Nov. 21, 1967 W. R. BAUER 3,354,274

SWITCH WITH TRANSVERSE SHEET METAL SNAP ACTION MEMBERS

Filed May 5, 1966

3 Sheets-Sheet 1

FIG-1

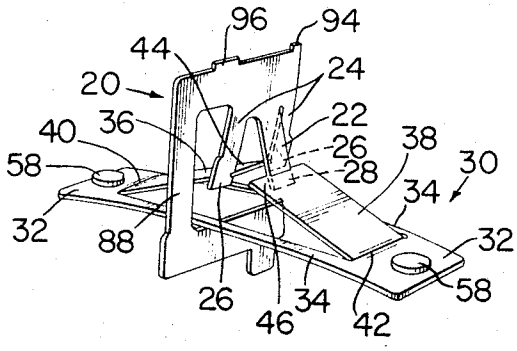


FIG-2

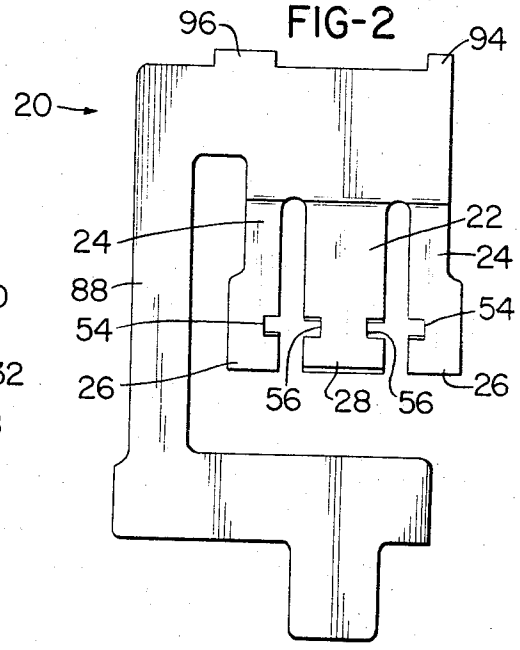


FIG-3

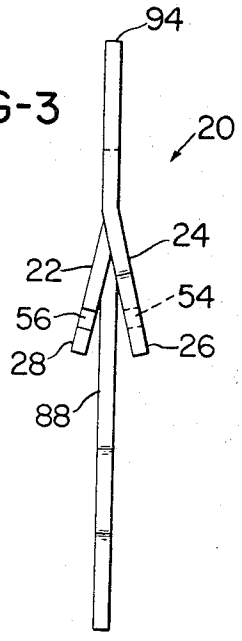


FIG-4

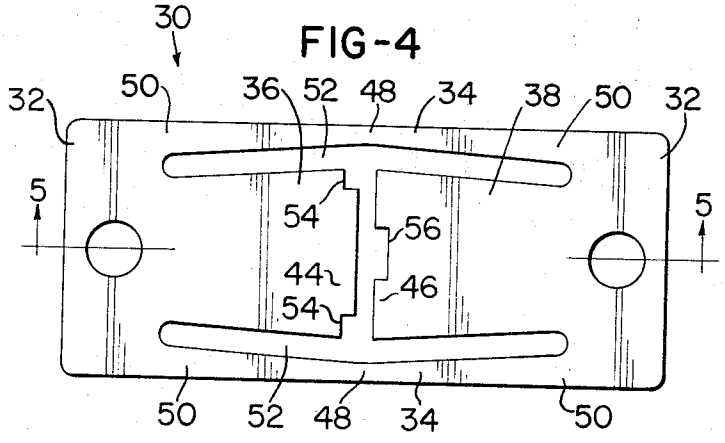
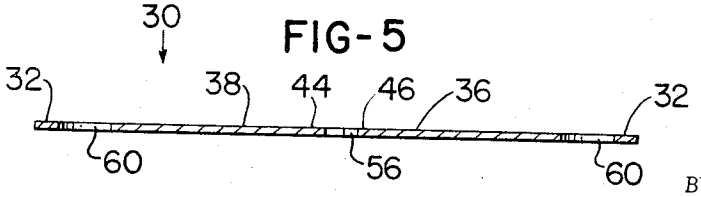


FIG-5



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SWITCH WITH TRANSVERSE SHEET METAL SNAP ACTION MEMBERS

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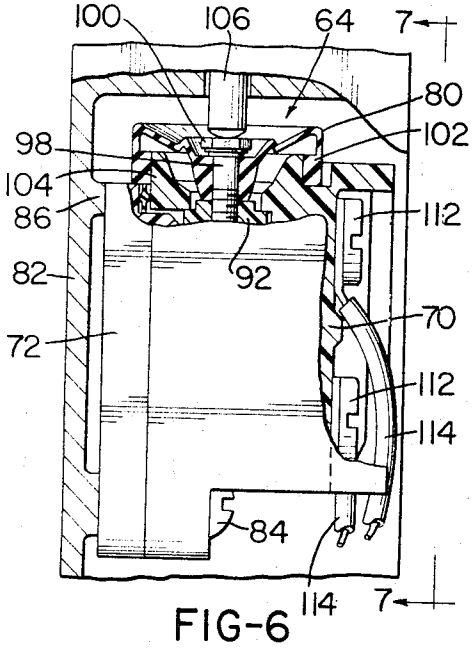


FIG-6

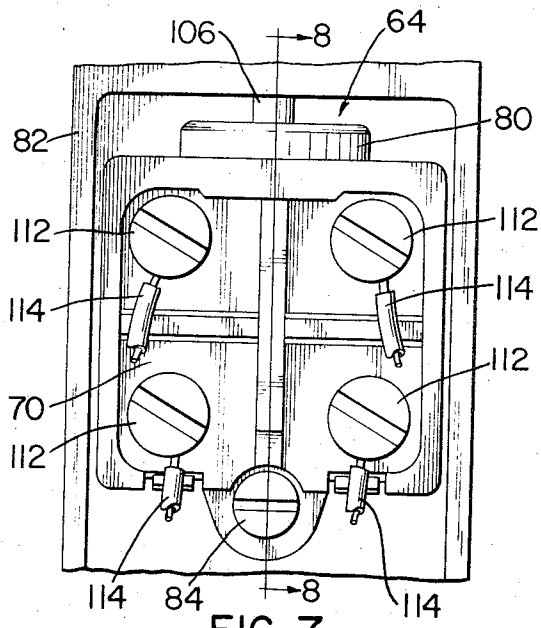


FIG-7

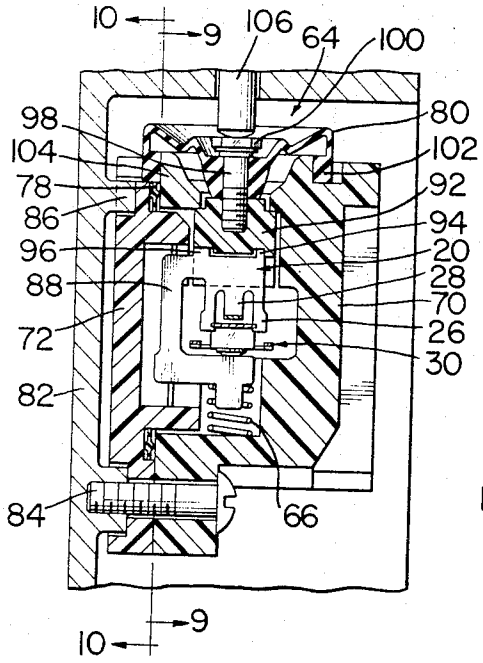


FIG-8

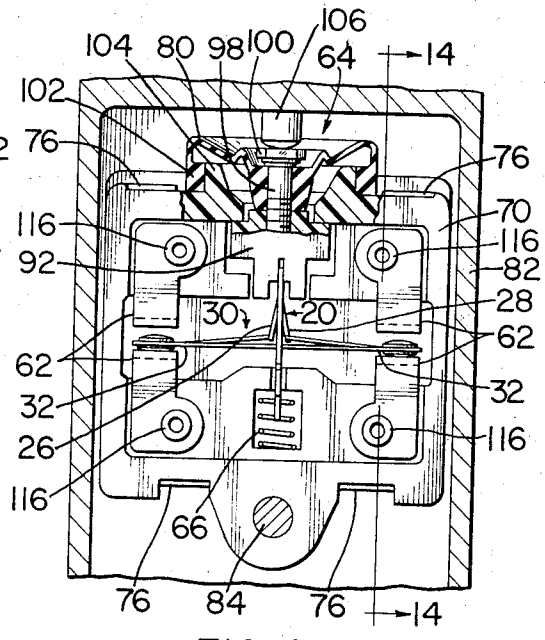


FIG-9

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SWITCH WITH TRANSVERSE SHEET METAL SNAP ACTION MEMBERS

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FIG-10

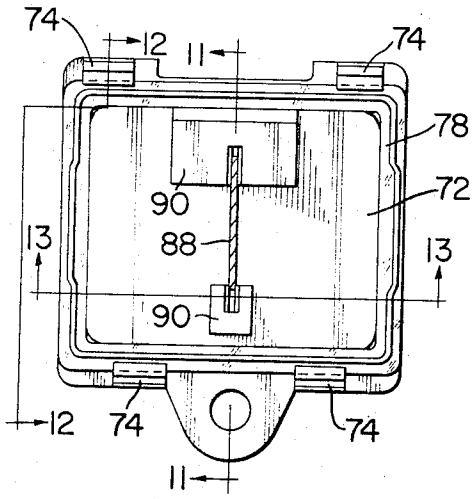


FIG-11

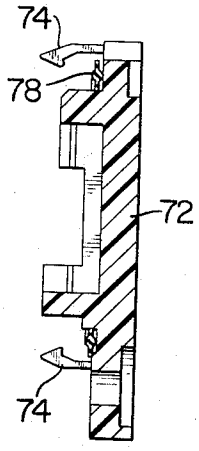
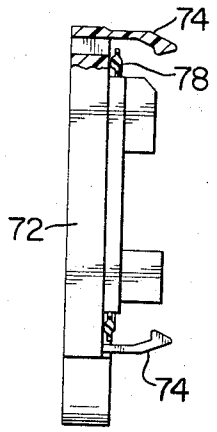


FIG-12



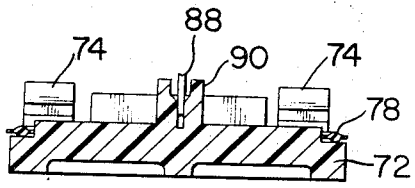


FIG-13

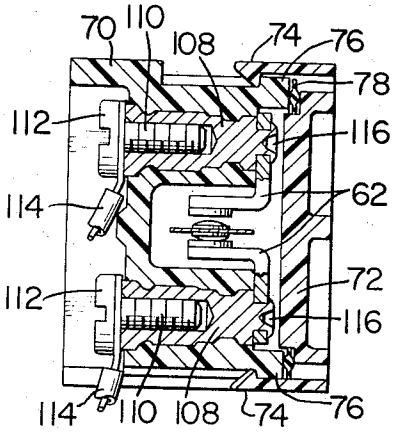


FIG-14

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United States Patent Office 3,354,274 Patented Nov. 21, 1967

3,354,274

SWITCH WITH TRANSVERSE SHEET METAL SNAP ACTION MEMBERS

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Filed May 5, 1966, Ser. No. 547,980
14 Claims. (Cl. 200—67)

This application is a continuation-in-part of my copending application Ser. No. 493,108, filed Oct. 5, 1965, for Sealed Limit Switch and the Like.

This invention relates to a snap action means, such as a snap action switch means.

Such snap action means may include an edgewise reciprocable first snap acting one-piece sheet metal member having a central tongue and two outer tongues on either side of such said central tongue, such tongues having free tongue ends, and a second snap acting one-piece sheet metal member transverse to such first sheet metal member, such second sheet metal member having two end contact bridge members joined by two outer tension strips and two inwardly directed legs between such tension strips and supported at their outer leg ends by such bridge members, and having their inner free leg ends in snap locking engagement with such free tongue ends.

This invention also includes a method of making such snap action means, which includes forming such one-piece first sheet metal member, forming said snap acting second one-piece sheet metal member into the forms described in the preceding paragraph and placing such first and second sheet metal members transverse to each other with their inner free leg ends in snap locking engagement with such tongue ends, to form such snap action means, or snap action switch means.

Other features of this invention are apparent from this description, the appended claimed subject matter, and/or the accompanying drawings in which:

FIGURE 1 is a perspective diagrammatic view of the switch sheet metal members assembled together diagrammatically, and illustrated without supports, stationary contacts etc., for a clear showing of the sheet metal members.

FIGURE 2 is a plan view of the first or edgewise reciprocatable sheet metal member.

FIGURE 3 is a side edge view of FIGURE 2.

FIGURE 4 is a plan view of the second or snap acting sheet metal member.

FIGURE 5 is a cross section along line 5—5 of FIGURE 4.

FIGURE 6 is a diagrammatic side view of a casing in which the sheet metal members of FIGURES 1–5 may be mounted.

FIGURE 7 is a front view of FIGURE 6, taken along the line 7—7 of FIGURE 6.

FIGURE 8 is a cross section along the line 8—8 of FIGURE 7.

FIGURE 9 is a cross-section, with the cover removed, along the line 9—9 of FIGURE 8.

FIGURE 10 is a cross-section along the line 10—10 of FIGURE 8.

FIGURE 11 is a cross-section of the casing cover member, taken along the line 11—11 of FIGURE 10.

FIGURE 12 is a cross-section, partly in elevation, along the line 12—12 of FIGURE 10.

FIGURE 13 is a cross-section along the line 13—13 of FIGURE 10.

FIGURE 14 is a cross-section along the line 14—14 of FIGURE 9.

The snap action means of this invention may include an edgewise reciprocatable one-piece first sheet metal member 20 having a central tongue 22 and two outer tongues 24. These tongues may have tongue ends 26 and 28 respectively.

A snap acting one-piece second sheet metal member 30 may have two end contact bridge members 32, joined by two outer tension strips 34, and two inwardly directed legs 36 and 38, between said tension strips 34. The legs 36 and 38 are supported at their outer leg ends 40 and 42 by the bridge members 32.

The inner free leg ends 44 and 46 of member 30 are in snap locking engagement with the free tongue ends 26 and 28 of member 20.

The central tongue 22 of member 20 may be relatively wide in relation to the other tongues 24. The main width of the central tongue 22 may be substantially equal to the combined main widths of the upper parts of the outer tongues 24, FIGURE 2. Such main widths of the outer tongues 24 may be substantially equal to each other.

The first sheet metal member 20 may be generally C-shaped.

The second sheet metal member may be of generally quadrilateral shape, and may have its tension strips 34 passing through the central part of the C-shaped first sheet metal member 20.

The outer tension strips 34 preferably are parallel to each other. The intermediate parts 48 of the tension strips 34 are narrower than the ends 50 of the tension strips 34. The legs 36 and 38 have their free ends 44 and 46 wider than their supported leg ends 40 and 42, so that the grooves 52, which are between the legs 36, 38, and the tension strips 34, are substantially of constant width, as shown in FIGURE 4. The free tongue ends 26 and 28 of member 20 have tongue end notches 54 and 56 which interlock with the free leg notches 54 and 56 of member 30.

The bridge end members 32 may be provided with contact buttons 58, and may be welded to the bridge members 32. The contact buttons 58 may be made on both sides of the bridge members 32, for example, by providing rivets that pass through openings 60, FIGURE 5, which may be stamped in the sheet metal member 30.

The snap action means may be provided with stationary stops 62 on opposite sides of the bridge members 32, as shown in FIGURES 9 and 14. The contact buttons 58, and the stationary stops 62 may be electrically conductive, and may form the make and break contact means for a snap acting switch means into which the snap acting device may be formed.

Means, such as plunger construction means 64, and reset means, such as the compression spring 66, as shown in FIGURES 8 and 9 may be provided to reciprocate said first sheet metal member 20 longitudinally or edgewise, such as longitudinally of the tongues 22 and 24, to cause the bridge members 32 to snap back and forth between the stops 62 and to be stopped thereby. The plunger means 64, may act on one part of the first sheet metal member 20, such as the upper part, in FIGURES 8 and 9. The compression spring 66 may act oppositely to said plunger construction 64 on another part, such as the lower part of the first sheet metal member 20; so that the sheet metal member 30 may be positioned to snap in one direction by a force applied to the sheet metal member 20 via the plunger construction 64 and upon release of the force applied via the plunger construction 64 be snapped in the opposite direction by the spring force stored in the compression spring 66.

The parts of the snap action means so far described, may have an electrical insulating support, such as the electrical insulating casing illustrated in FIGURES 6–14, reciprocatably to support such first sheet metal member 20, the second sheet metal member 30. Such casing may also support the stop means 62, and the plunger construc-

tion 64 and compression spring 66, to provide a snap acting means, such as a switch means. Such electrical insulating support may be of the character more fully described in applicant's prior application S.N. 493,108, to which reference is made for a more detailed description of such support or casing, if necessary.

Briefly, such electrically insulating support may include an insulating box 70, FIGURES 7–9, and 14, in which the various switch members may be located, and such insulating box 70 may be closed by a cover 72, FIGURES 6, 8 and 10–14, which may be releasably secured to the box 70 in any desired manner. For example, resilient fingers 74 may extend from the cover 72 and may engage suitable ridges or flanges 76, FIGURE 9, which may be formed along the rim of the box 70. The fingers 74 may be inwardly biased, so that they snap over the ridges 76 when the cover is applied to box 70. These fingers may be pried outwardly, when it is desired to remove the cover 72.

If desired, a resilient flexible seal member 78 may be placed between the cover 72 and box 70. The seal member 78 may be an integral member which extends completely around the rim of the box between the cover 72 and the rim of the box. The plunger construction 64 may be provided with a flexible seal member 80, which seals the plunger construction 64 to the box 70, so that when the cover 72 is secured to the box 70, the interior of the switch casing, including box 70, is substantially sealed against inward travel of atmospheric air into the switch casing or vice versa.

If desired, the box or casing 70 may be secured to another support, panel, casing or the like 82, by means of the screw 84, which may pass through the rim of the box 70 and the edge of the cover 72 into a threaded opening in the panel 82. The panel 82 may have a lug 86, which may extend into a suitable recess in the cover 72, so that the casing or box 70, and the cover 72 may be secured to the panel 82 by the single screw 84. This is more fully described in my said prior application.

Certain words may be used in this specification and claimed subject matter, which indicate direction, relative position and the like. These words are used for the sake of previty and clearness. However, such words are used only in connection with the illustrations and the drawings, and it is to be understood that in actual use, the parts so described may have entirely different direction, relative position and the like. Examples of such words are "upper," "lower," "vertical," "horizontal," etc.

Certain parts of the sheet metal members 20 and 30, the stops 62, the spring 66, and the plunger means 64 may be secured, supported, or guided, so that the parts may be properly operated. For example, the vertical portion 88 of sheet metal member 20 may be reciprocably guided in the grooved lug construction 90 in the cover member 72, as shown in FIGURES 10–13. The plunger construction 64 may include a reciprocatable insulating ring 92, which is suitably grooved, FIGURES 8 and 9, to receive the upper edge of the C-shaped sheet member 20 in a manner to hold the extensions 94 and 96, so the member 20 is held against lateral displacement. The ring 92 receives a plunger screw 98, with a head 100, which holds the flexible member 92 tightly between the ring 92 and the screw head 100. The outer rim 102 of the seal member 80 may be inwardly biased, tightly to hug an extension 104 of the box 70, which tightly receives the rim 102. A lever or mechanically operated rod 106 may be reciprocated back and forth to reciprocate the plunger construction 64 in response to any condition or requirement as may be desired.

Further details of the supporting structure for the removable members of the switch means are further described in my said prior application.

The stop members 62 may be connected to screw receiving conductive cups or members 108, FIGURE 14, which may be sealingly molded into the plastic box 70.

Such cups 108 may receive screws 110 with screw heads 112 for the reception of electrical lead in wires 114. The cups 108 are riveted at 116 to the stop members 62, so that the lead in wires 114 may be electrically connected to the stop members 62.

If desired, the screw heads 112 and wires 114, FIGURE 14, may be covered with epoxy adhesive or other insulative covering, not shown. The switch construction shown in FIGURE 14 may be held with the screw heads 112 directed upwardly, and then the epoxy adhesive may be applied to cover the screw heads 112 and the wires 114, and the adhesive may be allowed substantially to set in that position.

A great advantage and accuracy in manufacture of the snap means is obtained by the use, construction and assembly of the homogeneous or one-piece structure of the members 20 and 30.

It is desirable and important for proper operation that certain relationships between the sheet metal member 20, sheet metal member 30 and the contacts 62 exist. The degree to which one is able to attain these relationships determins the excellence of operation of the switch. Thus, the juncture of the tongue end 28 with the leg edge 56, should define a line and the juncture of tongue ends 26 with the leg end notches 54 should define a line, which lines are parallel to one another and lie in a single plane which is perpendicular to the plane defined by the flat portions of member 20. It is also desirable that the plane containing such lines be parallel to a line joining the upper stationary contacts 26 and also parallel to a line joining the lower stationary contacts 62.

The legs 36 and 38 do not substantially deform or bow between their outer leg ends 40, 42 and their inner free leg ends 44 and 46 respectively. The tongues 22 and 24 act as spring members and are flexed as member 20 is moved up and down to operate the switch. The tongues 22 and 24 thus store the energy needed for the snap action obtained when the snap over is reached.

Also, since the outer strip members 34 are narrower at the central portion 48, the outer strip members 34 deflect in the direction of movement of member 20 until the snap over is reached. This flexure of the outer legs causes a flexing action at the ends 50 of the outer strips 34 tending to move the movable contacts 58 of member 30 toward the stationary contacts 62 then engaged and produces a wiping action at the contacts.

The method of making the members 20 and 30 respectively as single, homogeneous, integral or one-piece members, by stamping procedures, and equal tongue bending procedures for tongues 22 and 24, provides a quick and accurate method of achieving the desired relationships just described.

In view of the disclosure herein made, it now will be obvious to those skilled in the metal working art how to stamp and bend the members 20 and 30, and how to assemble them as disclosed in FIGURES 1–5 and in the casing structure as disclosed in the other figures of this application.

The drawings of this application are greatly enlarged for the sake of clearness. The actual size of the switch may be less than one-half in size shown in the drawings. The tolerances where the member 20 passes adjacent guiding parts of the casing or box 70 and cover 72 should be made as small as practically possible and much less than the tolerances shown for clearness of illustration in the drawings. Likewise, the tolerances between the insulating ring 92 and the surrounding parts of the casing box 70 and the cover 72 likewise should be reduced as much as practically possible to obtain the substantially simultaneous snap movement of the contacts 58 upward and downward, as previously described.

It is to be noted that the member 20 is made from a single flat blank, making it easy to control the amount of bending needed to displace the tongues 24 and the tongue 22 an equal distance from the center line of the actuator

portion 98 and the central plane of the main part of the member 20. These equal distances are very desirable since they control the force exerted on the legs 36 and 38 and also assures that the point of mating of the spring members or tongues 24 with the leg 36 will define a first line and the point of mating of the spring member or tongue 22 with the leg 38 will define a second line which is parallel to said first line with the first and second lines being in a plane which is perpendicular to the plane defined by the main portion of member 20.

It should also be noted that the outer tension strips 34 are narrower at the central portion. Since the central portion 48 of the strips 34 is weakened at this central portion, such strips 34 will bow more when the switch is actuated, to provide greater wiping action between the movable contacts 58, and the stationary contacts 62.

It is therefore to be seen that applicant has provided an improved and unobvious snap acting means, and an improved method of making such snap acting means.

While the form of the invention now preferred has been disclosed as required by statute, other forms may be used, all coming within the scope of the claimed subject matter which follows.

What is claimed is:

1. Snap action means including: an edgewise reciprocatable one-piece first sheet metal member having a central tongue and two outer tongues on either side of said central tongue, each of said tongues having a respective tongue end; a snap acting one-piece second sheet metal member transverse to said first sheet metal member, said second sheet metal member having two end contact bridge members joined by two outer tension strips and two inner inwardly directed legs between said tension strips and supported at their outer leg ends by said bridge members, and having their inner free leg ends in snap locking engagement with said free tongue ends, one of said free leg ends engaging said free end of said central tongue, and the other of said free leg ends engaging said two free tongue ends of said two outer tongues.

2. Snap action means according to claim 1, said central tongue being relatively wide in relation to said outer tongues.

3. Snap action means according to claim 2, the main width of said central tongue being substantially equal to the combined main widths of said outer tongues.

4. Snap action means according to claim 3, the main widths of said outer tongues being substantially equal to each other.

5. Snap action means according to claim 1, said first sheet metal member being generally C-shaped.

6. Snap action means according to claim 5, said second sheet metal member being of generally quadrilateral shape and having its tension strips passing through the central part of said C-shaped first sheet metal member.

7. Snap action means according to claim 1, said outer tension strips being parallel to each other.

8. Snap action means according to claim 7 the intermediate parts of said tension strips being narrower than the ends of said strips.

9. Snap action means according to claim 8, said legs having their free leg ends wider than said supported leg ends.

10. Snap action means according to claim 1, said free tongue ends having tongue end notches and said free leg ends having leg end notches interlocking with said tongue end notches.

11. Snap action means according to claim 1, with contact buttons attached to said bridge members.

12. Snap action means according to claim 1 with stationary stops on opposite sides of said bridge members, and with means to reciprocate said first sheet metal member longitudinally of said tongues to cause said bridge members to snap back and forth between said stops and to be stopped by said stops.

13. Snap action means according to claim 1 with an electrical insulating support reciprocatably to support said first sheet metal member, having stop members on opposite sides of said bridge members, having a reciprocatable plunger construction acting on one part of said first sheet metal member and having a compression spring acting oppositely to said plunger construction on another part of said first sheet metal member, said snap action means being a snap action switch means.

14. Snap action means according to claim 13, said insulating support including a box shaped casing means and a cover means having means to guide said first sheet metal member edgewise along the central line of reciprocation of said plunger construction.

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