June 1, 1954

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2,680,167

ELECTRIC SWITCH

Filed May 23, 1951

2 Sheets-Sheet 1

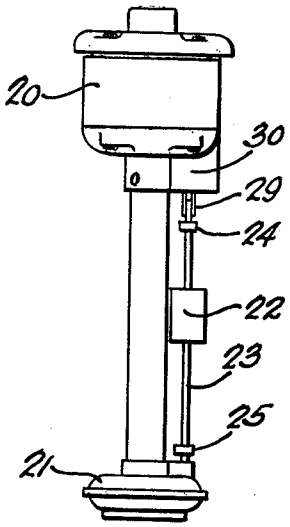


Fig. 1.

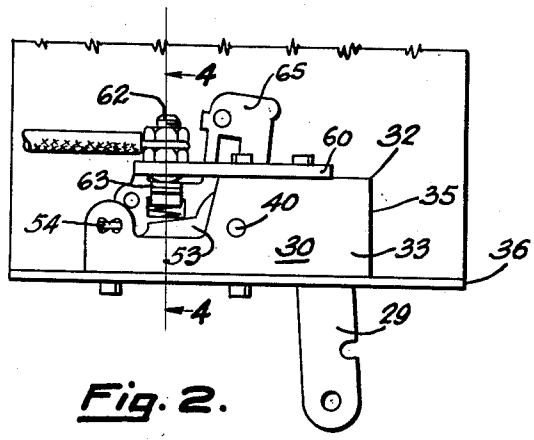


Fig. 2.

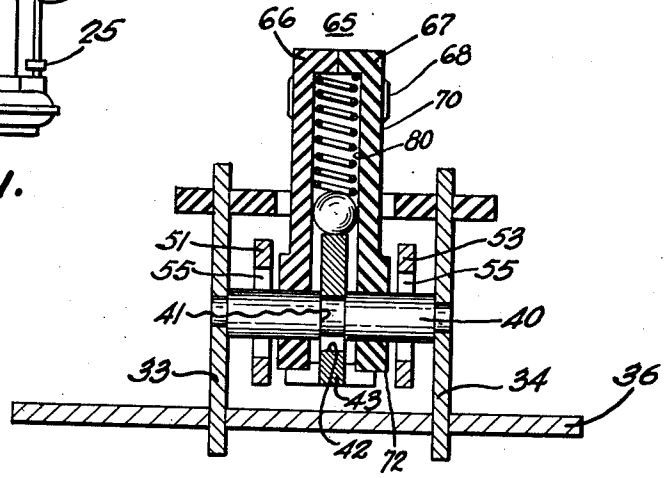


Fig. 3.

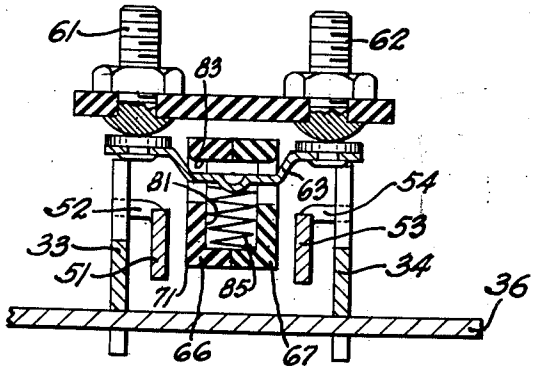


Fig. 4.

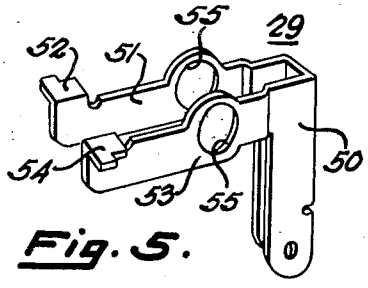


Fig. 5.

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2 Sheets-Sheet 2

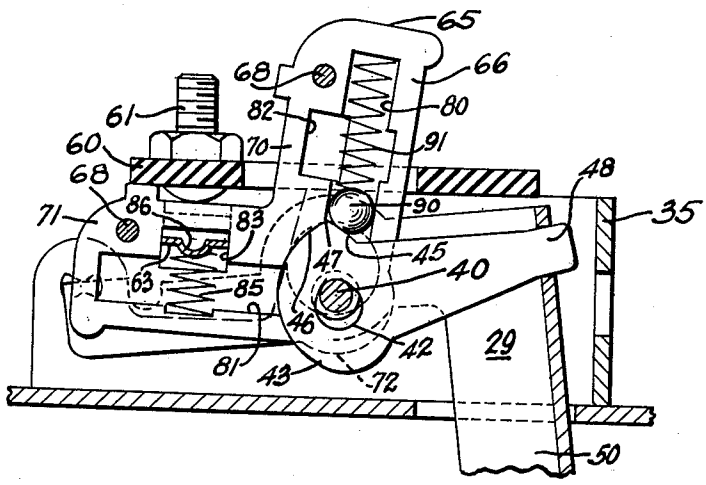


Fig. 6.

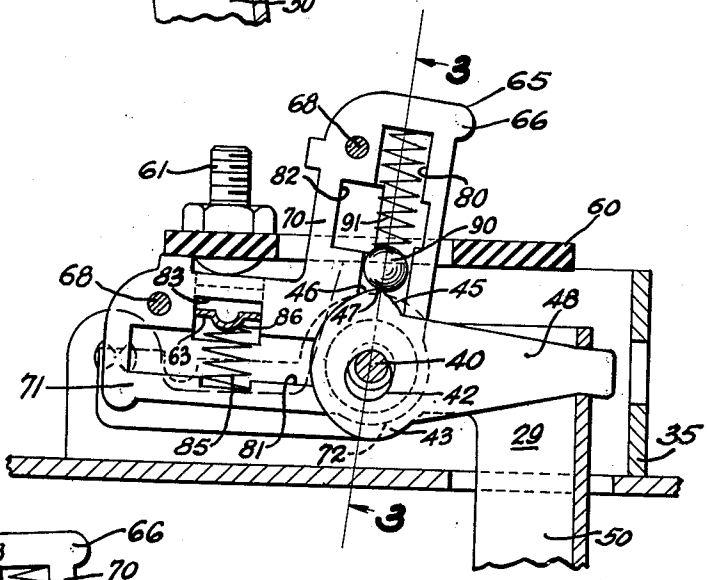


Fig. 7.

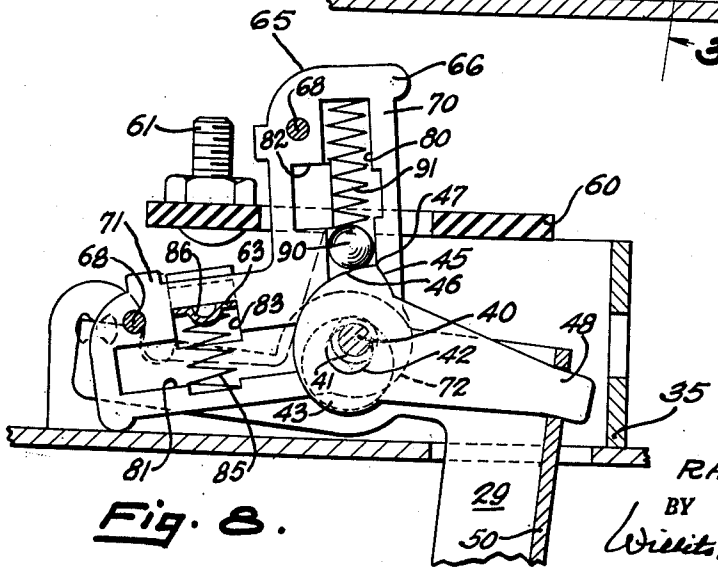


Fig. 8.

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ELECTRIC SWITCH

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4 Claims. (Cl. 200—68)

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This invention relates to an electric switch.

It is among the objects of the present invention to provide an electric switch in which the cooperating contacts are held in engagement with a constant or even an increasing pressure up to the instant said contacts are disengaged with a snap action.

A further object of the present invention is to provide an electric switch with means tending substantially to increase contact engagement pressure up to the instant said contacts are disengaged even though said switch is actuated very slowly or in a hesitating manner as would be the case where the switch is actuated by a thermo-responsive, or by a float controlled means.

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 illustrates an electric motor driven sump pump equipped with the present invention.

Fig. 2 is a side view of the switch at actual size.

Fig. 3 is a cross sectional view taken along the line and in the direction of the arrows 3—3 of Fig. 7.

Fig. 4 is a cross sectional view, at enlarged scale, taken along the line and in the direction of the arrows 4—4 of Fig. 2.

Fig. 5 is a perspective view of the cam actuating lever.

Fig. 6 is a view partly in section and partly in elevation showing cooperating switch parts in contact closing positions.

Fig. 7 is a view similar to Fig. 6, showing the cooperating switch parts in an intermediate position.

Fig. 8 is a similar view showing the switch parts in the contact open position.

The switch of the present invention is particularly adapted for use in connection with electrically driven devices in which the switch actuator moves very slowly and ofttimes in a hesitant manner. For instance in an installation when the switch is actuated by a thermal responsive element, changing temperatures may cause the thermal element to fluctuate at the point at which it should actuate the switch and, as a result the switch is fluctuated so that its engaging contacts, though not completely separated, are not held together with the proper contact pressure and thereby arcing and pitting of the contacts results. The same is ofttimes true

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when the switch is actuated by the float member of a sump pump which, due to fluctuating fluid levels does not decisively move the switch but on the contrary may hesitatingly move it back and forth near the point of switching, thus causing the contacts to flutter and burn.

The present switch is designed and constructed to have full or even increased contact engagement pressure applied until the instant of throw-over or switching. No matter if the switch actuator is vacillatingly moved or oscillated in a fluttering manner near the point of throw-over or switching, full contact pressure is maintained until, in response to one of said fluttering movements, the actuator reaches the zero point at which throw over is attained, causing the contacts to be suddenly disengaged.

Fig. 1 illustrates an installation equipped with the present invention. Here an electric motor 20 drives a sump pump 21. A float 22 is slidably supported on a rod 23 provided with high level stop 24 and low level stop 25 engageable by the float. Rod 23 is connected with the actuator 29 of the switch 30 carried by the motor 20 for controlling it. When the float strikes stop 24 the switch actuator 29 is moved to operate switch 30 to start the motor. When stop 25 is engaged by the float 22 switch 30 is operated to stop the motor.

Switch 30 shown in detail in the remaining figures of the drawings consists of a housing 32 which is U-shaped having side walls 33 and 34 and one end wall 35, attached to base 36. A pivot pin 40 is supported by side walls 33 and 34 so as to extend across the housing 32. Midway between the two side walls, pivot pin 40 has an annular groove 41 providing a reduced diameter portion about which the smaller end of the egg-shaped opening 42 in cam 43 rotatably fits, the larger diameter of said opening fitting the pin to permit placing of the cam in the annular groove 41. Whereby the cam may oscillate upon the pin but is held against movement longitudinally thereon and therefore constantly held midway between the two parts of the carrier as will be explained hereinafter.

Cam 43 has its disc-like head portion rotatably supported upon pin 40. The head portion of the cam has a lancet arch shaped protuberance presenting two oppositely disposed similar arcuate cam surfaces 45 and 46 diverging from an apex edge 47 extending across the face of the cam. An arm 48 extends from the head portion of the cam at substantially right angles to the protuberance 45—46. This arm extends into and

through an opening in the end wall of the wall of the switch actuator lever 29.

As illustrated in Fig. 5, lever 29 has a one arm portion 50, U-shaped in crosss-ection and extending through an opening in the housing 32 of the switch so as to permit attachment of the switch operating means thereto as shown in Fig. 1. At one end and from each side portion of arm 50 there extends an angular arm substantially at right angles to the arm 50. Angular arm 51, extending from the one side of arm 50, has an outwardly extending ear 52 at its outer end which projects into an opening in the one side wall 33 of the housing so as to be rotatably supported in said opening. Likewise arm 53 extending at substantially right angles from the other side wall portion of arm 50, has an ear 54 rotatably extending into a similar opening in the side wall 34 of the housing. Thus the actuator 29 is pivotally supported in the housing 32, the arms 51 and 53 of said actuator each being at a respective side of the carrier to be described. Each arm portion 51 and 53 has an enlarged opening 55 through which the pivot pin 40 extends, said openings permitting oscillation of the actuator about its pivots 52 and 54 without striking the pin.

Housing 32 has a cover 60 of insulating material which carries two spaced terminals 61 and 62 forming the stationary contacts of the switch. These two stationary contacts 61 and 62 are adapted to be engaged and bridged by the movable member 63 provided with a contact element at each end. Bridging member 63 is spring loaded and movably supported upon the carrier 65 made of two identical pieces of insulating material 66 and 67 shown attached one to the other by rivets 68 and both pivotally carried by the pin 40. The carrier has two arm portions 70 and 71 extending from a central hub portion 72 substantially at right angles to each other. The hub portion 72 has a transverse opening which fits over pin 40 whereby the carrier is rotatably supported on said pin and between the two arm portions 51 and 53 of the actuator 29, see Fig. 3. The contacting surfaces of the two pieces 66 and 67 of insulating material forming the carrier are recessed longitudinally of their arm portions 70 and 71, said recesses, when the two pieces 66 and 67 are riveted together, forming an interior chamber in each arm portion extending from near the outer end of the arm toward the pivotal support in the hub portion 72 where they converge and join. The interior chamber in arm 70 of the carrier is designated by the numeral 80 and the corresponding chamber in arm 71 by the numeral 81. Each arm has a transverse opening passing completely therethrough, the one in arm 70 being designated 82 and in arm 71 being designated 83.

As shown in Fig. 4, the bridging member 63 extends through the transverse opening 83 and is urged toward the side of opening 83 adjacent the stationary contacts 61—62 (see Fig. 8) by a spring 85 which is in chamber 81 laterally thereof. A nubbin 86 in the bridging member winding of its contact carrying ends, is surrounded by the end of spring 85 so that the self adjusting, tiltable bridging member is prevented from accidental removal from the carrier and will align itself with the stationary contacts 61—62 and assure solid contact engagement when shifted by the carrier to bridge said contacts.

The chamber 80 in arm portion 70 of the carrier has a ball 90 contained therein, which is constantly urged into engagement with the cam

43 by spring 91, the cam, as shown in Fig. 3, being located between the hub portions 72 of the two pieces 66 and 67 which, when riveted together, form the carrier 65. The cam is so positioned relatively to the chamber 80 in the carrier that the lancet arch shaped portion 45—46—47 is always exposed to the said chamber 80 and therefore to engagement by the ball 90 in said chamber, said ball being urged against said cam portion by the spring 91.

Figs. 4 and 6 show the switch mechanism in contact engagement position. Here the bridging element 63 is held in engagement with stationary contacts 61 and 62 by spring 85 inasmuch as the carrier 65 is being held in its extreme clockwise position as regards Fig. 6, by the ball 90 being urged against the arched surface 45 of cam 43 by spring 91. The ball engaged surface 45 of the cam being on the clockwise side of the radial line passing from the pivotal center of cam 43 through the apex line 47 of the diverging arch like surfaces 45 and 46, the force of spring 91 holding the ball on surface 45 acts against the carrier to urge it clockwise and thus urge its arm portion 71 toward the stationary contacts and against the cover 60, providing a positive stop. The bridging member 63 engages the stationary contacts 61—62 before the carrier engages the cover and thus as the carrier continues its movement to engage the positive stop or cover 60 under the effect of spring 91, the bridging member 63 moves relatively to the carrier and compresses its spring 85 which now acts to urge the bridging member into engagement with both stationary contacts 61 and 62.

Assuming that the switch 30 is applied in an installation including a motor driven sump pump as shown in Fig. 1, and the dropping water level lowers the float 22, as soon as the float strikes the stop 25 it will move the rod 23, connected to the switch actuator lever 29, downwardly causing the lever 29 to be moved clockwise about its pivotal ears 52 and 54 supported in the housing of the switch. This movement of the float 22 downwardly may be very slow or even hesitant, depending upon the varying water level and thus movements of the switch lever 29 would be the same. As the actuator lever 29 is moved clockwise about its pivotal ears 52 and 54, the cam 43 connected to said device will likewise be rotated clockwise about the pivot pin 40 so that the arch like surface 45 of cam 43 will be moved relatively to the ball 90 to cause said ball to ascend said arch like surface 45 toward the apex line 47. This force of cam surface 45 against the ball tends to move the carrier clockwise with the cam and thus said carrier is maintained against the top or cover 60 acting as a stop thereby permitting the spring 85 fully to perform its function of urging the bridging member into good engagement with the stationary contacts 61—62 even while the switch is being operated toward its contact breaking position by clockwise operation of the actuator lever 29 and its connected cam 43. Thus no matter if this lever movement is slow or even hesitant with a tendency to vacillate, contact pressure remains constant and is not reduced until the instant of complete contact separation.

Fig. 7 shows the relative positions of switch parts at the start of contact separation movements. The actuator lever 29 having been moved clockwise sufficiently to rotate cam 43 so that the ball 90 has ascended the arch shaped cam surface 45 to reach the apex line 47, spring 91 will

now urge the ball 90 to descend along the arch like surface 46 of the cam. Now the ball 90 is on the counterclockwise side of the line 3—3 of Fig. 7 and the spring 91 reacts to shift the carrier 65 counterclockwise about its pivotal support 40 thereby quickly shifting the bridging element 63 from engagement with the stationary contacts 61—62 and breaking the circuit. This counterclockwise thrust of the carrier 65 by spring 91 is limited by the striking of the carrier upon the base 36 of the switch.

As soon as rising water level raises the float 22 to strike stop 24 on rod 23, the switch actuator lever 29 will again be actuated counterclockwise causing the cam 43 to be rotated counterclockwise. Now the ball 90 ascends the arch like surface 46 of the cam 43 and as soon as the apex line 47 is reached spring 91 will urge ball 90 to descend arch like surface 45, reaction of the spring 91 upon the carrier 65 quickly thrusting the carrier clockwise about its pivotal support 40 and thereby causing the bridging member 63 of the carrier arm 71 to engage and bridge the stationary contacts 61 and 62 to close the motor circuit.

The present invention thus provides a positively acting, quick break, over center switch in which full contact pressure is assured until the instant of throw over. This avoids fluttering and weak contact engagement thereby eliminating frying or arcing of the contacts an unsatisfactory condition found in most electrical switches and particularly those actuated by a slowly moving or even hesitatingly moving actuating member such as a thermoresponsive element or a float in a sump pump.

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. An electric switch comprising in combination, a pivoted member tiltable in either direction between two positive stops and comprising two angularly disposed arms and having means for pivoting of the same at the juncture of the said arms; a shaft pivotally supporting said member; a spring loaded ball in one of said arms of said pivoted member; stationary contacts at one of said stops; a spring loaded contact movably supported by the other of said arms of said member and engageable with the stationary contacts when said pivoted member is tilted to engage the stop supporting the stationary contacts; a cam pivotally supported on said shaft, said cam having substantially corresponding diverging surfaces operable within said pivoted member and engageable by the ball and cooperating therewith to effect tilting of the pivoted member in one direction or the other dependent upon the surface engaged by the ball; and actuating means operatively connected with the cam for rotating it on said shaft and relatively to the ball and pivoted member.

2. An electric switch comprising in combination, a pivoted member tiltable in either direction between two positive stops and comprising two angularly disposed arms and having means for pivoting of the same at the juncture of the said arms; a shaft pivotally supporting said member; stationary contacts insulatingly carried at one of said positive stops; a contact supporting blade extending through one arm of the pivoted member so as to be movable with and relative thereto and engageable with the stationary contacts;

spring means positioned within said one arm and engaging said blade to provide for resilient movement thereof relative to said blade and provide pressure holding said blade contacts against said stationary contacts, a cam pivoted on said shaft so as to be coaxial of the pivoted member and within the same, said cam having substantially corresponding surfaces diverging oppositely from a common apex; a ball and a spring within the other arm of the pivoted member, said spring acting in a line constantly bisecting the cam supporting shaft for urging the ball into engagement with the cam portion having the diverging surfaces and consequently tilting the pivoted member in one direction or the other dependent upon which diverging surface of the cam the ball is riding upon; and an actuator operably connected with the cam.

3. An electric switch comprising in combination, a housing insulatingly supporting stationary contacts; a shaft in said housing; a member pivotally supported on said shaft within the housing and oscillatable between two positions; a contact element carried by said member and movable thereby into engagement with the stationary contacts in response to oscillation of said member into one of its positions; a ball in said member urged by a spring toward the pivotal support of said members; oscillatable means pivoted on said shaft and engaged by the ball, said means being operative for one portion of its movement in either direction to move the ball and compress its engaging spring whereby the pivoted member is urged into its assumed position at increasing pressure until said ball reaches a predetermined point of engagement with said means at which times the spring pressed ball effects sudden movement of the pivoted member toward its other position; and an actuator pivoted in the housing on one side of the said shaft and connected to said means on the opposite side of the shaft for oscillating said means.

4. An electric switch comprising in combination, a housing; two stationary contacts insulatingly supported in said housing; a pivot pin in said housing; a member of insulating material oscillatably supported by said pivot pin, said member having two arm portions extending radially therefrom, substantially at right angles one to the other, said member being movable between two stationary parts of the housing; a spring loaded contact element movably carried by one of said arm portions and engageable with the stationary contacts when said arm is moved toward said contacts; a ball and an engaging spring in the other arm of said member, said spring yieldably urging the ball toward the axis of the pivot pin; an oscillatable cam pivotally supported by said pin so as to be coaxial of said member, said cam extending into said other arm of the oscillatable member and engaged by the ball, the portion of the cam engaged by the ball being lancet arch shaped presenting two surfaces diverging from an apex, each surface acting either as a raising or a lowering element for the ball, dependent upon the direction of cam rotation, whereby said ball, as it ascends a cam surface, compresses the spring yieldably to urge and maintain the oscillatable member in its assumed position with increased pressure until the instant said ball reaches the apex of the cam surfaces at which time the ball descends along the opposite cam surface and, under the influence of the spring, quickly thrusts the oscillatable member into its other position;

and an actuator lever pivoted in the housing and connected to the cam for oscillating it.

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