Oct. 26, 1948. D. E. MORAN ET AL 2,452,065

ELECTRIC SWITCH

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Fig. 1.

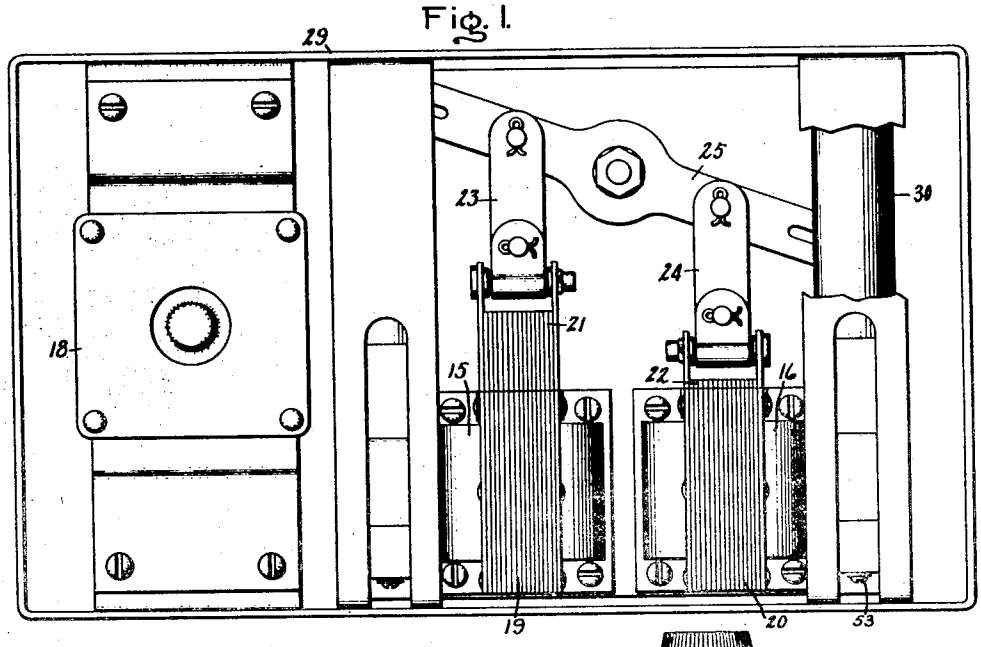


Fig. 2.

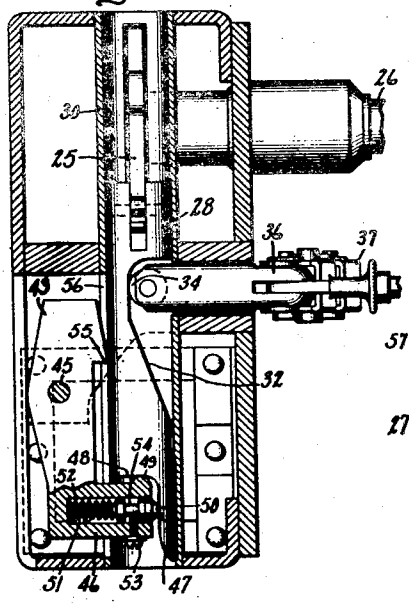
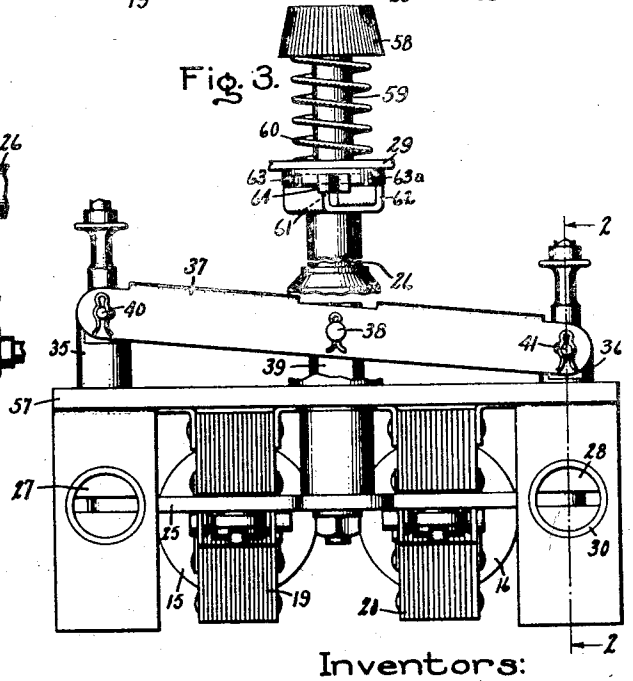


Fig. 3.



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Fig. 4.

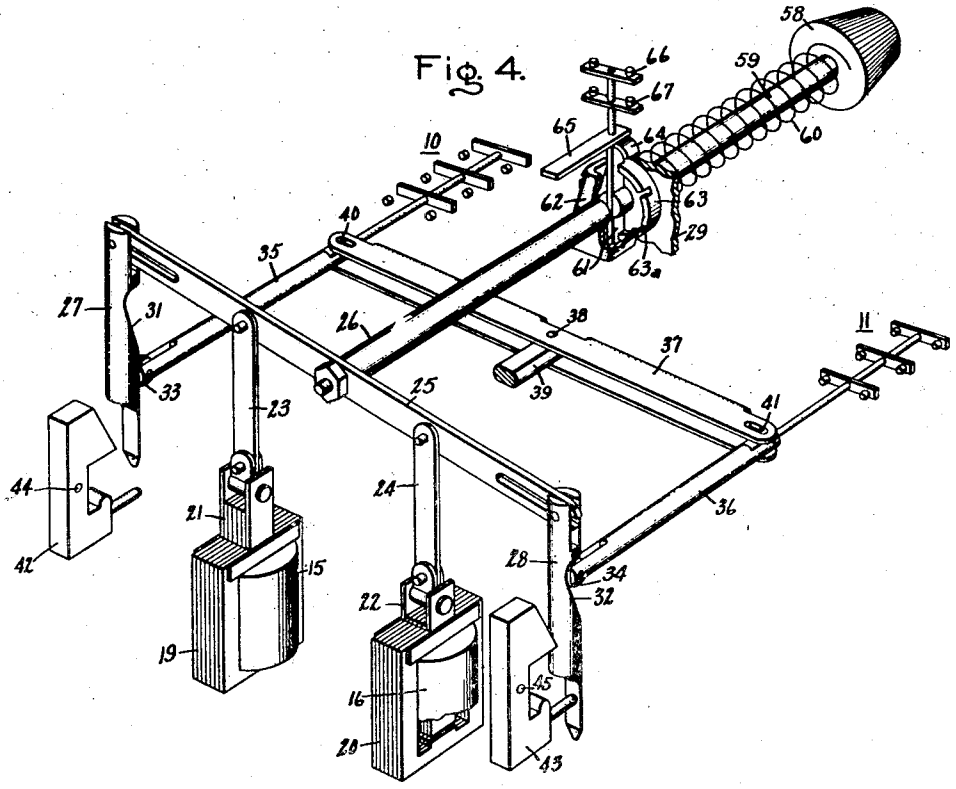
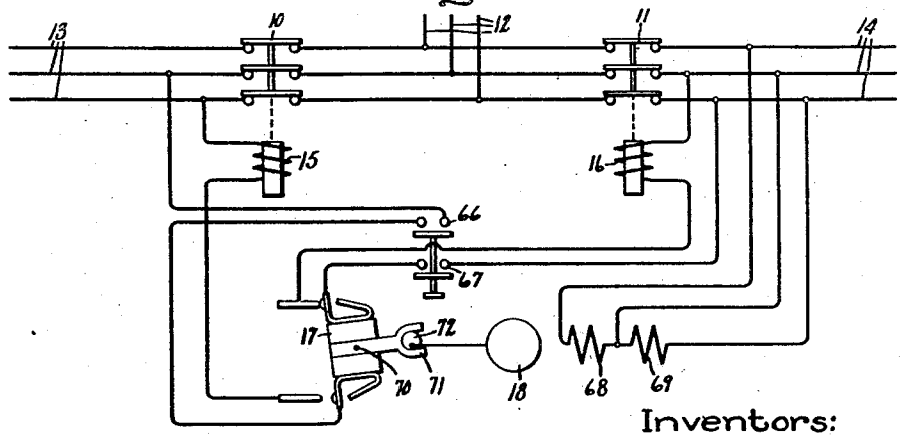


Fig. 5.



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Patented Oct. 26, 1948

2,452,065

UNITED STATES PATENT OFFICE

2,452,065

ELECTRIC SWITCH

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Application December 30, 1943, Serial No. 516,260

4 Claims. (Cl. 200—87)

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Our invention relates to electric switches, more particularly to electromagnetically operated switches, and has for its object a reliable and inexpensive switch which is free from operation by heavy shocks.

When electromagnetically operated switches are subjected to heavy shocks at the time the magnet is energized and the armature is in a normal attracted position against the stationary magnet frame, the shock has the effect of throwing the armature away from the magnet frame toward its unattracted position. This occurs against the magnetic force holding the armature in its attracted position. The type of shock contemplated is one that is applied to the body on which the switch is mounted, such as a shock caused by a nearby explosion. The effect of such a shock is applied from the supporting body to the magnet frame of the magnet and transmitted by the frame to the armature whereby the armature is thrown away against the magnetic force holding it in its attracted position.

In accordance with our invention, we prevent the transmission of the force of the shock from the magnet frame to the armature by bringing the armature to rest in its attracted position before it has moved far enough to engage the magnet frame. This we accomplished by providing stopping means for bringing the armature to rest in its attracted position before it engages the magnet frame. Moreover, our means for bringing the armature to rest does not have the rebound characteristic referred to when subjected to a shock. In one form of our invention we provide friction braking means for engaging the armature as it approaches its attracted position and for applying an increased braking force as the armature continues its movement thereby to bring the armature to rest in spaced relation with the magnet frame.

Our invention relates also to bus transfer switching means and, in accordance therewith, we provide electromagnetic means for normally operating the switching means together with manual means for deenergizing the electromagnetic means and for manually operating said transfer switching means.

For a more complete understanding of our invention, reference should be had to the accompanying drawing, Fig. 1 of which is a bottom view looking up of a two-way electromagnetically operated switch embodying our invention; Fig. 2 is a view mainly in section taken along the line 2—2 of Fig. 3 looking in the direction of the arrows; Fig. 3 is an end view of the device shown

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in Fig. 1; Fig. 4 is an exploded view in perspective showing the various operating parts of the device; while Fig. 5 is a wiring diagram showing the application of our invention as a changeover switch for transferring the connections of a load from one supply source to another automatically in response to a predetermined decrease in the voltage of one supply source.

Referring to the drawings, we have shown our invention in one form as applied to a double-throw bus transfer switching means comprising the two three-pole switches or contactors 10 and 11 (Figs. 4 and 5) which are shown diagrammatically. As shown in Fig. 5, these switches are controlled selectively to connect the load connections 12 to either a supply source 13 or a supply source 14, the load and supply circuits being indicated as three-phase. The operating coils 15 and 16 for the two switches are controlled by a two-way selector switch 17 which in turn is operated by a control motor device 18 connected to the supply source 14. The control device 18 is responsive to the voltage of the source 14 to energize the coil 16 when the voltage of the source 14 drops to a predetermined minimum value thereby to disconnect the load circuit 12 from the supply source 14, while at the same time the coil 15 is deenergized to close the switch 10 and thereby connect the load circuit to the supply source 13.

As shown, particularly in Fig. 4, the coils 15 and 16 are provided with stationary magnet frames 19 and 20 and with plunger armatures 21 and 22. These armatures are connected through links 23 and 24 to a lever arm 25 secured at its center to one end of a pivot shaft 26. Connected to the ends of the arm 25 by means of suitable pin and slot connections are reciprocating slider members 27 and 28, shown as cylindrical plungers, which are mounted in suitable cylindrical guides in the support 29 for the mechanism. Thus, as shown in Fig. 2, the slider member 28 is slidably mounted in a cylindrical support 30.

For the operation of the switches 10 and 11 the sliders 27 and 28 are provided with cut away portions forming cam surfaces 31 and 32 with which cooperate rollers 33 and 34 on the ends of switch operating plungers 35 and 36 to which the switches 10 and 11 are directly connected. As shown in Fig. 4, the coil 15 is deenergized while the coil 16 is energized and has moved the arm 25 clockwise, as seen in Fig. 4, and pulled downward its right-hand end. This action causes the cam surface 31 in moving upward to push the rod 35 toward the right, thereby opening the switch 10. This movement of the rod 35 is trans-

mitted through a lever 37 to the plunger 36 in the reverse direction so that the plunger 36 is moved toward the left whereby the switch 11 is closed. The lever 37 has a fixed pivot 38 at its center on a stationary support 39, and its ends are connected through pin and slot connections 40 and 41 to the two plungers.

It will be understood that when the coil 16 is deenergized and the coil 15 is energized, the lever 25 is moved counterclockwise on its pivot shaft 26 thereby to open the switch 11 and close the switch 10.

For the purpose of stopping the plunger armatures 21 and 22 before they engage and seat against their magnet frames 19 and 20, we have provided friction braking means associated with the two slider members 27 and 28, comprising two pivoted braking and stop members 42 and 43 mounted adjacent their upper ends, as shown clearly in Fig. 2, on stationary pivots 44 and 45. This braking means is particularly described and claimed in our copending divisional application Serial No. 702,290, filed October 8, 1946, and assigned to the same assignee as the present application. Referring particularly to Fig. 2, the pivoted braking member 43 is provided with a projection or extension 46 on its lower end extending toward the right into a recess in the lower end of the member 28. This recess or cut away portion in the lower end of the member 28 provides a portion 47 on its lower end presenting a flat surface or side wall to the laterally extending end projection 46 of the pivoted member, this surface lying in a plane parallel with the length of the member 28. Also, at the upper end of this portion 47 is a shoulder 48 forming an abutment lying in a plane at right angles to the length of the member 28.

Continuing with reference to Fig. 2, on the pivoted braking member 43, specifically on the portion 46, are projections 49 and 50 which engage respectively the plane surfaces on the shoulder 48 and the portion 47. The projection 49 is rigidly secured on the pivoted member while the projection 50 is yieldable and is in reality, as shown, a plunger slidably mounted in a cylindrical recess 51 in the portion 46 and pressed outward by a helical spring 52. A screw 53, whose inner end projects into an annular groove 54 on the plunger 50, limits the outward movement of the plunger by the spring. Also, at its upper end at a point above and to the right of the pivot 45, the pivoted member has a projection 55 in position to engage the side of member 28 when the member 43 is moved clockwise on its pivot 45. As seen in Fig. 2, the cylindrical guide or support 30 for the member 28 is provided with a slot 56 through which extends the projections 46 and 55 on the member 43.

As shown in Fig. 2, the member or plunger 28 is in its lowermost position in engagement with the projections 49 and 50. Its engagement first with the projection 50 has turned the member 43 clockwise about its pivot 45 and thereby swung the projection 55 with a force dependent upon the strength of the spring 51 against the side of the member 28. The pressure thus applied by the projection 55 forces the member 28 toward the right, as seen in Fig. 2, tightly against the wall of its guide 30, thereby producing a frictional braking effect between the two as well as producing a frictional braking effect directly between the projection 55 and its point of engagement with the member 28. Also the projection 49 when engaged during the final movement of the member 28 increases the frictional braking effect and

ultimately acts as a positive abutment stop for the member 43. This brings the member 28 to rest in a position in which the lower end of the armature 22 is still in spaced relation with the magnet frame, as shown in Fig. 4. Therefore, shocks applied to the support for the device and transmitted from the support to the magnet frame or components of these shocks in an upward direction, as seen in the drawing, are not applied to the plunger armature 22, the magnet frame 20 moving upward independently of the armature and relative thereto. Consequently, the shock has no effect in producing turning movement of the lever 25 and operation of the switches.

This upwardly directed shock will not throw the slidable member 27 nor the member 28 from its latched position, as shown in Fig. 2, for the reason that the slidable member is held in this predetermined lowermost position by the relatively great friction between it and its guide 30, which friction is produced as previously described by means of the pivoted locking or braking member 42 or 43. Also, it will be observed that because the various parts of the device that are rigidly connected together will be moved by a shock upward together, as well as in other directions, then the pivot shaft 26 and the plungers 35 and 36 will be moved upward together by the shock whereby the arm 25 is lifted, and with it lifted the plungers 21 and 22 at the same time that the magnet frames are lifted by the shock. This action thus serves to maintain a predetermined air gap between the lower end of the particular plunger, at that time in its attracted position, and the magnet frame.

It will be understood that the switches 10 and 11 may be of any suitable type although they are shown diagrammatically in the drawing for the purpose of clarity.

As shown in Fig. 3, the operating mechanism thus far described is mounted on a supporting base or plate 57, the magnet frames, armatures and slidable members 27 and 28 being mounted below the plate 57 with the plungers 35 and 36 extending upward through apertures in the plate and with the connecting lever 37 mounted above the plate. This mechanism, as shown in Fig. 3, is preferably, as shown in Fig. 1, fitted into an open bottom casing 29. On the top of this casing are mounted the switches 10 and 11.

We have also provided manual means for operating the switches through the lever mechanism. This manual operating means comprises a knob 58 mounted on a shaft 59 which is supported on the top wall of the enclosing casing 29, the shaft being biased outward from the casing by a helical spring 60. Inside the casing the end of the shaft 59 is provided with a transversely extending clutch member or blade 61. On the end of the pivot shaft 26 is a channel-shaped member 62 which is rigidly secured at its center to the shaft 26 and turns with the shaft. The channel member is wide enough, however, to provide a loose connection with the blade 61 which lies between the sides of the channel so that the shaft 26 is free to turn during the operation of the switch from one position to the other without bringing either side of the channel member into engagement with the blade 61. This assumes that the blade 61 is held in an intermediate position, as shown, by means of the cup member 63 secured to the enclosing casing 29 and having pairs 63a of diametrically opposite notches in its edge. The shaft 59 is mounted on the cover in alignment with the pivot shaft 26.

When the knob 58 is depressed manually, the blade 61 is forced out of the central pair of notches and then the knob can be turned in the appropriate direction to bring the blade into engagement with the side walls of the channel member and operate the switch to the desired position. The knob can then be released to provide for movement of the shaft 59 outward by the spring and the locking of the blade 61 in the pair of notches corresponding to its position whereby the switch is locked in the position to which it has been operated. It will be understood that the side walls of the channel member are high enough to provide for this lateral movement of the blade 61 while the blade still remains between the side walls.

Also, to assure deenergization of the coils 15 and 16 when manual operation is resorted to, one end of the blade 61 is provided with a curved operating cam 64 which, when the knob 58 is in an intermediate position, bears on a switch rod 65 and forces it upward to hold closed the two switches 66 and 67. These switches, as shown in Fig. 5, are in the circuits of the operating coils. When the handle is turned from the mid position, the cam 64 moves to one side of the switch rod 65 whereby the switch is opened to open the circuits of the coils.

This manual operation of the switch by the knob 58 permits operation of it in the event that the voltage responsive device 18 fails to operate the switches or in the event the operator desires to transfer the load from one circuit to the other, regardless of the voltage conditions.

In Fig. 1 the voltage responsive motor 18 is shown mounted in the casing in a position adjacent the switch operating mechanism. It will be understood that this motor, provided with two coils 68 and 69 connected across two phases of the supply source 14, is connected permanently to the supply source 14 so as to be energized at all times. The rotor of the motor thereby under normal voltage conditions has a torque applied to it sufficient to return it to a predetermined position against the force applied by a biasing spring (not shown). When the voltage decreases to a predetermined minimum value, however, the torque applied to the rotor decreases and the spring thereupon turns the rotor back to its other predetermined position, shown in Fig. 5, in which the switching device 17 is in position to energize the coil 16 to open the switch 11 and deenergize the coil 15 to close the switch 10. As shown, the switching device 17 is mounted on a pivot 70 and is provided with a forked portion 71 embracing an eccentric 72 operated by the motor.

While we have shown a particular embodiment of our invention, it will be understood, of course, that we do not wish to be limited thereto since many modifications may be made, and we therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of our invention.

What we claim as new and desire to secure by Letters Patent of the United States, is:

1. An electric switch comprising a movable switch member, an operating member movable to operate said switch member, said operating member being provided with an abutment, electromagnetic actuating means for said operating member including an armature connected to said operating member and a stationary magnet frame for said armature, an operating coil on said magnet frame, a pivoted member extending in the direction of movement of said operating member, a laterally extending projection on said pivoted member positioned to be engaged by said abutment when said operating member approaches the limit of its movement when said coil is energized to move said armature to its attracted position whereby said pivoted member is moved on its pivot, braking means operated by said pivotal movement of said pivoted member for engaging said operating member thereby to apply a frictional braking force to said operating member whereby said operating member is brought to rest by said projection in a predetermined position with said armature in spaced relation with said magnet frame.

2. An electric switch comprising two movable switch members, stationary contacts with which said switch members cooperate, a plunger for operating each of said movable switch members, a longitudinally movable cam member cooperating with each of said plungers provided with a cam surface for moving its plunger longitudinally upon longitudinal movement of said cam member, a pivoted braking member pivotally mounted adjacent each of said cam members, a projection on each of said braking members engaged by its said cam member in abutting relation therewith thereby to bring said cam member to rest in a predetermined position, a second projection on each of said braking members on the opposite side of the pivot of said braking member from said first projection for frictionally engaging its said cam member when said braking member is moved by said cam member, a lever forming a mechanical connection between said cam members, and electromagnetic means including movable armature means connected to said lever for effecting movement of said cam members in opposite directions and operation of said switch members between their open and closed positions, said braking members operating alternately to bring said cam members to rest in predetermined positions thereby to limit the movement of said armature means.

3. An electric switch comprising two movable switch members, stationary contacts with which said switch members cooperate, a plunger for operating each of said movable switch members, a longitudinally movable cam member cooperating with each of said plungers provided with a cam surface for moving its plunger longitudinally upon movement of said cam member, each of said cam members being formed at one end to provide a plane surface at right angles with the direction of movement of the cam member and a second plane surface at right angles with said first plane surface, a pivoted braking member pivotally mounted adjacent each of said cam members, a projection on said braking member engaging said first plane surface in abutting relation therewith, a spring pressed member on said projection engaging said second plane surface in abutting relation therewith, a second projection on each of said braking members on the opposite side of the pivot of said braking member from said first projection for frictionally engaging the side of said cam member when said cam member is moved into engagement with said braking member, a lever forming a mechanical connection between said cam members, and electromagnetic means including movable armature means connected to said lever for effecting movement of said cam members in opposite directions and operation of said switch members between their open and closed positions, said braking members operating alternately to bring said cam members to rest in

predetermined position thereby to limit the movement of said armature means.

4. The combination with a magnet provided with a magnet frame, a coil, and an armature movable from an unattracted position to an attracted position in spaced relation with said magnet frame, of a plunger connected to said armature so as to move with said armature between unattracted and attracted positions, a guide wall for said plunger, a braking and stop member for said plunger pivotally mounted adjacent one end of said plunger, a spring pressed projection on one end of said braking member arranged to engage a side wall of said plunger as said plunger moves toward its attracted position thereby to move the opposite end of said braking member into engagement with a side wall of said plunger and apply a frictional braking force to said plunger, and a second rigid projection on said braking member engaged by said plunger to bring said plunger and armature to

rest with said armature in said spaced relation with said magnet core.

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SAMUEL F. JARVIS.

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