June 3, 1952 H. C. SWAN ET AL 2,598,856

SNAP ACTION SWITCH

Filed Feb. 24, 1951

Fig. 1.

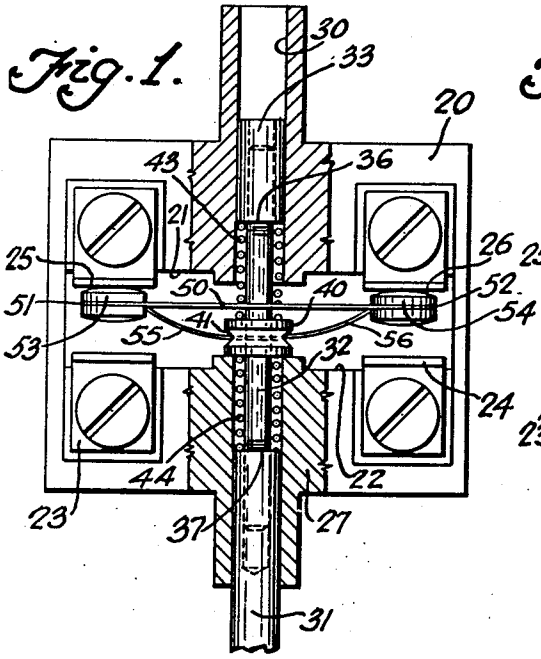


Fig. 2.

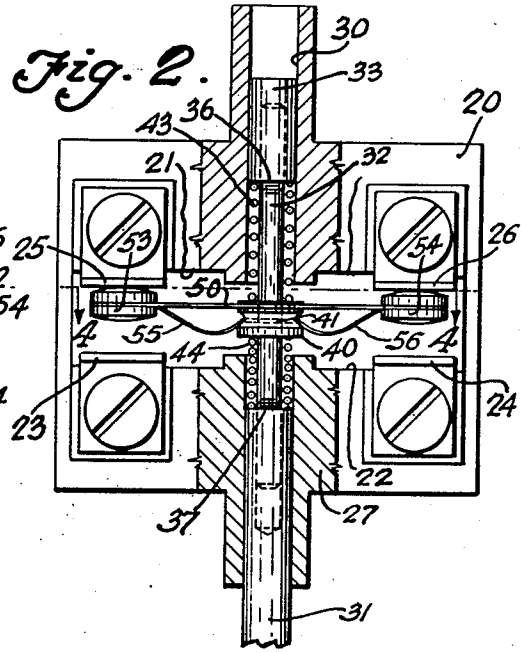
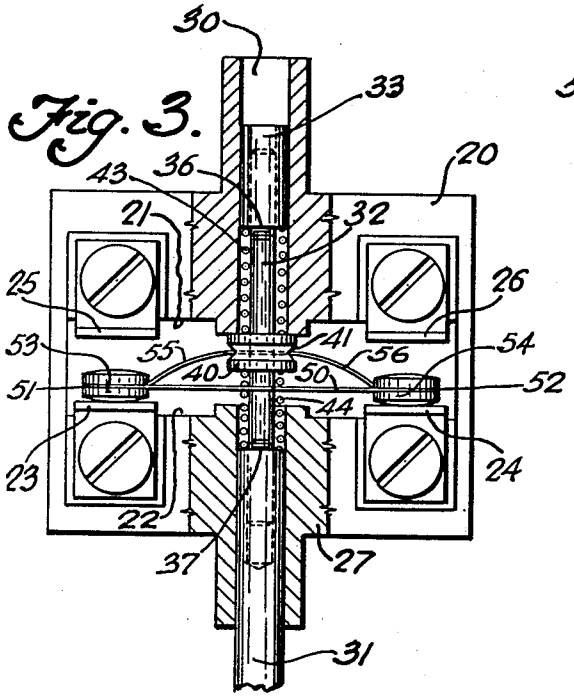


Fig. 3.



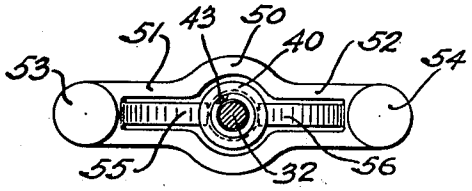


Fig. 4.

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SNAP ACTION SWITCH

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7 Claims. (Cl. 200—76)

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This invention relates to an electric switch particularly of the snap action type.

It is among the objects of the present invention to provide a snap action switch capable of being suddenly shifted from one position into another under the influence of a slowly moving actuator.

A further object of the present invention is to provide a snap action switch to be operated by a slowly moving actuator, with shifting mechanism being stable and effecting good contact pressure during a predetermined portion of switch operation by the actuator but being capable of effecting instability and sudden shifting of the switch before it reaches a neutral, dead center position in which contact engagement is at lowest pressure.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a front view of an opened double acting switch embodying the present invention;

Fig. 2 is a view similar to Fig. 1 with moving parts of the switch in positions just prior to a sudden switch-over;

Fig. 3 is another view similar to Fig. 2 with the parts in the switch-over position; and

Fig. 4 is a detail view taken along the line and in the direction of the arrows 4—4 in Fig. 2.

The present drawings, illustrating the invention, apply to a double acting switch capable of completing electric circuits in either one of its two operative positions. The invention may be applied to a single acting switch which, when in one position, does not complete electric circuits and in its other operative position renders a circuit active. The double acting switch illustrated in the drawings consists of a housing base 20 having a transverse recess in one surface thereof providing spaced oppositely disposed walls or abutments 21 and 22. Two spaced, stationary contacts 23 and 24 are insulatingly secured to the base, the contact lying contiguously to the abutment or wall 22. Directly opposite these contacts 23 and 24 and abutting against the wall 21 are stationary contacts 25 and 26. A central portion 27 of the base, separated by the transverse opening between walls 21 and 22 has a central opening the axis of which is at right angles to the walls 21 and 22. This central opening is designated by the numeral 30 and, due to the transverse aperture, is divided into two portions, the inner end of one portion terminating in wall

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21, the inner end of the other portion in wall 22 into the base. As shown in the drawings, these two portions of opening 30 are in coaxial alignment.

An actuator rod 31 is slidably supported in the opening 30. This actuator rod has a portion 32 of substantially lesser diameter than the main body portion of said actuator. Portion 32 may be adjustably secured to the body portion 31 in any suitable manner preferably by having portion 32 threaded thereto. Another rod portion 33, threaded to portion 32 is slidable in opening 30 adjacent wall 21. In operation the central portion 32 is the only portion of the actuator which extends across the transverse recess providing opposed abutment walls 21 and 22 in the base. Because of the two different diameter portions of this actuator 31, shoulders 36 and 37 are provided thereon, the spacing between said shoulders being predetermined and adjusted by the screwing of portions 33 and 34 relatively to the central portion 32.

A spool or collar 40 is slidably supported upon the reduced diameter portion 32 of the actuator 31, this spool being operative between the opposed walls 21 and 22 of the base. Spool 40 has an annular groove 41 provided in its peripheral surface, the groove preferably being V-shaped. Between the spool 40 and the two shoulders 36 and 37 on the actuator portion 32, coil springs are provided, the spring between shoulder 36 and spool 40 being designated by the numeral 43 while the spring between shoulder 37 and the spool is designated by the numeral 44. These two springs 43 and 44 are identical, being constructed so as to have the same rate of compression and when assembled on the actuator being predeterminedly compressed so as to normally hold the spool 40 midway between the shoulders 36 and 37.

The movable bridging element operative by the actuator 31 to engage and bridge either the pair of contacts 23 and 24, or 25 and 26, consists of a resilient spring plate 50 having a disc-like center portion from which extends oppositely disposed arms 51 and 52. At the end of arms 51 and 52 contacts are secured on each side thereof, the two contacts 53 at the end of arm 51 being engageable with either stationary contact 23 or 25 and contacts 54 at the end of arm 52 being engageable with either stationary contacts 24 or 26. The central portion of the movable plate 50 is perforated to provide integral, inwardly extending spring fingers 55 and 56 respectively, the adjacent ends of the fingers engaging and seating within the V-shaped annular groove of the spool

40 whereby the fingers 55 and 56 are biased as shown. This spool 40 may pass through the central perforation of the disc-like central portion of plate 50.

When in the position, as shown in Fig. 1, the resilient fingers 55 and 56, being biased by having their adjacent ends seated in the annular spool 40, urge said spool into engagement with the abutment wall 22 of the base and at the same time urge the spring blade contact carrier 50 so that the contacts 53 and 54 thereon are in electrical engagement with these stationary contacts 25 and 26. In the reverse position as illustrated in Fig. 3 these same resilient fingers 55 and 56 have a reverse bias urging the spool 40 into engagement with the abutment wall 21 and urging the contacts 53 and 54 of the movable contactor 50 into electrical engagement with the stationary contacts 23 and 24.

Fig. 2 illustrates the spool 40 and its engaging fingers 55 and 56 of the movable contactor 50 approaching the dead center position under the influence of actuator 31 acting in an upwardly direction as regards this figure. By "dead center" position is meant that when the point of engagement by the resilient fingers 55 and 56 with the spool 40 aligns with or is moved into the plane of the blade 50, which constitutes the main body portion of the movable contactor, dead center is reached, at which time the resilient fingers 55 and 56 exert substantially only directly opposed forces which do not urge the contacts 53 and 54 into good electrical engagement with the stationary contacts being engaged by said contactor, nor do these fingers exert any substantial moving force against the spool, the force against the spool by fingers 55 and 56 being substantially transversely opposed and at right angles to the axis of part 32 upon which the spool slides. However, as soon as the point of contact of resilient fingers 55 and 56 passes this aligned or dead center position, then the resultant forces exerted by the fingers 55 and 56 will move the spool 40 from the position as shown in Fig. 2, against the wall 21 and at the same time quickly thrust the contacts 53 and 54 into engagement with the stationary contacts 23 and 24, as shown in Fig. 3.

Where a very slow moving actuating force is applied to the actuating rod 31 as, for instance, by a slow moving thermostatic element, a float valve, or any other device mechanically attached to the actuator 31 and moving it extremely slowly and perhaps in a hesitant manner, hesitation of movement of the actuator 31, particularly when the spool is moved near dead center position, reduces the efficiency of the switch inasmuch as contact pressure between contact 53, 54 on the movable carrier and the cooperating stationary contacts which ever pair it be, is reduced to a minimum causing sparking and pitting. However, as has been stated, when dead center position is passed then the resilient fingers 55 and 56 will become effective quickly to shift the spool 40 into engagement with an abutment block or wall and the contacts on the movable carrier with cooperating stationary contacts.

In order to create an unstable condition, by which poor contact pressure due to a slow or hesitant approach of the spool to the dead center position reducing contact pressure is avoided, applicants have provided springs between shoulder portions on the actuator and the spool 40. These springs are preloaded and of identical compression rate, each engaging the spool 40 and a respective

shoulder on the actuator 31 at each side of the spool. When the actuator 31 is moved upwardly as regards Fig. 1, spring 44 will be compressed between the shoulder 37 and the spool 40 due to the fact that the initial strength of the spring 44 is weaker than and therefore cannot overcome the counteracting pressure exerted by the resilient fingers 55 and 56 which act to maintain the spool 40 against the wall 22 under these conditions. However, as the actuator 31 is continued to be moved upwardly, thereby continuing to compress spring 44, a point will be reached in which the pressure of the spring 44 against spool 40 to move it upwardly under the effect of the upwardly moving actuator 31 will counterbalance the opposing forces exerted by the resilient fingers 55 and 56. From here on, upward movement of the actuator rod 31 to compress spring 44 will cause said spring to move the spool 40 slidably upwardly on the portion 32 of said actuator rod thereby biasing the resilient fingers 55 and 56. As this movement continues and the flexible fingers 55 and 56 are flexed or biased by the upward movement of spool 40 under the effect of the now dominating spring 44, the resultant force exerted by the fingers 55 and 56 pressing contacts 53 and 54 upon stationary contacts 25 and 26, is gradually being reduced.

In Fig. 2 the upward movement of the spool 40 under the effect of spring 44 has reached a position in which the upward thrusting force of the spring 44 is about completely to overcome the now weaker opposing forces of the resilient fingers 55 and 56. When the force of spring 44 exceeds the said opposing force of the resilient fingers 55 and 56, it quickly moves the spool 40 upwardly to and through dead center whereby the forces of the resilient fingers 55 and 56 are completely reversed and said fingers biased, as shown in Fig. 3. It will appear, however, that the springs 43 and 44 are so calibrated as compared to the bias of the resilient fingers 55 and 56 that at a predetermined point before dead center is reached either one of the springs 43 and 44 will be effective to overcome the remaining opposing effect of said spring fingers. The point of balance between springs 44—43 and the resilient fingers 55 and 56, or more particularly the point in the movement of the spool 40 at which the spring 43 or 44 completely dominates the resilient fingers force and thrusts said collar to and past dead center to reverse contact engagements is such that the said spring fingers will, at the switch-over point, still be sufficiently biased and exert a sufficient urging force upon the contact carrying plate or blade 50 in order to maintain good electrical engagement between contacts 53 and 54 on the movable carrier and the respective pairs of stationary contacts with which they are engaged. This good and sufficient electrical engagement between the cooperating and movable stationary contacts is thus maintained up to the instant of separation between the movable and stationary contacts, thus completely eliminating the undesirable and damaging fluttering of the movable contacts when dead center position is very slowly approached and passed.

The portions of the actuator rod 31 threaded to the smaller diameter intermediate portion 32 of the rod provides for adjustments for timing purposes whereby any desirable range of movement of the actuator rod 31 may effect switch throw-over.

The present invention therefore provides a snap switch capable of being suddenly shifted from

one position into another under the influence of a slowly and perhaps hesitatingly moving actuating force whereby fluttering of the movable contacts and consequent sparking and burning thereof are eliminated.

The switch of the present invention maintains good contact pressure between the movable and stationary contacts while the switch is being slowly and hesitatingly shifted by any type of slow moving actuator mechanism, said good contact engagement being maintained even during hesitancy of movement of the actuator up to a predetermined point before dead center is attained by the switch and before suitable pressure upon the contacts is reduced. Movement of the actuator beyond this approach point quickly shifts the spool in the switch and reverses the bias of the resilient means which actuates the movable contacts before dead center is reached and specifically a predetermined distance before the resilient means on the movable contacts reach a neutral point at which fluttering movement of the movable contacts is permitted.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A snap action switch comprising in combination, a stationary support carrying two stationary contacts insulated therefrom and providing an abutment opposed to and spaced from said contacts; a rod slidable in the support between the two contacts, said rod having a reduced diameter portion forming two spaced annular shoulders on the rod; a collar slidable on the rod portion between said shoulders, said collar having a peripheral groove; coil springs surrounding the rod and interposed between the collar and each shoulder respectively, said springs normally yieldably maintaining the collar substantially midway of said shoulders; and a movable contact carrying element centrally apertured to permit the collar to move therethrough, opposite ends carrying contacts movable to engage either the stationary contacts or the abutment on the support, said movable element having flexible fingers extending from the region of the respective contacts on said element toward the rod, each finger being biased by having its free end seated in the groove of the collar.

2. A snap action switch comprising in combination, a stationary base insulatingly supporting two contacts and providing opposed abutments spaced from said contacts; a carrier supporting two contacts movable by the carrier into engagement with the respective stationary contacts or the abutments said carrier having two resilient, oppositely disposed fingers extending inwardly, their respective, adjacent ends being seated in an exteriorly grooved collar and thereby biased to urge the carrier to effect engagement of its contacts with either stationary contacts or the abutment, dependent upon the position of the collar relatively to the carrier; a rod reciprocatively carried by the base and having a reduced diameter portion upon which said collar is slidably carried and which provides spaced shoulders between which the collar is reciprocated on the shaft; substantially identically compression rated springs interposed between each rod shoulder and the collar, each spring being energizable by movement of the rod in a respective direction gradually to overcome the force of the resilient fingers and suddenly move the collar into and past dead center alignment with the carrier to effect movement of the collar into engagement with the base and the carrier contacts with the stationary contacts or the abutment on the base, dependent upon the direction of movement of the collar by the rod and before said collar reaches its neutral or dead center position relatively to the carrier.

3. A snap action switch comprising in combination, a base providing spaced and substantially parallel abutment walls; contacts insulatingly mounted on one of said walls; a rod slidably carried in the base transversely of the space between the abutment walls, a portion of the rod being of reduced diameter to provide spaced shoulders; a collar slidable on the reduced portion of the rod and across said space; two substantially identical coil springs each interposed between and engaging a respective shoulder on the rod and the adjacent side of the collar; and a movable carrier for contacts to cooperate with the stationary contacts, said carrier having biased, resilient spring fingers extending inwardly from adjacent each end of the carrier to engage and rest upon the annular edge of the collar, which, when shifted to one side or the other of the carrier by one or the other coil spring predeterminately compressed by the reciprocated rod, quickly reverses the biasing force of the spring fingers to actuate the carrier toward one or the other abutment walls of the base before said collar reaches its neutral or dead center position relatively to the carrier.

4. A snap action switch comprising in combination, a base; spaced stationary contacts on said base; an abutment spaced from and opposite each contact; a movable carrier between the abutments and contacts, said carrier supporting contacts cooperable with the stationary contacts and engageable with the abutments; diametrically opposed spring fingers secured to the carrier adjacent each contact thereon and extending toward each other to engage and seat upon a movable collar, said fingers being biased by said collar to urge the carrier toward the abutment or the stationary contacts, dependent upon which side of the carrier said collar is moved to; and an actuator for said collar, said actuator consisting of a rod slidable in the base and slidably supporting the collar and having abutments on each side of the collar and a coil spring interposed between each abutment and the collar, each coil spring being normally weaker than the opposing biasing effort of the spring fingers but when being compressed gradually approaching and finally overcoming the opposing effort of the fingers thereby suddenly shifting the collar to reverse the biasing effect of said fingers and move the carrier before the said fingers have reached the dead center position by movement of the collar in one direction or the other by said rod supported springs.

5. A snap action switch comprising in combination, a base providing spaced stationary contacts and an abutment opposite each contact and spaced therefrom; cooperating contacts supported upon a carrier which is shiftable between the stationary contacts and their opposed abutments; resilient fingers extending from the carrier adjacent each contact thereon, toward the center thereof, said fingers being biased by engagement of their adjacent ends with a shiftable collar, said collar, when moving from one side of the carrier toward the other gradually shifting the fingers and altering their bias so that when the point of engagement of said fingers

with the collar has passed the carrier, the biasing effort of said fingers upon the carrier is reversed and the carrier is quickly shifted into the position opposite that previously occupied; and an actuator for said collar, said actuator consisting of a rod slidable in the base and having spaced abutments between which said collar is slidable on the rod, and coil spring of a predetermined biasing rate interposed between the abutments on the shaft and the collar, the biasing effort of each coil spring being normally weaker than the biasing strength of the resilient fingers, the biasing rate of the spring gradually increasing while the rate of the fingers gradually decrease as the rod compresses said spring and moves the collar toward the carrier, the spring overcoming the fingers and quickly shifting the collar to the opposite side of the carrier before said collar has reached dead center position, whereby the carrier is quickly shifted to its opposite position by said fingers.

6. A snap action control device comprising in combination, a stationary support providing oppositely disposed, spaced, stationary abutments; a rod slidable in the support between the two abutments, said rod having a reduced diameter portion forming two spaced, annular shoulders on the rod; a collar slidable on the rod portion between said shoulder having a peripheral groove; coil springs surrounding the rod and interposed between the collar and each shoulder respectively, said springs normally yieldably maintaining the collar substantially midway between said shoulders; and a movable element centrally apertured to permit the collar to move therethrough, opposite ends being movable to engage either abutment on the support, said movable element having flexible fingers extending from the end regions thereof toward the rod, each finger being biased by having its free end seated in the groove of the collar.

7. A snap action control device comprising in combination, a base; spaced, stationary abutments on said base; a member movable between said abutments; diametrically opposed spring fingers secured to the member adjacent each end thereof and extending toward each other to engage and seat upon a movable collar, said fingers being biased by said collar to urge the member toward either abutment dependent upon which side of the member said collar is moved to; and an actuator for said collar, said actuator consisting of a rod slidable in a base and slidably supporting the collar and having abutments on each side of the collar and a coil spring interposed between each abutment and collar, each coil spring being normally weaker than the opposing biased effort of the spring fingers but when being compressed gradually approaching and finally overcoming the opposing efforts of the fingers thereby tightly shifting the collar to reverse the biasing effect of said fingers and moving the member before said fingers had reached the dead center position by movement of the collar in one direction or the other by said rod supported springs.

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No references cited.