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SNAP ACTION DEVICE

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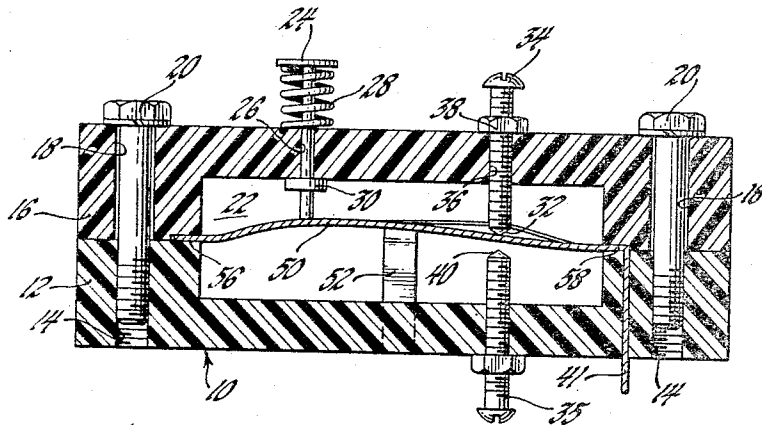


Fig. 1

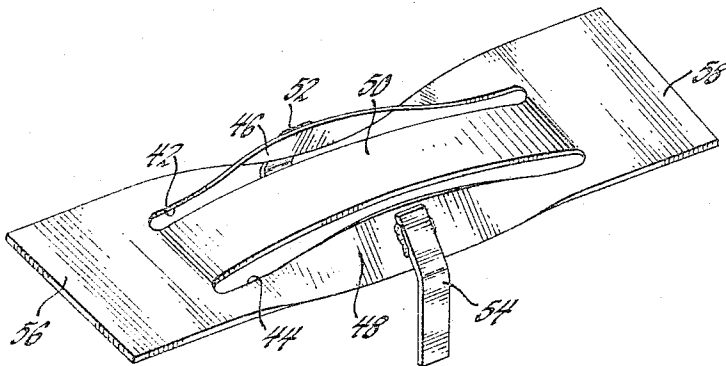


Fig. 2

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SNAP ACTION DEVICE

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This invention relates to snap action devices and in particular to a snap action device which requires a small amount of work to actuate it, and whose moving element is of light weight resilient material to insure rapid separation of a given set of contacts.

In snap action devices for use in electrical switches and fluid valves, it is desirable that the snap action device be constructed so that a high applied force is maintained by the snap element until the instant that snap action occurs. This characteristic is of importance particularly in mechanically controlled devices in that it avoids arcing and consequent pitting of the contacts in electrical switches, and premature leakage of gas in fluid valves. Such detriments commonly result from the progressive decrease in contact pressure during slow opening movement of the snap element actuator in snap action devices of previous designs.

It is, therefore, an object of the present invention to overcome the above noted defects in the prior art devices in simply constructing a snap action device which maintains a high operating force up to the instant of snap over.

Another object is the provision of a snap acting mechanism whereby movement of an actuating device in one direction will cause the snapping element to snap over center from one position to another.

A further object is to provide a unitary switching mechanism, the contact element of which is stressed by means of torque applied to the side elements intermediate the ends of the device.

A still further object is to provide an improved snap acting mechanism having instantaneous contact separating characteristics suitable for use as an electrical circuit controller.

Still another object is to provide a novel snap acting device adaptable for use as a gas valve controller.

Yet another object of this invention is to provide a snap acting mechanism which is simple in construction, inexpensive to manufacture and reliable in operation.

A further object is to provide a novel snap acting element which may be stamped from a single piece of resilient sheet metal stock.

Other objects and advantages of this invention will become apparent from the following description and appended claims, with reference being made to the accompanying drawings which form a part of this specification and wherein:

FIG. 1 is a cross-sectional view illustrating one embodiment of a snap acting switching means constructed in accordance with the present invention; and

FIG. 2 is an enlarged perspective view of the snap action device of FIG. 1.

As is illustrated in FIG. 1, a preferred embodiment of the present invention as applied to an electric switch is disposed in a housing 10 of suitable dielectric material. The housing 10 includes a centrally hollowed base 12 having a threaded bore 14 adjacent each end and a cover 16 having cylindrical bores 18 at each end in aligned relationship with the base bores 14. The matching parts 12 and 16 of the housing are held in assembled relationship as by lock washers and hex head bolts 20 which pass through bores 18 of the cover 16 to be received by the threaded bores 14 of the base 12. The hollowed portions of the housing members define complementary re-

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cesses which when in assembled relationship cooperate to form a chamber 22 for enclosing the switching mechanism.

At a distance from the left side of the chamber 22 of approximately one-fourth of the length of the chamber and passing through the top of the cover 16 there is disposed an actuating plunger member 24. The actuating member 24 is constructed of dielectric material and extends through and is guided by a smooth bore 26 in the cover 16. A resilient member 28 biases the plunger 24 in an upwardly direction and a stop 30 limits the upward travel of the plunger.

At a distance from the right side of the chamber 22 of approximately one-quarter of the length of the chamber there is disposed an upper contact means 32. The upper contact means as shown may take the form of a threaded screw 34 to be received by a threaded bore 36 in the top housing member 16. Since it is desirable that the contacts be adjustable and yet fixed when once adjusted, a locking nut 38 is provided for securing the contact in a desired axial position. In aligned relationship with the contact 32 and passing through the base 12 there is disposed in adjustable relationship a lower contact 40 which also includes a threaded member 34 and a locking nut 38. A third contact means extends through the base 10 and terminates as a terminal 41.

As is illustrated in FIG. 2 of the drawing, the switching mechanism initially has the form of a flat sheet metal stamping with elongated apertures or slots 42 and 44 extending longitudinally in spaced relation to each other. The apertures 42 and 44 functionally divide the sheet metal stamping into a first stressing element or ribbon 46, a second stressing element or ribbon 48, and a switching element or ribbon 50; the several elements or ribbons being joined at either end. Rigidly affixed to the elements 46 and 48 are stressing members 52 and 54 respectively. As is apparent to those skilled in the art, torque applied to stressing elements 46 and 48 by means of rotating the stressing members 52 and 54 towards each other in a plane perpendicular to the longitudinal axis of the metal stamping will cause the stamping to be shortened in the longitudinal direction thus placing the switching element 50 in a state of longitudinal compression. Since the element 50 is long and of thin cross-section it will, as a result, be bowed upward as shown. The degree of deformation of the switching element 50 is naturally dependent on the amount of arcuate displacement of the stressing members from the plane of the initially flat sheet material. For example, rotation of the stressing members 52 and 54 thru an angle of approximately 90 degrees will cause the switching element 50 to be bowed substantially higher than would be caused by an arcuate rotation of 45 degrees which is shown in FIG. 2.

As is shown in FIG. 1, the switching mechanism is disposed in operative relationship within the chamber 22 of housing 10. The ends 56 and 58 are positioned to be held between the upper part 16 and lower part 12 of the housing 10. The ends 56 and 58 are pressed between the parts 12 and 16 by bolts 20 and thus rigidly fixed therewith with a portion of the end 58 making good electrical contact with the terminal connector 41. As a practical matter, the terminal 41 may be integrally formed with the metal stamping end 58.

The switching element 50 is placed in compression and is thus bowed upward by rotating the stressing members 52 and 54 toward the base 12 to be affixed thereto by any suitable means, such as vertical slots in the base 12 or by clamping means removably secured to the side of the base 12. It is understood that the stressing members 52 and 54 are to be rotated and secured to the base 12 prior to tightening bolts 20.

The operation of the switch is as follows: The switch-

ing element 50 normally assumes the position shown in FIG. 1 in which the contacting portion of element 50 is in contacting engagement with contact 32 and an electrical circuit is completed through the bolt 34 and the switching element 50 to the terminal 41. When the actuator 24 is moved downwardly the leftmost part of the switching element 50 is also moved downwardly until such a time that the switching element is caused to instantaneously snap over center and come into contacting engagement with contact 40. An alternate electrical circuit is thereby completed through bolt 35 and the switching element 50 to the terminal 41.

It is of interest to note that the switching element would bow upwards with a crest point at approximately one-half of its effective length were it not for the restraint made upon it by contact 32. As contact 32 causes that portion of the bowed element to remain in a position lower than it would freely assume, it is apparent that the crest point of the bow is shifted toward the left of its center position. Now, as pressure is applied through actuator 24 to depress the opposite end of the element 50, the crest point is seen to move back towards contact 32 until such a time that the element snaps over center into engagement with contact 40. It is this crest point shifting effect that causes a continuous pressure to be applied between the element 50 and the respective contacts until the instant of snap over from one position to another and it is this feature that contributes to make the present switching mechanism a marked improvement over conventional types of switching devices.

The utility of the present invention is apparent from the above description and the appended drawing. For use in an electrical switching device, the switching mechanism is preferably made of resilient material such as spring steel or bronze. However, any suitable resilient electrically conductive material may be used. In addition, it is contemplated that for use in some application, it may be desirable to affix to the snapping element 50 one or more contact heads to protect the element 50 from damage occasioned by the repeated striking against contacts 32 and 40.

When it is desired to use the disclosed switching mechanism in a gas valve embodiment or similar application, it is contemplated that the switching mechanism may be constructed from any suitable resilient plastic or synthetic material which will remain resilient after repeated flexures.

In the foregoing specification there has been described a relatively simple structure suitable for use as a snap acting mechanism and which may be initially formed by punch press operation then later stressed into snap acting configuration during assembly of a particular switching device. It should be noted that while the torquing tabs 52 and 54 are shown as being welded to the stressing elements 46 and 48, respectively, such tabs may also be integrally formed with the sheet metal stamping; thus, the entire switching mechanism could be economically and simply manufactured as by a stamping or pressing machine.

Inasmuch as the preferred embodiment of the present invention is subject to many modifications and changes in details, it is intended that all matter contained in the foregoing description or shown on the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In a snap acting device, the combination comprising a housing including a base member and a cover member, said base member including a first contact means and a second contact means extending therethrough, said

cover member including an actuating member and a third contact means extending therethrough, said first and third contact means being disposed in axial alignment with each other, an elongated snap switching mechanism mounted by its end portions within said housing members adjacent said actuating member and between said first and third contact means so as to bear against one of said contact means, said switching mechanism including a single sheet of resilient electrically conductive material having a plurality of elongated apertures therein and having means for applying lateral torque to portions thereof, and said lateral torque applying means being removably attached to said housing.

2. In a snap acting device, the combination comprising a housing including a first member and a second member each adapted to mate with the other, said first member including a first contact means and a second contact means extending therethrough, said second member including a spring biased actuating device and a third contact extending therethrough, said first and third contact means being disposed in separated axial alignment with each other, means for compressively mating said first member and said second member, a snap acting mechanism comprising a single sheet of resilient material having a plurality of elongated apertures extending longitudinally thereof and substantially dividing the sheet into at least three longitudinal strips joined at either end and torquing means rigidly affixed in transverse relationship to the outer strips at points intermediate their lengths, said snap acting mechanism being compressively secured at two extremities between the mating portions of said first member and said second member, and disposed between said first and second contacting means, means for securing said torquing means to one of said members so as to exert a constant torquing action on said outer strips thereby causing any remaining strips to assume a bowed configuration thus engaging one of said contacting means, said actuating device operatively engaging a portion of said remaining strips so as to facilitate mechanical deflection of said remaining strips.

3. In a snap acting device, the combination comprising housing means, a substantially rectangular sheet of resilient material, opposite end portions of said sheet being fixed in said housing means to support said sheet therein, a pair of spaced slots extending longitudinally in said sheet intermediate said end portions and forming a pair of side strips and a central strip therebetween, torquing means on each side strip attached to said housing means to twist each side strip whereby said central strip is bowed to define a snap acting element, and

actuating means carried by said housing means for moving said central strip relative to said side strips.

4. The invention as recited in claim 3 wherein said torquing means comprises a stressing tab on each side strip intermediate said end portions, whereby said side strips are twisted toward a plane normal to said slots and said central strip is stressed to its bowed configuration.

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