March 20, 1951 C. M. CHRISTENSEN 2,545,765

SNAP ACTING DEVICE

Filed July 11, 1946

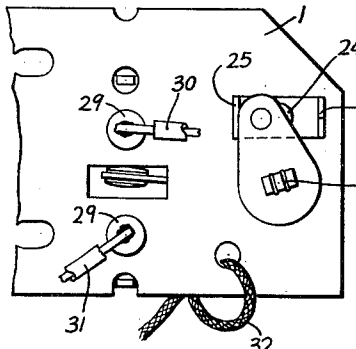



FIG. 2

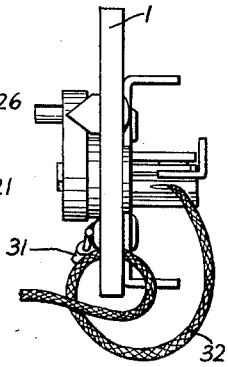



FIG. 1

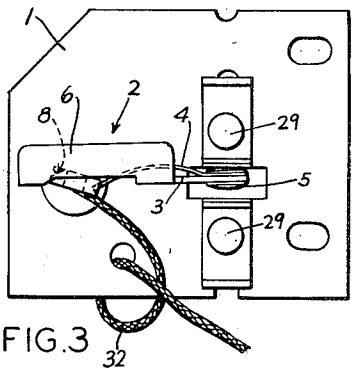



FIG. 3

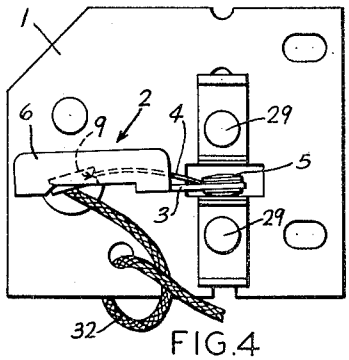



FIG. 4

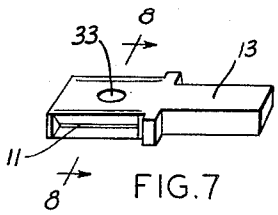



FIG. 7

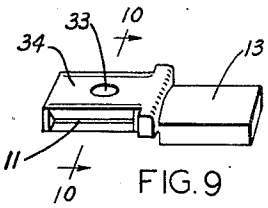



FIG. 9

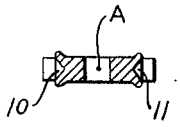



FIG. 8

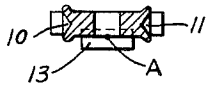



FIG. 10

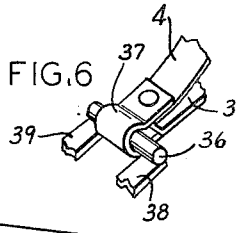



FIG. 6

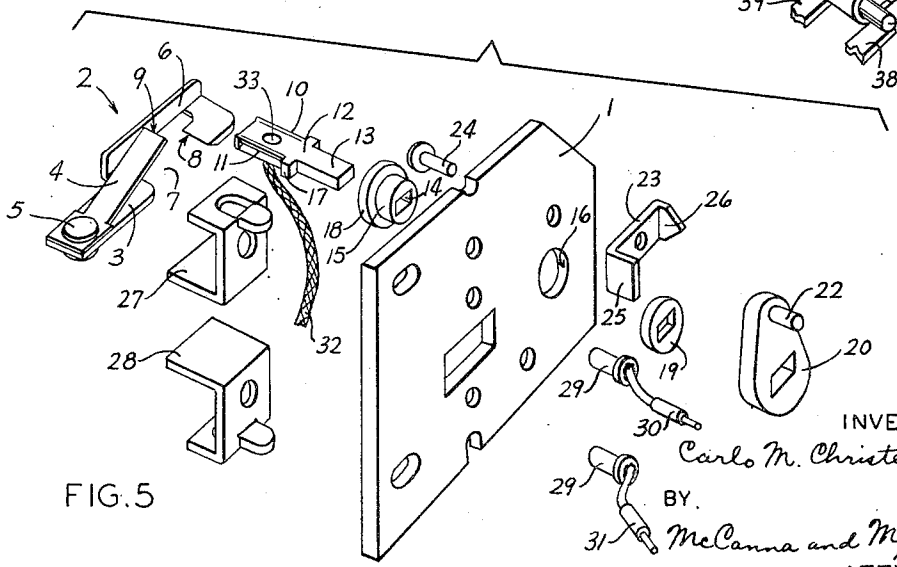



FIG. 5

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Patented Mar. 20, 1951 2,545,765

# UNITED STATES PATENT OFFICE

2,545,765

## SNAP ACTING DEVICE

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Application July 11, 1946, Serial No. 682,733

12 Claims. (Cl. 200—67)

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This invention relates to snap acting devices and more particularly to improvements in snap acting mechanisms employed in electric switches of the compact precision type which operate in response to very slight movement of the operating member and which operate consistently at the same position of the operating member.

Another object is to produce a snap acting mechanism in which movement of the parts is minimized by constructing the anchor and actuating member of a single piece that is pivotally journaled for support within the housing wall or base.

Another object resides in the provision of a snap acting device which is highly precise in operation yet capable of being manufactured easily by reason of the fact that tolerances need be controlled only on two parts: (*a*) the combined anchor-actuator and (*b*) a spring blade having the tension and compression elements integral or permanently affixed to one another so that in effect they are integral.

A still further object lies in providing a novel snap acting switch construction wherein the tension and compression elements are pivotally engaged in diametrically opposed grooves formed on the operating member, and the operating member terminates short of the tension element to clear the tension element so the latter may be moved to intersect the axis of the operating member as well as the pivot grooves to effect snap movement in opening and closing the contacts.

Another object lies in the provision of a novel snap acting switch construction wherein the tension and compression elements are pivotally engaged in non-diametrically opposed grooves formed on a rotatable operating member whereby making and breaking of the contacts is characterized by a wiping snap action and whereby the switch may be operated with relatively small rotational movement of the operating member.

Another object is the provision of a rotary actuated snap acting switch which lends itself particularly to shorting bar construction with the attendant advantages of (*a*) large capacity in a small switch, (*b*) complete isolation of electrical and mechanical mechanisms, (*c*) use of the most advantageous spring material without regard for current-carrying ability, (*d*) circuit flexibility, and (*e*) double break operation.

Other objects and advantages will become apparent from the following description in connection with the drawings in which—

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Figure 1 is an end view of one modification of the present invention;

Fig. 2 is a side view of Figure 1 showing the outside of the base on which the mechanism is mounted;

Fig. 3 is a side view of Figure 1 opposite to that shown in Fig. 2 showing the parts in one operative position with the upper stationary contact engaged;

Fig. 4 is a view similar to Fig. 3 showing the parts in their opposite position, with the lower stationary contact engaged;

Fig. 5 is an exploded perspective view of the parts of the switch shown in Figs. 1, 2 and 3;

Fig. 6 is a perspective partial view of another modification showing how a shorting bar may be applied instead of the movable contact employed in the previous figures;

Fig. 7 is an enlarged perspective view of the combined switch blade anchor and actuating member employed in the previous figures;

Fig. 8 is a sectional view of Fig. 7, taken on the line 8—8;

Fig. 9 is a view, similar to Fig. 7, of a modified form of anchor and actuating member in which the pivot grooves are offset from the axis of rotation to effect wiping action of the contacts with respect to one another when they are engaged or disengaged, and

Fig. 10 is a sectional view of Fig. 9, taken on the line 10—10, showing more clearly the offset relation of the pivot grooves with respect to the rotational axis.

Referring now more particularly to the drawings, the switch in the present instance is mounted upon a base 1 of insulating material. A suitable cover plate (not shown) may be used where desired to protect the working parts from dust or injury from other sources. A switch blade or spring system, generally designated 2, in this instance is made of two parts, a relatively rigid tension element 3 and an inwardly extending resilient tongue or compression element 4 of strip material, both riveted together at common ends by means of the double-headed movable contact 5. The side portion 6 interconnects the opposite end portions of the tension element and is turned up, as shown, to minimize the width of the switch blade as much as possible as well as to improve the stiffness of the tension element. An interior portion 7 of the tension element is cut away and an interiorly facing knife or pivot edge is formed at 8 on one of the end portions. The edge 8 and the inwardly facing edge 9 on the end of the tongue 4 are assembled within the pivot

grooves 10 and 11 in the actuating member 12, the free distance between the edges being formed smaller than the distance between the grooves so that when assembled in this manner the tension element is stressed in tension and the compression element is stressed in compression and the actuating member 12, is, therefore, effective to hold the switch blade in place without assistance from any other supporting means. The actuating and spring support member 12 may be formed by pressing from a piece of flat plate material and will have a rectangular or other suitable cross-sectioned end portion 13 extending through a similarly formed aperture 14 in the bushing 15 which is rotatably journaled within the circular base opening 16. Shoulders 17 and 18 on the actuating member 12 and the bushing 15 serve to limit their outward movement. The end of the actuating member which protrudes beyond the outside of the base 1 is provided with a washer 19 and an operating lever or arm 20; the latter being staked in place by peening the end of the actuating member, as shown at 21. The operating lever is provided with a pin 22 which in use may be engaged by a cam or other driving means to operate the switch. It will usually be preferable to insulate the pin 22 from the internal switch mechanism as by forming the operating lever 20 from suitable insulating material. A member 23, fastened to the base by rivet 24, has the outturned ends 25 and 26 which serve as stops to limit rotatable movement of the lever 20.

The free end of the switch blade is movable between limiting positions defined by stops 27 and 28, at least one of which is an electrically conducting stationary contact. In the present instance, where a double throw type of switch is illustrated both stops are stationary contacts connected through rivets 29 to conducting wires 30 and 31. The third or common conducting wire comprises a flexible cable or "pigtail" 32 connected electrically to the switch blade in any suitable manner, for example, by mounting the end of the pigtail within the hole 33 in the actuating member and soldering or welding it in place.

In the above described modification the pivot grooves 10 and 11 are substantially diametrically positioned with respect to the pivotal axis of the actuating member 12; that is, the grooves 10 and 11 and the pivotal axis A are substantially parallel and in the same plane, as shown in Figs. 7 and 8. This construction permits the switch to be operated with a minimum of rotational movement of the actuating member. An important feature of the present invention is that the above described construction can be modified to effect wiping make and break movement of the contacts where such type of engagement and disengagement is desired from the standpoint of breaking welds and cleaning the contacts. This construction may be effected by offsetting a plane containing the grooves 10 and 11 from the pivot axis A, as shown in Figs. 9 and 10, where the groove portion 34 is offset with respect to the end portion 13. Thus, rotational movement of the operating member 12 will be accompanied by sliding or wiping movement of the movable contact 5 along the stationary contact until the actuating member is rotated through the maximum stress position to cause the blade to snap of its own volition to the opposed contact or stop.

In some cases it may be undesirable to pass electrical current through the switch blade 2, for example, where the metallic material which is preferred for its physical characteristics is a poor electrical conductor. In such case, a shorting bar, such as designated 36 in Fig. 6, may be mounted by an insulating fiber strip 37 or the like upon the end of the switch blade in place of the double headed contact 5, as shown in the previous figures, and a bottom pair of stationary contacts 38 and 39 will be provided which will be connected by the shorting bar when in the Fig. 6 position. An upper pair of stationary contacts (not shown) may be provided, or if preferred, simply an upper stop to limit the upward movement of the switch blade. All other parts of such a switch would be the same in construction and operation as the switch already described.



Considering now the operation of the modification shown in Figures 1 through 5, assume first that the parts are in the Fig. 3 position. Current will flow between pigtail 32 and wire 30 through the switch blade 2. To operate the switch the lever 20 will be moved toward its stop 26. This will move groove 11 upward and groove 10 downward until the groove 11 is intersected by the tension center line of the tension element 2 which will be approximately coplanar with the fastened end of the compression element 4. In case the actuating member 12 is of the form shown in Figs. 9 and 10, its rotation will also cause wiping movement of the contact 5 along the contact 27 which is beneficial in breaking any weld that may have occurred between the contacts and also in scouring the contacting surfaces. When the groove 11 intersects the tension center line as above stated, the compression element will then have been moved to its maximum stress position and further slight movement past this position will cause the switch blade to be moved quickly downward whereupon the movable contact 5 will be disengaged from the stationary contact 27 and be moved into engagement with stationary contact 28 by snap action. The parts will now be in the position shown in Fig. 4 where current can flow between pigtail 32 and wire 31 through the switch blade 2 and the switch blade will be maintained in this position until the operating lever 20 is moved in the reverse direction. The particular switch shown is of the non-self-returning type but obviously the principles of this invention are equally applicable to a self-returning spring constructed as, for instance, by providing a separate spring member for biasing the switch blade to either the Fig. 3 or 4 position as desired.

The reverse operation will be exactly the same as that above described in that the groove 11 will move downwardly through the axis of maximum stress after which the movable contact will be snapped quickly away from the stationary contact 28 and upward into engagement with stationary contact 27.

While a particular form of the present invention has been shown as applied to electric switches, it will be apparent that it is applicable to snap acting devices generally and that minor changes in the invention will readily suggest themselves to others skilled in the art without departing from its spirit and scope. Having thus described the invention, what is claimed as new is:

1. A snap acting switch comprising a pivoted member, an element pivoted to said member and carrying a contact at a free end, said pivotal connection between said member and said element including two spaced cooperating groove and edge connections, said two groove and edge

connections being on opposite sides of said member and non-diametrically disposed with respect to the pivotal axis thereof, a second contact disposed to cooperate with said first contact, and means for pivotally moving said member to effect snap pivotal movement of said element accompanied by sliding movement of said carried contact with respect to said stationary contact.

2. A snap acting switch comprising a base, a member having one end rotatably mounted in said base and extending therethrough, said member having grooves in its edges parallel to the rotational axis, a switch blade including a cutaway portion and an interiorly disposed resilient tongue, the distance between the end of the tongue and an opposed interior edge being less than the distance between said grooves, said blade being pivotally supported by the said member by means of the said interior edge and the edge of the tongue resting within said grooves, a contact on the blade remote from the pivotal support, a second contact, means limiting the movement of the free end of the blade, said grooves on said member being less than 180° apart with respect to the pivotal axis to effect wiping make and break action of said contacts, and means associated with said member for pivoting the blade through limited rotational movement of the member to make and break the contacts by snap action.

3. A snap acting switch comprising a base, a member pivotally engaged by said base, the pivotal axis of said member being substantially normal to said base, said member having a pair of grooves parallel to its pivotal axis, said pivotal axis being positioned to one side of a plane common to said grooves, a switch blade including spaced parallel longitudinally extending tension elements and an inwardly extending tongue or compression element, the distance between the end of the tongue and an opposed interior edge being less than the distance between said grooves, said blade being pivotally supported by the member by means of the said interior edge and the edge of the tongue resting within said grooves, said member having an interior axial portion cut away to clear one of said tension elements, a contact on the blade remote from the pivotal support, a second contact, and means for effecting snap pivotal movement of said member by pivotally moving said member.

4. A snap acting device comprising a pivoted member, an element movable between preselected positions and pivoted to said member by means including two cooperating groove and edge connections spaced on opposite sides of said member but non-diametrically disposed with respect to the pivotal axis thereof, and means for moving said member to effect snap movement of said element between said preselected positions.

5. A snap acting device comprising a base, a member pivotally mounted upon said base, an element pivotally mounted upon said member by means including a pair of connections on two sides of the pivotal axis of said member and non-diametrically disposed with respect to said axis, said element being movable between preselected positions defined by stops, said member and said element being compressibly engaged with one another at each of said connections, and operating means including means for pivotally moving said member to move said member and element through an axis of maximum stress to initiate snap movement of said element between said preselected positions accompanied by sliding movement of said element with respect to one of said stops.



6. A snap acting switch comprising a rotatably mounted member, a single tension member comprising relatively broad spaced end portions and an integral interconnecting portion disposed along one side of and in a plane at an angle to said end portions, one of said portions carrying a contact movable between preselected positions and the other of said portions formed with a knife edge facing the contact, a compression member having one end interconnected with the end portion of the tension member carrying the contact and having the opposite end in spaced relation with the knife edge, said knife edge and said opposite end of the compression member being pivotally supported at spaced positions on opposite sides of said rotatable member to stress said tension and compression members, and means for rotating said member between preselected positions whereby to move the knife edge and said pivotally supported end of the compression member through a plane common to said knife edge, said pivotally supported end and said interconnected end and thereby move said contact between its preselected positions with a snap action.

7. A snap acting device comprising a base, rotatable means projecting outwardly from one side of said base, a tension member mounted adjacent said base in edgewise relation thereto and having a cutaway section along one edge forming first and second spaced opposed portions, said first portion formed with a knife edge facing the second portion and said second portion being movable between preselected positions, a compression member mounted adjacent said base in edgewise relation thereto and having a first end in spaced relation with said knife edge and the opposite end rigidly interconnected with the second portion of the tension member, said knife edge and said first end shaped to be pivotally supported on said rotatable means, and means operatively associated with said rotatable means on the opposite side of said base for oscillating said latter means between preselected positions to move said pivotally supported knife edge of the tension member and said pivotally supported end of the compression member so that a plane defined by said knife edge and supported end is moved through the juncture between the opposite end of the compression member and the second portion of said tension member to effect snap movement of said second portion between the preselected positions.

8. A snap acting switch having in combination, a single rigid tension member formed by a metal stamping having a cutaway portion along one side to provide spaced opposed end portions and having the opposite side deformed out of the plane of the end portions to stiffen the stamping, one of said end portions carrying a contact movable between preselected positions and the other of said end portions formed with a knife edge facing said contact, a resilient compression member overlying said tension member and having one end interconnected with the contact carrying end of the tension member and the opposite end in spaced relation with said knife edge, and a rotatably mounted member shaped to pivotally support the knife edge and the opposite end of the compression member at spaced positions to form a snap spring system

having an axis of maximum stress, and means for rotating said member between preselected positions so that one of said knife edges and said pivotally supported end of the compression member moves through the axis of maximum stress to effect snap movement of the contact between preselected positions.

9. In a snap acting device, the combination of a thin sheet of insulating material forming a base, an overcenter snap spring system including tension and compression members in edgewise relation to said base, means for mounting and actuating said snap spring system comprising an actuating and support member including means intermediate its ends for pivotally mounting the same on the base, said means constituting the sole means for supporting said actuating and support member, a spring supporting portion carried on said mounting portion and projecting from one side of the base, said spring supporting portion having grooves on opposite sides for pivotally receiving the compression and tension members of the spring system and an operating portion rigid with said spring supporting portion and projecting from the opposite side of the base, said operating portion including a lever for rotating and operating the actuating and support member to move the grooves circumferentially of the axis of rotation to effect snap action of the spring system, and stops on said base for limiting rotation of said lever between preselected positions.

10. In a snap acting device, the combination of a base, an overcenter snap spring system including a tension member and a leaf compression member in edgewise relation to said base and interconnected at one end to form an end free to move between opposed positions, means for mounting and actuating said snap spring system comprising an actuating and support member including means intermediate its ends for pivotally mounting the same on the base, said means constituting the sole means for supporting said actuating and support member, a spring supporting portion carried on said mounting portion and projecting from one side of the base, said spring supporting portion having grooves on opposite sides for pivotally receiving the opposite ends of the compression and tension members of the spring system and an operating portion rigid with said spring supporting portion and projecting from the opposite side of the base, the operating portion including a lever for rotating and operating the actuating and support member to move the grooves circumferentially of the axis of rotation to effect snap action of the spring, means acting between said actuating and support member and said base for preventing relative movement between these members in the direction of the axis of rotation of said actuating and support member, and stops on said base for limiting rotation of said lever between preselected positions.

11. In a snap acting switch, the combination of a thin sheet of insulating material forming a base, an overcenter snap spring system adjacent one side of said base including tension and leaf compression members in edgewise relation to said base, a spring support projecting outwardly from and rotatable about an axis normal to said base, said spring support having grooves on opposite sides for pivotally receiving the tension and compression members of the spring system, and forming the sole support for said spring system, pivotally supported means mounted on said base and providing the sole support for said spring support, means acting between said last mentioned means and the base for holding said pivotally supported means against axial movement relative to the base, an operating portion rigid with said pivotally supported means and projecting outwardly from the opposite side of the base, said operating portion including a lever engageable for rotating said pivotally supported means and said spring support to move the grooves circumferentially of the axis of rotation to effect snap action of the spring system.

12. In a snap acting switch, the combination of a thin sheet of insulating material forming a base, an overcenter snap spring system adjacent one side of said base including tension and compression members interconnected at one end to form an end free to move between opposed positions, at least one of said members being a leaf-like member in edgewise relation to said base, a mobile contact mounted on said free end, a spring support projecting outwardly from and rotatable about an axis normal to said base, said spring support having grooves on opposite sides for pivotally receiving the opposite ends of the tension and compression members of the spring system and forming the sole support for said spring system, pivotally supported means mounted on said base and providing the sole support for said spring support, means acting between said last mentioned means and the base for holding said pivotally supported means against axial movement relative to the base, an operating portion rigid with said pivotally supported means and projecting outwardly from the opposite side of the base, said operating portion including a lever engageable for rotating said pivotally supported means and said spring support to move the grooves circumferentially of the axis of rotation to effect snap action of the mobile contact, spaced fixed stops mounted on the base for limiting movement of said free end, at least one of said stops being defined by a fixed contact adapted for connection to an external circuit and a flexible connector connected to said spring support for connection to an external circuit.

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