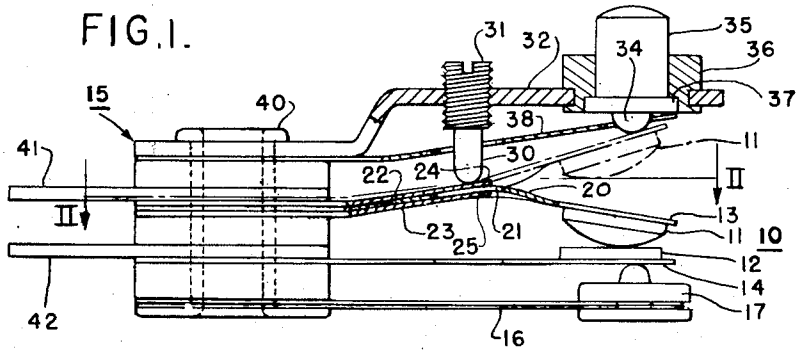
July 30, 1957 D. M. ROSENBERG ET AL 2,801,315

THERMOSTATIC SWITCH

Filed Dec. 28, 1955

FIG. 1.



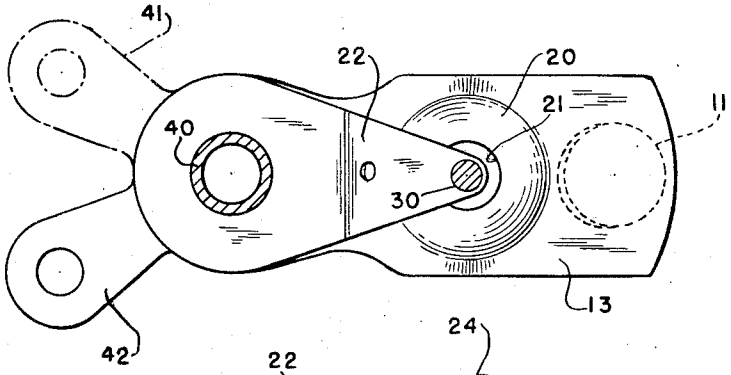


FIG. 2.

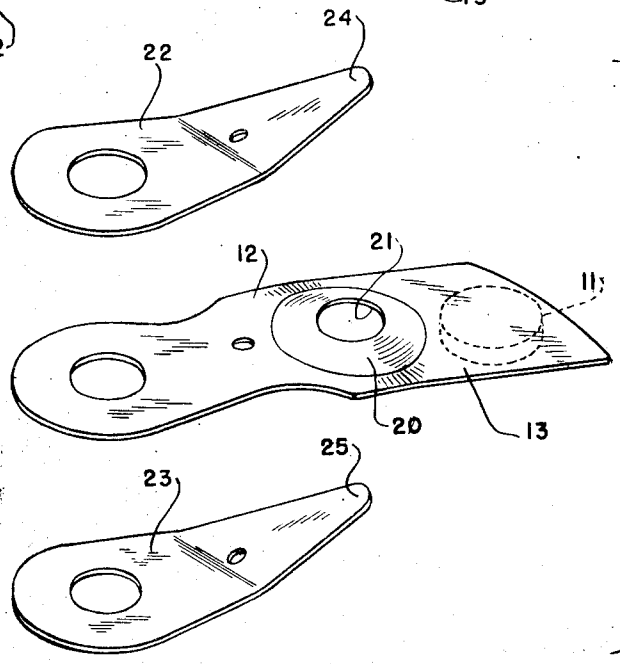


FIG. 3.

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United States Patent Office 2,801,315 Patented July 30, 1957

2,801,315

THERMOSTATIC SWITCH

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Application December 28, 1955, Serial No. 555,970

5 Claims. (Cl. 200—138)

This invention relates to a snap acting switch structure, particularly of the type in which the switch elements are supported in stacked relationship, and it has for an object to provide an improved switch structure of this kind.

Further objects of this invention are to improve the performance and life of the contacts, as well as their current interrupting capacity, in a snap acting switch of the type set forth.

A further object of this invention is to keep the cost of a snap acting switch at a minimum by utilizing similar metal blanks for forming different elements of the switch.

It is a further object of this invention to increase the contact separation resulting from a snap action in a thermostatically actuated and manually resettable snap acting switch.

A snap acting switch made in accordance with this invention includes a pair of relatively movable contacts, one of which is carried on the free end of a snap acting resilient spring arm. An area of this spring arm between its fixed end and the free contact-carrying end is embossed to make the arm a snap acting element. A pair of flat spring strips are positioned against opposite surfaces of the spring arm to stiffen the latter between the center of the embossed area and the fixed end of the arm. The arm and the two flat strips are clamped together in the switch stack. One of the spring strips is engaged adjacent the center of the embossed area by a movable element of an adjusting device. The device adjusts the free ends of the spring strips and the portion of the spring arm that is clamped therebetween to change the point of instability, for each direction of snap action, at which the free contact-carrying end of the arm snaps over center. Increased snap acting movement of the free end of the arm is obtained due to the fact that the portion of the arm between the two spring strips is kept from moving during the snap action.

These and other objects are effected by the invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a side elevation of a snap acting thermostatic switch, portions being shown in section for clearness;

Fig. 2 is a section taken along the line II—II of Fig. 1; and

Fig. 3 is an exploded view showing the snap acting element of the switch of Fig. 1 with two spring strips that are positioned on opposite sides thereof.

Referring to Fig. 1, the snap acting thermostatic switch **10** comprises a pair of contacts **11** and **12** supported on the free ends of flat spring arms **13** and **14**, respectively. The opposite ends of these arms are fixed in a stack **15** of switch components. The spring arm **13** will move the contact **11** with a snap action to the dotted line position seen in Fig. 1 when the contact **11** is forced upwardly from the full line position of Fig. 1 beyond a critical position of instability of the arm **13**. This snap acting

movement of the contact **11** will cause it to move out of engagement with the contact **12** on the arm **14**.

A thermally responsive member for actuating the switch **10** comprises a bimetallic strip **16** having one end clamped in the stack **15** and extending parallel to the contact carrying spring arm **14**. An electrical insulating member **17** is supported on the free end of the bimetal and engages the underside of the arm **14**, adjacent the contact **12**, as seen in Fig. 1. Upon being heated, the bimetal **16** will move the insulating member **17** upwardly and push the lower contact **12** against the contact **11** on the end of the snap acting member **13**. When heated to a predetermined temperature, the bimetal **16** will have deflected sufficiently to cause the contact **12** to push the other contact **11** past a critical point of instability of the snap acting member **13** and the latter will snap contact **11** out of engagement with the contact **12**.

The snap acting spring arm **13** has an annular embossed area bumped out of the plane of the strip to render the strip snap acting. The area **20** is concentric with a circular hole **21** located on the longitudinal centerline of the arm **13** between the contact **11** and the fixed end thereof. The hole **21** at the center of this circular concavo-convex area **20** reduces the resistance to snap acting movement of the arm **13**. In the drawings, the left end of this strip **13** is secured in the stack of switch parts and the other end that carries the contact may snap to two positions of stability. In one of these positions, the embossed area **20** will extend outwardly on one side of the strip, and in the other stable position it will extend outwardly on the other side.

A pair of identical spring strips **22** and **23** are positioned on opposite sides of the snap acting member **13** against the faces thereof. Each of these spring elements **22** and **23** has a portion clamped in the switch stack **15** and tapers to a point adjacent the center of the embossed area **20**. The pointed ends **24** and **25** of these strips **22** and **23**, respectively, terminate opposite the hole **21** in the center of the bumped area **20** to reduce binding between the strips **22** and **23** and the snap acting arm **13**. Both of the spring strips **22** and **23** are bent to bias their ends **24** and **25** upwardly, as seen in Fig. 1. The pointed end **24** of the upper strip **22** is engaged near the center of the embossed area **20** by an adjustable element comprising an insulating pin **30** that extends downwardly from a screw **31**. The screw **31** is threaded in a central portion of a metal plate **32** which is also supported in the switch stack **15**. The lower spring strip **23** presses upwardly against the lower surface of the snap acting arm **13** and the portion of the arm **13** outside the stack **15** and between the two spring strips, including a sector of the annular embossed area **20**, is stiffened to reduce its movement relative the switch stack **15** during snap acting movement of the arm **13**. The position of the adjusting screw **31** determines the angular deflection of this relatively rigid or stiffened portion of the arm **13** with respect to the end thereof clamped in the stack **15**.

The spring arm **13** is reduced in width adjacent the fixed end thereof so that it may be more readily deflected by the two spring strips **22** and **23**. The angular adjustment of the stiffened portion of the snap acting arm **13**, relative the switch stack **15** determines the positions of instability beyond which the contact **11** must move in order to be snapped in opposite directions.

When the contact arm **13** snaps upwardly to the dotted line position of Fig. 1, the arm **13** engages an abutment comprising insulating pin **34** in a movable reset button **35**. By pressing the button **35**, the snap acting arm may be reset to the full line position of Fig. 1. The button **35** is slidable within a cylindrical member **36** attached to the outer end of the plate **32**. The button **35** has a shoulder **37** to limit its upward movement

within the cylindrical member **36**. When the snap acting member **13** is in the position indicated by full lines in Fig. 1, the reset button is biased upwardly by means of a spring arm **38** having a fixed end secured in the switch stack **15**. The arm **38**, extending between the plate **32** and the snap acting arm **13**, has openings through which the adjusting pin and the reset pin extend.

The fixed ends of the bimetal **16**, the plate **32** and each of the spring strips **22** and **23** and spring arms **38**, **13** and **14** are provided with respective holes through which a tubular rivet **40** extends. The fixed end of the contact carrying spring arms **13** and **14** are electrically insulated from each other and from the rivet **40** in the stack **15** by means of electrically insulating washers. A pair of terminal members **41** and **42** are positioned in the switch stack **15** to make electrical connections to the two arms **13** and **14**, respectively. The rivet **40** applies a compressive force to the plate **32** on one end of the stack **15** and to the bimetal **16** on the other end to clamp all of the switch components in fixed relationship.

Each of the spring arms **13**, **14** and **38** is formed from a common blank. The arm **14** is identical to arm **13** except that it is not embossed to make it snap acting. The arm **38** is identical to arm **14** except for the addition of a slot in its free end to accommodate the insulating pin **34** in the reset button **35**. The arm **38** is also bent to bias its free end toward the reset button **35**. The use of common blanks for each of the arms **13**, **14** and **38** reduces the cost of the switch assembly.

The spring strips **22** and **23** not only provide means by which the adjusting screw **31** can adjust the critical over-center points for the snap acting arm **13**, but they also keep the portion of the snap acting arm **13** that is restrained therebetween substantially immovable so as to increase the displacement of the contact **11** when the arm **13** moves with a snap action. If the snap acting arm **13** were unrestrained, the bumped area would tend to snap outwardly on different sides of the strip when the latter moves to its two stable positions. When unrestrained, the portion of the arm **13** between the center of the bumped area and the switch stack **15** would deflect relative the stack when the arm **13** snaps over-center. By stiffening this portion of the arm between the spring strips **22** and **23** and preventing it from moving relative the switch stack the snap-acting deflection of the outer contact-carrying end of the arm **13** is increased.

During the snap acting movement of the spring arm **13**, the snap acting movement of the contact **11** will be in an arc having a center of curvature near the center of the bumped area **20**, whereas, the angular adjustment of the snap acting arm effected by the screw **31** will be about an axis extending transversely across the strip where its width is reduced adjacent the stack **15**.

While we have shown our invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof.

What is claimed is:

1. A snap acting switch structure comprising a snap acting spring member having a fixed end and a movable end, an electrical contact supported by the movable end of said member, a second electrical contact positioned in said switch to cooperate with said first mentioned contact, said spring member having a concavo-convex area intermediate its ends to provide two positions of stability of the movable end thereof on opposite sides of a critical over-center position, a pair of stiffening elements on opposite sides of said snap acting member, each element being supported by said structure with a deflectible portion extending along one of the opposed surfaces of said member between its fixed end and the center of said area, an adjusting device engaging the deflectible portion of one of said elements near the center of the concavo-convex area, the deflectible portions of said elements being biased towards said adjusting device, said elements stiffening a portion of said snap acting member between the center of said area and the fixed end thereof, said device being adjustable to change the angular position of the stiffened portion of said snap acting member relative the fixed end thereof to change the critical position at which the movable end of said member snaps over center.

2. A switch structure comprising a pair of contacts movable into and out of engagement with each other with a snap action, a spring member having one end fixed in said structure and a movable end supporting one of said contacts, said member being formed with a concavo-convex area between said ends to provide snap-acting movement of the contact thereon to either of two stable positions, a pair of spring strips disposed adjacent opposite sides of said member, each strip being fixed in said structure adjacent the fixed end of the spring member and extending along a surface thereof to the center of the concavo-convex area, an adjustable element engaging one of said strips near the center of said area, said strips being biased toward said element and clamping a portion of the concavo-convex area therebetween to restrict its movement and provide greater snap-acting displacement of the contact carrying end of said member, and an actuating device for moving the contact carrying end of said member in one direction past a critical point of instability of effect relative snap-acting movement of said contacts, said element being adjustable to move said strips, changing the location of said critical point relative said actuating device.

3. A switch structure comprising a pair of contacts movable into and out of engagement with each other with a snap action, a spring member having one end fixed in said structure and a movable end carrying one of said contacts, said member being formed with a concavo-convex area between said ends to provide snap-acting movement of the contact thereon to either of two stable positions, said member having an opening at the center of said area, a pair of spring strips disposed adjacent opposite sides of said member, each strip being fixed in said structure adjacent the fixed end of the spring member and extending along a surface thereof to the center of said opening, an adjustable element engaging one of said strips near the center of the opening, said strips being biased toward said element and clamping a portion of the concavo-convex area therebetween to restrict its movement and provide greater snap-acting displacement of the contact carrying end of said member, and an actuating device for moving the contact carrying end of said member in one direction past a critical point of instability to effect relative snap-acting movement of said contacts, said element being adjustable to move said strips, changing the location of said critical point relative said actuating device.

4. A stack type thermostatic switch structure comprising a flat snap-acting spring arm having a fixed end and a movable end, a second spring arm having a fixed end and a movable end, a contact supported on the movable end of each of said arms, said snap acting arm having a concavo-convex area intermediate the ends thereof, the contact on the snap acting arm being movable with a snap action between two stable positions on opposite sides of a critical position, said contacts being in engagement in one of said stable positions, a resilient strip adjacent each face of said snap acting arm, each of said strips being secured in the switch stack together with the fixed ends of said contact carrying arms, said spring strips extending outwardly from said stack along opposite surfaces of said snap acting arm to the center of said area, an adjustable element supported for engagement with one of said spring strips, said spring strips being biased toward said element, said spring strips stiffening a portion of the concavo-convex area therebetween to render the

stiffened portion substantially non-deflectible and increase the deflection of said snap acting contact during its snap acting movement, said element being movable to adjust said strips to change the critical position of the snap acting contact, and thermostatic means for moving said other contact in the direction of said snap acting contact to cause the latter to move out of engagement with said other contact with a snap action.

5. A stack type thermostatic switch structure comprising a flat snap-acting spring arm having a fixed end and a movable end, a second spring arm having a fixed end and movable end, a contact supported on the movable end of each of said arms, said snap acting arm having a circular embossed area intermediate the ends thereof, said area having a hole near the center thereof, the contact on the snap acting arm being movable with a snap action between two stable positions on opposite sides of a critical position, said contacts being in engagement in one of said stable positions, a pair of resilient strips adjacent opposite faces of said snap acting arm, each of said strips being secured in the switch stack together with the fixed ends of said contact carrying arms, said spring strips extending outwardly from said stack along

opposite surfaces of said snap acting arm and tapering to a point at said hole, an adjusting screw supported by said structure for engagement with one of said spring strips adjacent the center of said area, said spring strips being biased toward said adjusting screw, said spring strips stiffening a sector of the embossed area of the snap acting arm therebetween to render the stiffened portion substantially non-deflectible during the snap acting movement, said screw being movable to adjust the angular position of said sector relative the switch stack to change the critical position beyond which the snap acting contact moves with a snap action, and thermostatic means for moving the other contact in the direction of said snap acting contact to cause the latter to move past its critical position and out of engagement with said other contact with a snap action.

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