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ELECTRIC SNAP SWITCH

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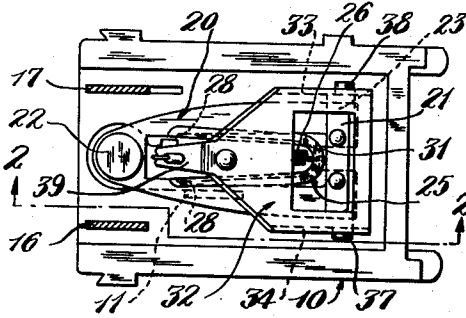


FIG. 1

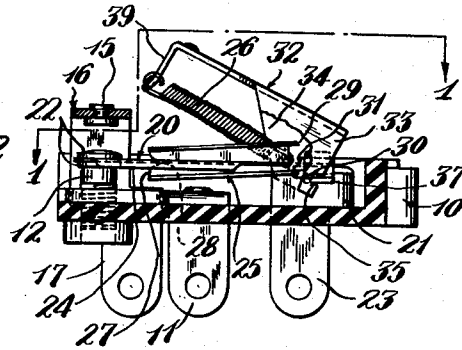


FIG. 2

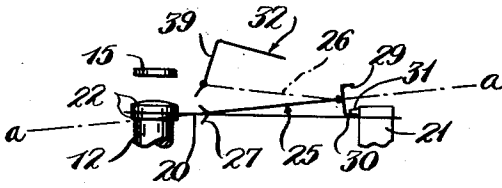


FIG. 3

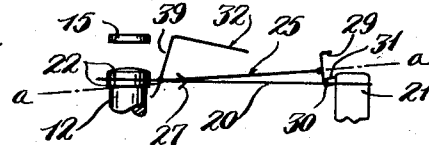


FIG. 4

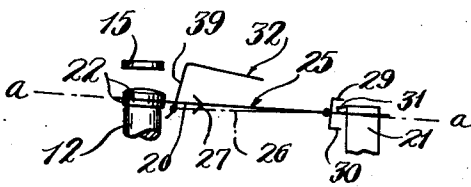


FIG. 5

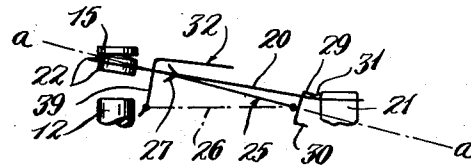


FIG. 6

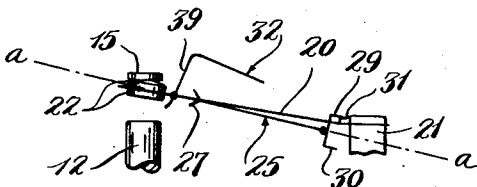


FIG. 7

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ELECTRIC SNAP SWITCH

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2 Claims. (Cl. 200—67)

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The present invention relates to snap acting mechanisms and more particularly to a double throw electric snap acting switch mechanism.

An object of the present invention is to provide a new and improved overcenter type snap acting electric switch mechanism having a contact carrying member which moves with a snap movement in opposite directions between spaced fixed contacts and in which a substantial contact pressure is maintained against the respective fixed contacts until the instant of movement of the movable contact to the other fixed contact.

Another object of the invention is to provide a new and improved snap acting electric switch having a contact carrying strip urged to one or the other of two spaced fixed contacts by a spring, the force of which is applied to the contact strip through a toggle arm or lever which is snap operated by the spring and which arm is adapted to carry the spring with a snap movement through the dead center position of the spring and the contact strip to cause the spring to snap move the strip from one of the contacts to the other in opposite directions without gradual reduction in contact pressures.

Another object of the invention is to provide a novel, relatively compact snap electric switch structure having a snap acting contact carrying member which is snap actuated in opposite directions by relatively short movements of an actuating member and in which a substantial contact pressure is maintained until the instant of movement of the contact carrying member.

Other objects and advantages of invention will be apparent from the following description of a preferred form of the invention, reference being made to the accompanying drawings wherein:

Fig. 1 is a plan view of a double throw electric switch embodying the invention;

Fig. 2 is a sectional view taken substantially on line 2—2 of Fig. 1; and

Figs. 3, 4, 5, 6 and 7 are diagrammatic views illustrating the relationships of various parts of the snap switch during operating movements of the switch mechanism.

The invention is particularly useful as embodied in double throw switches in which it is desirable to have a movable contact powered by a relatively slow moving actuator through a snap mechanism to snap the contact between two spaced fixed contacts to maintain a positive contact pressure until the instant of snap movement. The present invention contemplates a

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contact strip pivoted at a relatively fixed point at one end and having a contact member at the opposite end movable between two spaced fixed contacts by shifting of the far end of the contact strip. A toggle lever or arm is pivoted on the strip adjacent to the contact carrying end and extends generally toward the pivoted end of the strip. A spring is connected at one end to the unpivoted end of the toggle arm and continually urges the arm in the direction of its pivot, and the unpivoted end of the toggle arm has limited movement in the direction of movement of the strip so that the part of the spring connected thereto is shifted by the toggle arm to change its component of force on the contact strip to move the strip from one fixed contact to the other. The spring is connected at its other end to an actuating member which has the part to which the spring is connected movable in the direction of movement of the strip so that the actuating member may move relatively slowly to shift the center of force of the spring on the toggle arm from one side to the other of the dead center position of the spring and toggle arm, which dead center position is passed prior to the establishment of the dead center condition of the spring force and the contact strip so that the latter condition occurs only after the toggle arm has passed its dead center position and is moving with a snap action. By this construction the contact strip is maintained biased to either of the fixed contacts and is moved from one contact to the other by shifting of the spring by a snap movement imparted thereto by the toggle arm. The contact pressure is constant and substantial up to the instant the contact strip is moved in the opposite direction although the actuator may have an extremely slow or unsteady movement.

Referring now to the drawings, for the purpose of illustrating the invention, I have shown a double throw electric switch which may be actuated by any suitable means, such as a manually operated button, a pressure responsive element or a thermostat, or other suitable devices. As shown, the switch mechanism comprises a base 10, which is formed of a suitable insulating material having a conductor bar 11 attached thereto and which bar carries a fixed contact member 12. The bar 11 preferably extends through a slot in the base member to facilitate connection of the contact 12 in one electric circuit controlled by the switch but which is not shown.

A second contact 15 is supported in spaced re-

lation and immediately opposite contact 12 on an inverted U-shaped bracket 16 suitably attached to the base 10 and having one leg 17 thereof extending through the base similarly to the bar 11 for connection in another circuit, not shown.

A contact carrying strip 20 is attached at one end to a metal bracket 21 which is secured to the base 10 and the opposite or outer end of the strip extends between the fixed contacts 12 and 15, and a double contact 22 is attached to the outer end, which contact is adapted to alternately engage contacts 12 and 15 as the strip oscillates vertically as viewed in the drawings. The bracket 21 has a leg 23 extending through an opening through the base for connecting one end of the contact strip in a circuit common to the circuits of contacts 12 and 15, but not shown. The strip 20 is preferably formed of a flexible, U-shaped resilient member adapted to flex about the end attached to bracket 21 so that the contact carrying end may shift between contacts 12, 15. Preferably, opposite sides of the strip 20, except adjacent to its pivoted end, have downwardly extending flanges, one of which is shown at 24, to stiffen the major portion of the strip. As an alternate construction, the strip 20 could be relatively rigid and pivoted to the bracket 21 by a knife edge bearing structure to cause the free end to be swung between the contacts 12, 15 rather than flexing the member to achieve this end, as shown. It is to be understood that although the strip 20 is shown as flexible at its secured end, it nevertheless pivots at that end.

The contact carrying end of the strip 20 is adapted to be snap actuated between the contacts 12 and 15 by a toggle arm 25 and a spring 26. The toggle arm 25 comprises a U-shaped member having the outer ends of the two legs thereof notched as indicated at 27 and pivoted on beveled end lugs 28 formed in opposite edges of the opening through the strip 20 and adjacent to the contact 22 and engaging in the apexes of the notches to provide knife edge bearings for the toggle arm. The toggle arm extends generally toward the anchored end of the strip 20 and is provided with upper and lower flanges 29, 30 which are adapted to abut opposite sides of a tongue 31 forming a part of bracket 21 to limit oscillation of the toggle about its pivot.

The toggle arm 25 is adapted to be snap actuated between its limit of movement by the spring 26, one end of which is attached to an actuating member 32 at a point beyond the pivot for the legs of the toggle arm and the other end of which is attached to the yoke portion of the toggle arm and intermediate the flanges 29, 30. The actuating member 32 comprises a sheet metal member having two parallel web portions 33, 34 projecting from opposite sides thereof and notched as at 35 to receive lugs 37, 38 formed integral with the bracket 21 and forming pivots for the actuating member. The opposite end of the member 32 has a tongue portion 39 projecting laterally therefrom to which the spring 26 is attached by extending a hook portion of the spring through an opening in the tongue. The tongue 39 is adapted to be swung in the direction of movement of the contact strip 20 and to move from one side to the other of a plane extending through the strip 20 and normal to the direction of movement of the latter.

When the line of force of the tension spring 26 is inclined relative to a line through the point of connection of the spring with the toggle arm

and the pivot of the toggle arm, the spring forces the toggle arm to one or the other of its limits of movement established by the flanges 29 and 30, as may be seen in Figs. 3 and 6. When in these positions, the force of the spring on the contact strip 20 is along a line *a-a* which extends through the point of connection of the spring with the toggle arm and the pivot of the toggle arm, and since this line is to one side or the other of the point of connection of strip 20 with the bracket 21, the spring force urges the contact carrying strip 20 to contacts 12 or 15, as the case may be.

As the actuating member 32 is moved from the position shown in Fig. 3, to that shown in Fig. 5, for example, the line of force of spring 26 will come into coincidence with the line *a-a*, as seen in Fig. 4, at which time the force of the spring tending to urge the toggle member to one or the other of its limiting positions is in equilibrium or dead center, and although the pressure of the stop flange 30 on the tongue 31 is nil, the component of force of spring 26 tending to close contact 22 on contact 12 remains unchanged and of a substantial nature since the line of force remains above the pivot point on point of flexure of the strip 20 as indicated by the line *a-a*. Continued downward movement of the actuating member 32 causes spring 26 to pass its dead center position relative to the toggle arm, at which instant the toggle arm is snapped downwardly to bring flange 29 into engagement with tongue 31. This movement instantly passes the spring through its dead center position relative to the contact strip 20 since the toggle arm is beyond its dead center position and traveling under force of the spring. This condition is shown in Fig. 5. As the toggle arm snaps to the position shown in Fig. 6, it changes the component of force of the spring 26 on the contact strip 20, illustrated by the broken line *a-a* of Fig. 6, and the contact carrying end of the strip 20 is snapped upwardly to move contact 24 against contact 15.

For the sake of clarity, in the drawings, the actuator 32 is shown to move through a considerable angle to operate the contact strip 20, but actually it need move through an angle only sufficiently to move the outer end of the spring 26 slightly outside the limits defined by the strip 20 in its alternate positions.

The operation of the switch in the opposite direction is similar and the strip 20 is snapped downwardly instantaneously and without a gradual reduction in contact pressure.

By my novel combination a heavy contact pressure is maintained on either of the contacts 12, 15 until the instant of shifting of the contacts and regardless of the gradual movement of the actuating member so that a minimum or arcing results which effects long life of the contacts and positive control of the circuit in which the switch is connected.

In addition to the operating advantages of the switch mechanism, the arrangements of the various elements thereof permit inexpensive manufacture of the mechanism. For example, the tension of spring 26 maintains the notches 27 of the toggle arm in pivotal engagement with the lugs 28 of the strip 20 and the notches 35 of the actuating member 32 in pivotal engagement with lugs 37 of the bracket 21. In the embodiment of the invention shown, the spring 26 tends to urge the actuating member clockwise about its pivot, but by relocating the position of lugs 37,

38, the actuating member could be biased in the switch operating position shown in Fig. 6.

By my invention, I have provided a compact, positive acting double throw switch which can be operated by a relatively small actuating force as compared to the amount of contact pressure provided thereby and which is particularly useful for operation by thermostatic or pressure responsive elements.

Although I have described but one form of the invention, it is to be understood that other forms could be adapted all falling within the scope of the claims which follow.

Having thus described my invention, I claim:

1. In a snap switch, supporting structure, a contact carrying strip supported at one end and adapted to have its opposite end move between two spaced stops, said strip having a central, longitudinally extending opening, a relatively rigid U-shaped toggle arm disposed in said opening and having the legs thereof pivoted at one end on said strip adjacent to said opposite end of said strip, the yoke end of said toggle arm being swingable through the opening in said strip, an actuating member having a part movable through the opening in said strip, a spring interconnecting part of said actuating member and the yoke of said toggle arm and arranged to urge the toggle arm in the direction of its pivot the point of connection of said spring with said part of said actuating member being beyond the pivoted ends of the legs of said toggle arm, said part of the actuating member being movable from one side to the other of a line through the pivot of said toggle arm and the point of connection of said spring with said toggle arm, and means including two spaced stops associated with said toggle arm for limiting swinging of said toggle arm to cause said point of connection of the spring therewith to swing between positions on opposite sides of a plane through the said strip

and normal to the direction of movement of said strip.

2. In a snap switch, a supporting structure, a contact carrying strip supported at one end by said supporting structure and adapted to have its opposite end move between two spaced stops, said strip having a central, longitudinally extending opening, a relatively rigid U-shaped toggle arm disposed in said opening and having the legs thereof pivoted at one end on said strip adjacent to said opposite end of said strip, the yoke end of said toggle arm being swingable through the opening in said strip, an actuating member having a part movable through the opening in said strip, a spring interconnecting said part of said actuating member and the yoke of said toggle arm and arranged to urge the toggle arm in the direction of its pivot the point of connection of said spring with said part of said actuating member being beyond the pivoted ends of the legs of said toggle arm, said part of the actuating member being movable from one side to the other of a line through the pivot of said toggle arm and the point of connection of said spring with said toggle arm, and means for limiting swinging of said toggle arm to cause said point of connection of the spring therewith to swing between positions on opposite sides of a plane through the said strip and normal to the direction of movement of said strip, said means comprising spaced stops on said toggle member and a part of said structure adapted to be alternately engaged by said spaced stops.

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