amount is equal to that indicated by the letter "*a*" the full opening movement being equal to "*b*." In this manner the bottom contacts of the said opening switch C are held open. In the same manner the walking beam 32 acts to keep the bottom contacts of the switch arm C in firm electrical engagement when the switch arm B is closed, the walking beam 31 now acting to limit the opening movement of the switch arm B, and at this time prevent the closing of its bottom contacts.

Referring now particularly to the contact holding mechanism, it comprises a metallic tubular shaped member 36, which is accommodated by a suitable opening therefor in the slate, the same being seated by a flange 36', provided thereon. The contact 5 is made preferably of carbon, and is contained in a holder 37 pivotally supported by pins 37' engaging slotted arms 36'' formed integrally with the member 36. The member 36 extends somewhat beyond the back side of the slate, and secured thereto in the usual way is one end of a flexible conductor 38, the other end of which is soldered or otherwise suitably connected to a stem 37'' forming a part of the holder 37. A spring 39 interposed between the contact holder 37 and flange 36' tends to keep the pins 37' seated against the outer ends of the slots in the arms 36''. Now with the construction and arrangement of parts thus far described, it will be seen that the contact 5 can yield somewhat when engaged by the coacting contact 4, and by reason of the pivotal support provided therefor, permits the same to aline itself with the contact 4 so that their two faces are flush, and in this manner a perfect electrical engagement between the two contacts is assured, and furthermore the

chipping and rounding off of the carbon 4 is eliminated, thus considerably prolonging the life thereof.

Furthermore the slotted arms 36'' limit compression of the contact 5, and fix the armature air gap, which air gap in the switches now commonly used becomes variable as the carbons wear, and in which case a proper air gap is maintained through the use of the well known form of adjusting plug. This is at the expense of contact compression (good contact) and the tendency of the contacts to compress allows the armature to strike the adjusting plug with much force and noise which of course is objectionable. Now the continued adjustment of this plug is necessitated by the wear of the carbon, and as will be seen, makes the air gap variable, this feature being objectionable since it greatly reduces the pull of the armature as compared with the original setting of the plug. Now on the other hand with my improved arrangement the plug remains as originally set, so that the pull exerted by the armature is a maximum, and as the carbon becomes worn, a proper air gap is maintained by the provision of the following parts by means of which an adjustment may be quickly accomplished.

In carrying out the idea above set forth, there is carried by the member 36 a number of split washers such as 40, see Fig. 4a. These washers are positioned on the back side of the slate, and as the occasion may require by wear of the carbons, may be transferred from the back to the front side of the slate, the same being positioned between the flange 36' and the slate. In the way of facilitating this transfer of the washers without having to remove the member 36, the washers such as 40 are split as indicated, this split portion fitting the diametrically opposite flats formed by the cut outs 41, this construction enabling the washers to be slipped laterally on or off the said member 36, the washers being locked in position on the member 36 by rotating the same 90°, the advantages of this arrangement being obvious.

A further advantage of the cut outs 41, resides in the fact that they allow a certain amount of play or flexibility for the conductor 38.

Having thus described my invention, and without limiting myself to the precise details and arrangements of parts, what I claim as new and desire to secure by Letters Patent of the United States is:—

1. In switch mechanism the combination with a number of biased to open position switches, a single device for closing said switches and holding them closed, means operable selectively to effect an operation of the switches by means of the said single device, and means independent of the said device to support the switches.

2. In switch mechanism, the combination with a number of biased to open position switches, a single device for closing said switches and holding them closed, means operable selectively to effect a singular operation of the switches by the said actuating device, and means independent of the said device to support the switches.

3. In switch mechanism, the combination with a number of biased to open position switches, an electro-responsive device for closing said switches and holding them closed, means for effecting an operation of the switches singularly by the electro-responsive device, and means independent of the said device to support the switches.

4. In switch mechanism, the combination with a number of independently operable biased to open position switches, an electromagnet for closing said switches and holding them closed, selective means for effecting an operation of the switches singularly by the electromagnet, and means independent of the said device to support the switches.

5. In switch mechanism, the combination with a pair of biased to open position switch arms, an electromagnet for closing said switches and holding them closed, and means for singularly connecting the switch arms with the armature of the electromagnet for operation thereby, the said means being permanently secured to the said armature.

6. In switch mechanism, the combination with a pair of independently operable biased to open position switches, an electromagnet for closing said switches and holding them closed, and means operable to connect either of the switches with the electromagnet for operation thereby, said means being permanently connected to the armature of the electro-magnet.

7. In switch mechanism, the combination with a pair of biased to open position switch arms, an electromagnet for closing said switches and holding them closed, a single pilot magnet, and means controlled thereby for connecting the switch arms singularly with the electromagnet, for operation thereby.

8. In switch mechanism, the combination with a pair of biased to open position switch arms, an electromagnet for closing said switches and holding them closed, and means for connecting the switch arm singularly with the electromagnet, comprising an electrically operated hook or bar, permanently connected to the armature of the electromagnet.

9. In switch mechanism, the combination with a pair of biased to open position

pivoted switch arms, an electromagnet for closing said switches and holding them closed, having a reciprocating armature, and means for connecting the switch arms singularly with the armature of the electromagnet comprising a hook or bar permanently attached to the said armature.

10. In switch mechanism, the combination with a pair of biased to open position switch arms, an electromagnet for closing said switches and holding them closed and having a reciprocating armature, and means permanently attached to the armature operable to connect the switch arms singularly therewith for operation thereby.

11. In switch mechanism, the combination with a pair of biased to open position switches, an electromagnet for closing said switches and holding them closed and having a reciprocating armature, means permanently attached to the armature for connecting the switch arms singularly therewith, and means for controlling the first named means to effect a selective operation of the said switches.

12. In a switch mechanism, the combination with a pair of biased to open position switches, an electromagnet for closing said switches and holding them closed and having a reciprocating armature, means permanently connected to the armature for connecting the switch arms singularly therewith, and means comprising a pilot magnet for controlling the first named means to effect a selective operation of the switches by the said electromagnet.

13. In switch mechanism, the combination with a pair of biased to open position switches, an electromagnet for closing said switches and holding them closed and having a reciprocating armature, a bar attached to the armature for connecting the switches singularly therewith, and a pilot magnet for controlling the said bar to effect a selective operation of the switches by means of the electromagnet, and means independent of the armature to support the said switches.

14. In switch mechanism, the combination with a pair of pivoted switch arms, an electromagnet having a reciprocating armature, a bar attached to the armature for connecting the switch arms singularly therewith, a pilot magnet having an armature operatively associated with the bar, and adapted when in unattracted position to operatively connect the bar with one of the switches, and when in an attracted position to connect the bar with the other of the said switches.

15. In switch mechanism, the combination with a pair of pivoted switch arms, an electromagnet having a reciprocating armature, a bar attached to the armature for singularly connecting the switch arms to the latter for operation thereby, a pilot magnet having an armature operatively associated with the bar and adapted when in unattracted position to operatively connect the bar with one of the switches, and when in an attracted position to connect the bar with the other of the said switches, and means operable for both positions of the second named armature, to lock the same when a switch is operated and until the latter is returned to normal or full open position.

16. In switch mechanism, the combination with a pair of pivoted switch arms, and electromagnet, means for singularly and selectively connecting the switches with the said electromagnet for operation thereby, a manual switch controlling circuits for the said electromagnet, the circuits being arranged so that with a switch operated, a subsequent energization of the said electromagnet by a quick reverse movement of the car switch is prevented, until the operated switch is in normal or full open position.

17. In switch mechanism, the combination with a pair of switch arms, an electromagnet, means for singularly connecting the switches with the said electromagnet for operation thereby, a pilot magnet controlling the said means to effect a selective operation of the switches by means of the electromagnet, a manual switch controlling circuits for the said electromagnets, and means operable when a switch is operated, to prevent a subsequent energization of the first named electromagnet by a quick reverse movement of the manual switch, until the said operated switch is in normal or full open position.

18. In switch mechanism, the combination with a pair of switch arms, an electromagnet, means for singularly connecting the switches thereto for operation thereby, a pilot magnet operatively connected to the said means, a manual switch controlling a circuit for the pilot magnet, and a circuit for the electromagnet, said circuit including contacts actuated by the pilot magnet.

19. In switch mechanism, the combination with a pair of switch arms, an electromagnet, means for singularly connecting the switches therewith for operation thereby, a pilot magnet operable for one direction of movement to establish a circuit for the pilot magnet, and for a reverse direction to establish a circuit for the electromagnet by way of contacts controlled by the pilot magnet, and additional contacts dependent upon the operation of the pilot magnet, for establishing a circuit for the said electromagnet.

20. In switch mechanism, the combination with a pair of reversing switch arms, an electromangnet having a reciprocating armature, means operable with the armature in unattracted position for singularly connect-

ing either switch to the said armature for operation thereby, a pilot magnet having an armature operatively associated with the said means and adapted when in unattracted position to form by the said means, a connection between the first named armature and one of the switch arms, and when in attracted position to form by the said means a connection between the first named armature and the other of the said switches, means operable for both positions of the second named armature, to lock the same with the first named armature in its attracted position and until the same is returned to its unattracted position.

21. In switch mechanism, a pair of switch arms having a rocking movement, a pair of walking beams, and means movable with the switch arms and coacting with the said walking beams for the purpose substantially as described.

22. In switch mechanism, the combination with a pair of switch arms having a rocking movement, a pair of walking beams having a fixed pivot, and a stud carried by each switch arm, said pins being positioned on opposite sides of the said pivot for co-action with the said walking beam.

23. In switch mechanism, the combination with a pair of switch arms having a rocking movement, a pair of walking beams arranged on a common pivot, and a pin carried by each switch arm, the said pins being positioned on opposite sides of the said pivot for coaction with the walking beams.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

GUY B. SMITH.

Witnesses:
F. G. HOLMES,
E. H. STEELE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."