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2,513,804

SNAP ACTING CONTROL MECHANISM

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Fig. 1

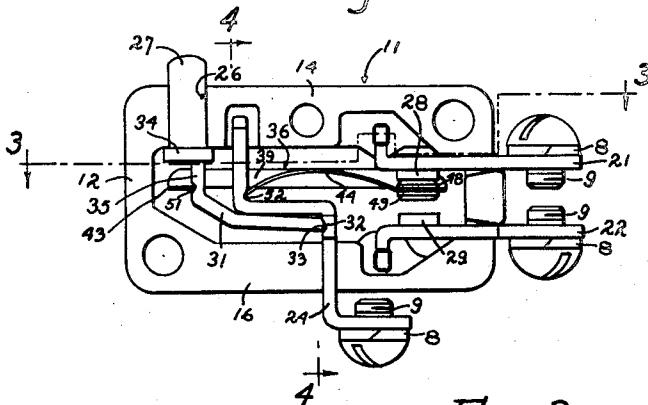


Fig. 2

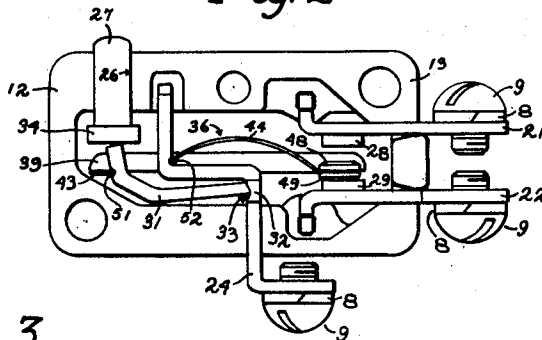


Fig. 3

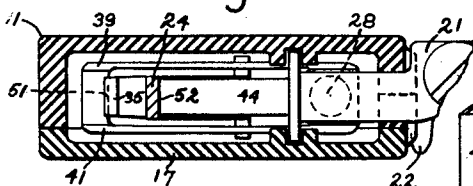


Fig. 4

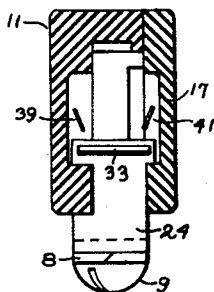


Fig. 5

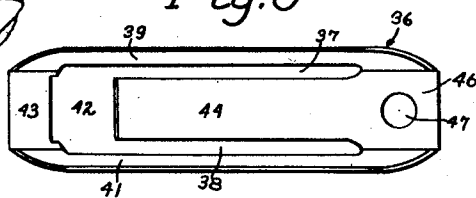


Fig. 7

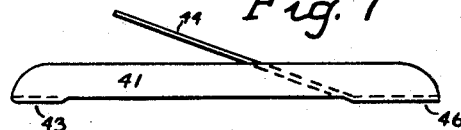


Fig. 6



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SNAP ACTING CONTROL MECHANISM

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4 Claims. (Cl. 74—97)

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This invention relates to a snap acting control mechanism of the type used in electric snap switches and an improved spring member therefor.

A specific object of this invention is the provision of an improved spring member for a snap acting mechanism made from a strip of very thin spring material and so formed as to have substantial resistance to bending along all lateral axes.

Another object of this invention is the provision of a very compact, overcenter snap spring mechanism wherein a contact carrier or the like is movable with a snap movement between two positions.

Other objects and advantages will appear from the following description and the accompanying drawing, in which—

Figure 1 is a side view with the cover plate removed of a switch embodying the invention;

Fig. 2 is a side view similar to Figure 1 showing the plunger depressed and the contacts in the opposite position.

Fig. 3 is a section on the line 3—3 of Figure 1;

Fig. 4 is a section on the line 4—4 of Figure 1;

Fig. 5 is a plan view of a spring member embodying the features of my invention, and

Figs. 6 and 7 are end and side views, respectively, of the spring member shown in Fig. 5.

Like reference characters refer to like parts throughout the figures of the drawing.

The present invention is concerned primarily with small precision type snap acting switch mechanisms of the type adapted to be operated by very small pressure and movement and adapted to switch relatively heavy electrical loads. The switch illustrated is generally similar to that shown in my copending application for a snap acting device, Serial No. 645,876, filed February 6, 1946, and which issued on October 25, 1949, as Patent No. 2,486,033. The specific embodiment of the invention herein comprises a hollow housing portion 11 of insulating material, such as molded plastic, having end walls 12 and 13, side walls 14 and 16, and an open side (facing the reader in Figs. 1 and 2) normally closed by the cover plate 17, which is likewise made of insulating material such as molded plastic.

Terminal members 21 and 22, carrying the spaced stationary contacts 28 and 29, respectively, extend through the end wall 13, and terminal member 24 extends through the side wall 16, these terminal members being held in place in any suitable manner, for instance as described in the above-mentioned copending application. The exterior end portions of the terminal members are adapted to receive screws 9 and washers 8 for the attachment of wires to connect the switch into suitable circuits. The side wall 14 has an aperture 26 fittingly engaging a longitudinally reciprocable plunger 27. A preshaped actuating mem-

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ber 31 has an edge at one end pivotally engaging a groove 33 formed in the terminal member 24, the opposite end portion 35 of the actuating member being caused to bear against the inner end surface of the enlarged portion 34 of the plunger by means of a spring member which is generally designated 36 and described in detail below.

In this case the spring member 36 comprises a somewhat rectangular member or frame of thin spring strip material such as beryllium copper, formed as by stamping, having two areas 37 and 38 of the central portion removed to provide spaced side portions or tension elements 39 and 41 and having area 42 of the central portion removed to provide the end portion 43, and the inwardly or transversely extending tongue or compression element 44 attached cantileverly to the end portion 46 which is apertured as at 47 to carry the movable contacts 48 and 49, so that in operation terminal member 24 may be selectively connected to terminal member 21 or 22, through the spring member.

As shown in Figs. 5, 6, and 7, the tension elements 39 and 41 are disposed at an angle with respect to a plane containing the end portions 43 and 46. From the standpoint of maximum stiffness in all lateral directions with respect to the longitudinal axis this angle should be 45 degrees. However, from the standpoint of maximum compactness this angle should be 90 degrees, making the sides parallel; but, with the sides parallel, the spring would be readily pliable in a direction normal to the sides whereby the movable and stationary contacts would be readily misaligned either by warpage caused in heat treating the spring or by stresses set up in assembling the switch. I have found by experimentation that a practical compromise is obtained when both the side tension elements are so disposed that angles α and γ (Fig. 6) are about 70 degrees, angles α and γ thus being supplementary with respect to the above-mentioned plane. While I prefer to dispose both of the tension elements upward in this manner for the best effect, it will be obvious that they may both be bent downward, or one upward and the other downward. By so disposing the sides it is possible to use a much thinner stock of spring strip material and to provide a much narrower spring which will fit into a desirably more compact switch housing than would be possible if the tension elements were flat, as previously has been the case in many switches using a flat strip type of spring.

A significant advantage of the improved stiffness resulting from this construction arises out of the tendency for the tension elements to warp into an S shape during heat treating; by disposing them at an angle as described, this trouble is eliminated and there is no tendency for the spring to become misaligned within the switch.

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In the switch, the spring member is mounted on combined compression and pivotal means, comprising the actuating member 31 and the terminal member 24, the end portion 43 of the spring member 36 being pivotally engaged with the groove 51 formed in the upper end portion 35 of the actuating member 31; and the end of the compression element 44 being pivotally engaged with the groove 52 formed in the terminal member 24. The distance between the mounting grooves 51 and 52 is sufficiently greater than the unstressed distance between the inner edge of the spring end portion 43 and the end of the compression element 44 that, when assembled in the manner shown, the element 44 is bowed upwardly under substantial compressive stress and the tension elements 39 and 41 are placed under substantial tensile stress.

The position of the parts shown in Figure 1 is the normal position of the switch mechanism, the movable contact 48 being disposed in engagement with the stationary contact 28. When the plunger 27 is depressed, the actuating member 31 is depressed from the position of Figure 1 to the position of Fig. 2, during which movement the groove 51 on the actuating member is moved downward toward the compression centerline of the spring member against the compression of the compression element 44. In the particular switch shown, the axis of maximum stress is reached when the groove 51 reaches a position slightly lower than groove 52, and when the groove 51 is moved downwardly through this axis, the spring member reverses its position to that shown in Fig. 2, with a snap movement.

Directing attention now more particularly to Figs. 6 and 7, it will be seen that the tongue or compression element 44 is given a permanent upward set. This is for the purpose of lowering the stress in the spring at the point where the tongue is joined to the end portion 46 when it is assembled in the switch and bowed upwardly as shown in the figures. Obviously, where the compression element is bowed downwardly, it will be equally advantageous to impart a permanent downward set to it.

While I have thus described and illustrated a specific embodiment of my invention, I am aware that numerous alterations and changes may be made therein without materially departing from the spirit of the invention and the scope of the appended claims. For example, while I have shown and described a specific embodiment in which the tension elements are movable by the plunger to initiate the snap action, it will be obvious that the switch may be so constructed that the compression element, instead, is movable by the plunger to initiate the snap action, as disclosed in one of the modifications in the above-mentioned copending application. Furthermore, the switch shown is made to return to the Fig. 1 position by locating pivot 33 so that it cannot be intersected by a line joining the end portions 43 and 46 of the spring, this line being known as the tension line; to make the switch non-returning, the construction need be altered merely by lowering the stop 29 or raising the pivot 33 so tension line can cross the pivot in moving from the Fig. 1 to the Fig. 2 position. And in case of a non-returning switch, a suitable operating plunger will need to be provided to move the spring from the Fig. 2 to Fig. 1 position.

I claim:

1. A spring member for a snap acting device

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comprising a substantially rectangular frame of spring material having spaced end portions and spaced side portions interconnecting the end portions, one of said end portions having a longitudinally extending portion intermediate said side portions adapted to distort substantially under compression, said side portions in their entirety being disposed at obtuse angles with respect to said end portions.

2. A spring member for a snap acting device comprising a substantially rectangular frame of spring material having spaced end portions and spaced side portions integrally interconnecting said end portions at opposite ends, one of said end portions having an inwardly extending portion normally deformed out of the plane of said end portions, said side portions being disposed at an obtuse angle with respect to said end portions throughout the entire length of said side portions.

3. In a snap acting device, a spring member formed of a resilient spring strip having the general shape of a rectangular frame with the long sides comprising spaced tension strips, the short sides comprising spaced end portions connecting said tension strips, one of said end portions having a compression strip attached thereto in cantilever fashion, said tension strips throughout their entire length being tilted with respect to one another but to a degree substantially less than that required to make them parallel to one another, mounting means engaging the end of said compression strip and said end portion opposed to said compression strip to stress said compression strip in compression and to stress said tension strips in tension, means operatively associated with said mounting means to move said spring member through an axis of maximum stress between preselected positions by snap action.

4. In a snap acting device, a spring member formed from a resilient spring strip and having spaced tension elements, said spring member having opposed end portions connecting said tension elements, one of said end portions having a compression element and the other of said end portions being movable between preselected positions, each of said tension elements throughout their length being disposed in a plane at an obtuse angle with respect to said end portions, means for mounting said compression element, means movable past said mounting means for supporting said tension elements, said means stressing said compression element in compression and said tension elements in tension to form a snap spring system having a position of maximum stress, and an actuating member for moving the means for mounting the tension elements through said axis of maximum stress to move the other of said end portions from one to the other of the preselected positions with a snap action.

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