

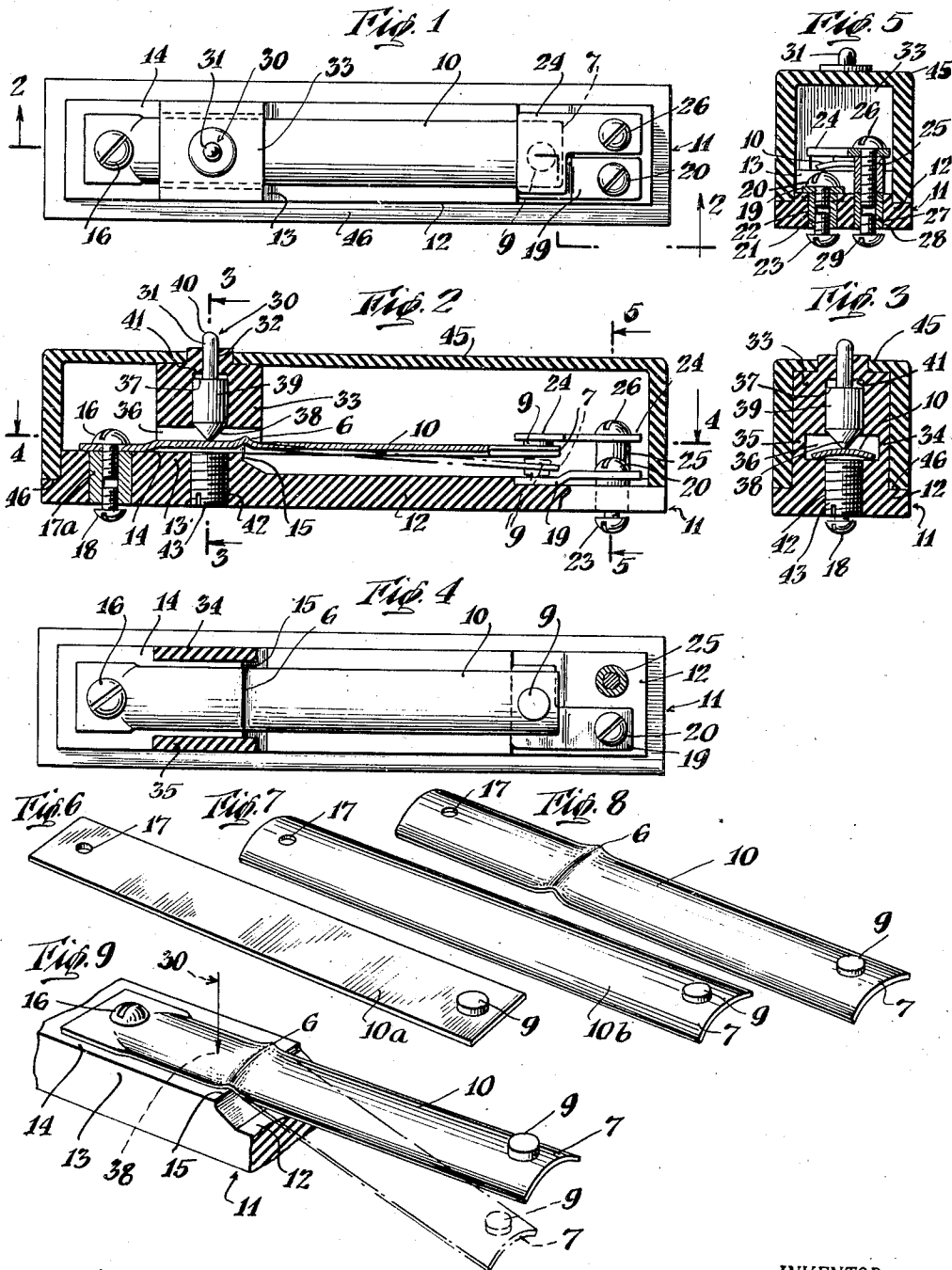
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SNAP ACTION SWITCH

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6 Claims. (Cl. 74-100)

This invention relates to mechanical movements which transform small motions to much larger ones and more particularly to a snap action switch.

The objects of the invention include the provision of a relatively simple, dependable, highly efficient and convenient device of the type above indicated.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawing forming a part thereof, in which

Fig. 1 is a plan view of a snap action switch illustrative of the invention;

Fig. 2 is a side view mostly in section along line 2-2 of Fig. 1;

Fig. 3 is a cross section on line 3-3 of Fig. 2;

Fig. 4 is a view on line 4-4 of Fig. 2;

Fig. 5 is a view on line 5-5 of Fig. 2;

Fig. 6 is a view in perspective of a blank for forming the leaf spring contact arm;

Fig. 7 is a view in perspective of the blank in an intermediate form which is bowed transversely throughout its length;

Fig. 8 is a view in perspective of the leaf spring contact arm as finally formed and set which is indented across its width; and

Fig. 9 is a view in perspective of the leaf spring of Fig. 7 mounted on a support to illustrate the movement of the leaf spring contact arm, the full lines showing the leaf spring contact arm in its normal stable position and the broken lines indicating the contact arm when in its unstable position caused by applying pressure as indicated by the arrow.

It will be understood that the figures showing the leaf spring contact arm are slightly exaggerated to aid illustration.

In the following description and in the claims various details will be identified by specific names for convenience but they are intended to be as generic in their application as the art will permit.

In the drawing accompanying and forming part of this specification, certain specific disclosure of the invention is made for purposes of explanation, but it will be understood that the details may be modified in various respects without departure from the broader aspects of the invention.

Referring now to the drawing, the leaf spring

contact arm 10 is supported on a frame 11. Frame 11 comprises a base 12 having a raised portion 13 which provides a table or flat-surface support 14 on which the spring contact arm 10 may be mounted in cantilever fashion. The table supporting the spring is preferably provided with a sharp corner or edge 15. The material of the frame may be of any suitable hard insulating material, such as hard rubber, phenol condensation composition, Bakelite, etc.

The leaf spring contact arm 10 is mounted, as indicated hereinabove, in cantilever fashion upon the table 14 by means of a cap screw 16 which extends through an aperture 17 near the end of the leaf spring 10 and which is screwed into a threaded metal bushing 17a fixed in a suitable aperture in the base 12. A cap screw 18 also mating with the threaded aperture of the metal bushing 17a provides a binding post to attach a wire of an electric circuit.

The base 12 also provides support for mounting metal contact member 19 which is fixed in a suitable manner as by a cap screw 20 extending through the contact plate 19 and threaded into a metal bushing 21 mounted on an aperture 22 in the base 12. A cap screw 23 also mating with the threaded aperture of the metal bushing 21 provides a binding post for attaching or connecting a wire of an electric circuit. Also mounted on the base is another contact plate 24 which is fixed at a suitable and desirable distance from the contact plate 19. This fixed distance may be maintained by a sleeve spacer 25 which may be of metal. The contact plate 24 may be mounted on the spacer 25 by cap screw 26 extending through an aperture in the plate, through the spacer and into a threaded aperture of the metal bushing 27 mounted in an aperture 28 in the base 12. A cap screw 29 mating with the aperture of the bushing 27 provides a binding post for attaching or connecting a wire of an electric circuit.

The spring contact arm 10 may carry a pair of contact members 9, which may be of silver, platinum or other suitable material. They are adapted to engage contact plates 19 and 24 to close a circuit. It will be noted also that contact plates 19 and 24 provide stops for the stroke of the free end of the contact arm 12. The spring, as will be described in further detail hereinafter, operates with a decided snap action and may be made so that its free end 7 may have a relatively long stroke or throw.

An actuator or push button designated generally by reference character 30, is provided to oper-

ate the switch. It may comprise a shank 31 of insulating material having a rounded head 40 which extends through a corresponding aperture 32 in a bridge 33 mounted over the table 14. The bridge 33 may have depending legs or supports 34 and 35 which are fixedly mounted to the table 14 or to the base 12. As shown, the bridge and base are of one integral form with a tunnel 36 to provide space for the spring 10 to extend therethrough when the spring is mounted on its supporting surface 14. The shank 31 is fixed to a cylindrical presser member 39 which may be of metal or of non-conducting hard material. It is of greater cross section than the shank 31 to provide an annular shoulder 37. The rounded point 38 of the actuator engages the spring 10 but it will be observed provision is made for limited vertical movement of the actuator. The head 40 of the actuator will extend above the surface of the bridge 33 but the actuator cannot come up out of the bridge because the annular shoulder will engage the abutment 41.

To facilitate mounting the actuator in its proper position in the bridge, an aperture 42 is provided in the base 12 large enough to permit the larger portion 39 of the actuator to pass through when the spring 10 is removed. After the actuator is slipped into its well in the bridge, the spring 10 is mounted in cantilever fashion on the table 14 by means of screw 16 and finally an adjustable stop screw 43 may be screwed into the threaded aperture 42. This screw 43 may be used to limit the downward movement of the actuator, if desired.

To cause the free end of the spring contact arm to move downwardly (see Fig. 2), the actuator 30 is caused to move downwardly toward the spring by depressing the head 40. The presser member 39 engaging the spring at point 38 will cause the free end 7 of the spring to move toward the contact plate 19 with a snap action and will close the circuit through posts 18 and 23. Or by releasing the pressure on head 40, the free end of the spring 10 will break the contact with plate 19 and return with a snap action to engage plate 24 to complete a circuit through posts 18 and 26. If desired, a cover 45, such as shown in Fig. 1, may be provided. It can be made to fit on a ledge 46 in the frame 11.

The snap action providing quick make and break of the contacts is obtained by distorting the material of leaf spring 10 in a peculiar manner. Referring now more particularly to Figs. 6 to 9, the leaf spring 10 comprises thin spring metal, such as steel, phosphor bronze or other suitable conducting resilient metal. Fig. 6 shows a strip 10a which is in flat condition. Preferably, the length is relatively much greater than its width; preferably, more than four to five times its length which is admirably suited to the purpose. The strip is bowed transversely throughout its length as indicated in Fig. 7 and designated 10b. A bow having a curvature with a radius of about four times the width of the spring has been thus bowed transversely of its length to give it a longitudinal axis and given a set in that shape (see Fig. 7), the spring is then distorted further by giving it a bowing to make a transverse axis by a tool which will give the spring a crease or indentation 6 across its width to produce a transverse axis and given a set in that shape. A flat tool with a rounded edge will provide such indentation and give the spring a transverse axis as shown at 6 in Fig. 8. An in-

dentation having a curvature with a radius of about one-fourth the width of the spring has proved very effective.

When distorted and given a set as indicated in Fig. 8, there are set up in the spring opposing internal stresses tending to straighten the longitudinal and transverse axes. The stresses of the transverse bowing along the longitudinal axis predominate the stresses set up by the transverse indentation so that the normal stable position of the spring is as shown in Fig. 2 and by full lines in Fig. 9. However, when the spring is mounted with the convex side up in cantilever fashion, as shown in Fig. 2 and in Fig. 9, with the transverse indentation or crease 6 just beyond and parallel to the edge 15, a pressure applied on the actuator 30 engaging the spring at point 38 will cause the free end 7 of the spring to move downwardly and a very slight movement of the actuator (indicated by the arrow in Fig. 9) will cause the mounted part of the spring at point 38 to move through a dead center position at which time this external pressure coupled with the internal stresses set up by the transverse indentation will predominate the opposing stresses set up by the bowing along the longitudinal axis and cause the free end 7 of the spring to move downwardly with a decided snap action. The broken lines in Fig. 9 indicate the position of the free end 7 of the leaf spring contact arm 10 when pressure is applied as indicated by the arrow, this position being unstable as the free end will return to stable position when the pressure indicated by the arrow is removed.

It is significant that spring contact arms may be constructed in accordance with the invention which will provide a stroke or throw of the free end of the contact arm more than three hundred times greater than the corresponding movement of the actuator. Thus the contact plates may be spaced a relatively great distance apart; yet the movement of the actuator may be limited to a very slight distance. Consequently, a switch made according to the invention is admirably suited to uses where only a small actuator movement is permissible. Moreover, a switch made according to the invention is admirably suited for direct current because a wide contact gap may be provided, requiring, however, a very small actuator movement to provide snap action.

While certain novel features of the invention have been disclosed herein, and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In a snap acting device, a leaf spring shaped in convexo-concave form throughout a substantial part of its length having stresses therein tending to maintain said spring extending in a normally stable longitudinal direction, an indentation across said spring in said convexo-concave portion setting up stresses tending to bend said spring out of a straight position but insufficient to cause such bending without application of external force, means providing a support having an edge mounting said spring at one end thereof with said indentation adjacent said edge, and means operative to exert an external force on said spring above said support near said indentation to flatten said convexo-concave portion on said support to cause said spring to bend with a snap action.

2. In a snap acting device, a leaf spring bowed

transversely throughout substantially its entire length to set up stresses therein tending to maintain said spring straight in a longitudinal direction along said spring, and having an indentation transverse of the length of said spring to set up stresses therein tending to cause said spring to bend in a direction at right angles to said longitudinal direction but insufficient to cause such bending without application of additional external force, means for providing support for one end of said spring adjacent said indentation, and means operative to apply additional external force to said spring adjacent said indentation to cause such bending with a snap action.

3. In a snap acting switch, a leaf spring bowed transversely of its length and creased across its width and given a set in that shape, said bowing and creasing setting up opposing internal stresses, the bowing setting up stresses tending to maintain the longitudinal axis of said spring in substantially straight normal stable position and the creasing setting up stresses tending to bend the longitudinal axis but of insufficient strength in and of themselves to cause the longitudinal axis to be bent out of normal stable position, a support to mount one end of said spring in cantilever fashion, with the crease adjacent said support, the other end of said spring being free to move, the side edges of the supported end of said spring engaging said support, means operative to exert a force on said spring on the supported end portion to cause the free end of said spring to be actuated by a snap action.

4. An electrical snap action switch which comprises a base, a flat supporting surface on said base having a fixed edge, a leaf spring having one end fixedly mounted on said supporting surface and the other end free to move, said spring being shaped in convexo-concave form throughout a substantial part of its length whereby stresses are set up therein tending to maintain said spring in a straight normally stable position, a narrow indentation across the width of said spring beyond and adjacent said edge and setting up stresses tending to bend said spring out of its normal stable position but insufficient to do so without application of external force, a movable actuator, means to support said actuator above said surface, said actuator being mounted for movement in such manner that a relatively small movement thereof against the convex portion of said spring on said surface adjacent said inden-

tation will cause a relatively long throw of the free end of said spring with a snap action.

5. In a snap acting device, a leaf spring having a transverse axis and a longitudinal axis, said spring being bent to make said transverse axis bow convexly and given a set in such position, said spring being also bent to make said longitudinal axis tend to bow convexly and given a set in such position, the convex bowings of said axes being with respect to the same face of the spring, said bowings setting up opposing internal stresses tending to straighten said axes, said device having a normal stable position in which the first bowing dominates to prevent said spring from flexing about said transverse axis, means mounting said spring, means operative to exert an external force on said spring to flatten said first bowing and cause said spring to flex about its transverse axis with a snap action to an unstable position, said spring returning, by virtue of its own internal stresses, to stable position when said external force is removed.

6. In a snap acting device, a leaf spring having a transverse axis and a longitudinal axis, said spring being bent to make said spring bow convexly throughout substantially its entire length along its longitudinal axis and given a set in such position, said spring being also indented across its width producing said transverse axis and to make said longitudinal axis tend to bend convexly near said indentation and given a set in such position, the convex bowing and indentation being with respect to the same face of the spring, said bowing and indenting setting up opposing internal stresses tending to straighten said axes, said device having a normal stable position in which the stresses of the first bowing dominate the stresses of said indentation to prevent said spring from flexing about said transverse axis, a flat surfaced support having an edge for fixedly mounting one end of said spring with said indentation adjacent and parallel to said edge, means operative to exert an external force on said spring above said support to flatten said first bowing on said flat surface and cause said spring to flex about its transverse axis with a snap action to an unstable position, said spring returning, by virtue of its own internal stresses, to stable position when said external force is removed.

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