

Nov. 8, 1949

E. S. SMITH

2,487,684

SNAP-ACTING SPRINGING AND THERMOSTATIC PLATE

Filed Sept. 19, 1946

2 Sheets-Sheet 1

FIG. 1.

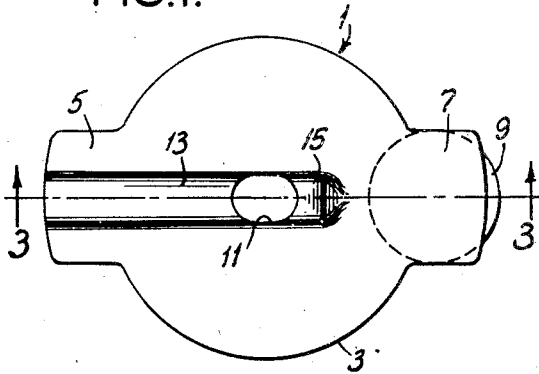


FIG. 2.

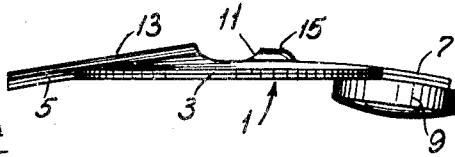


FIG. 3.

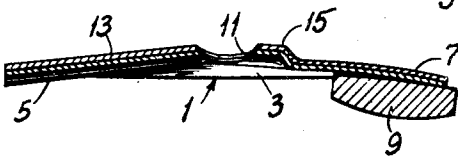


FIG. 7.

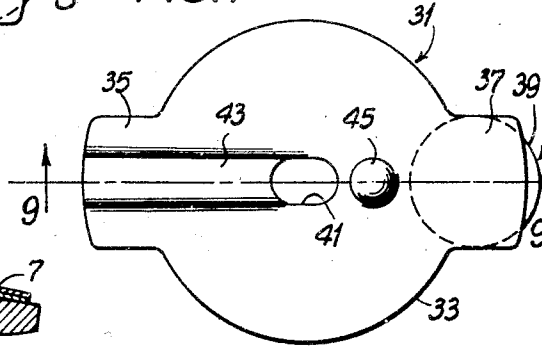


FIG. 4.

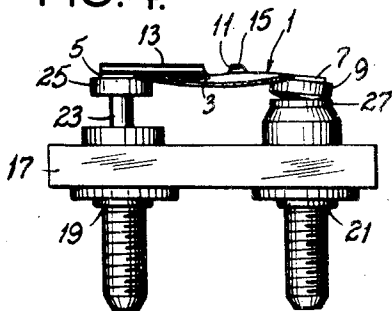


FIG. 8.

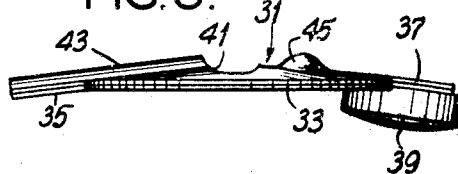


FIG. 9.

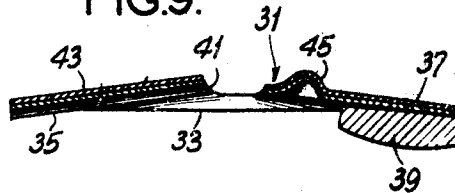


FIG. 5.

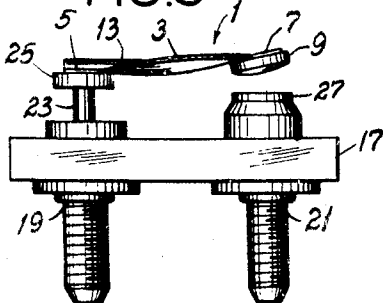
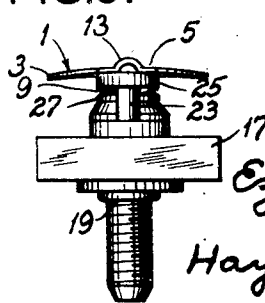


FIG. 6.



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FIG. 10.

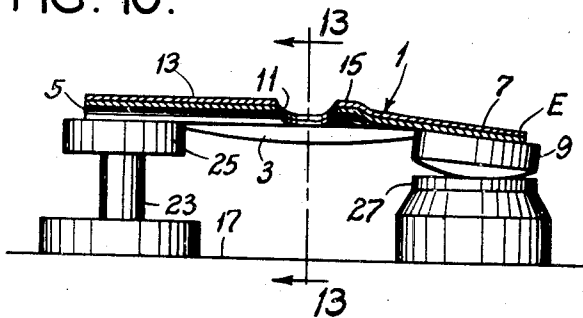


FIG. 13.

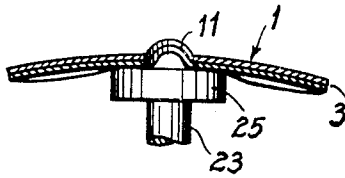


FIG. 11.

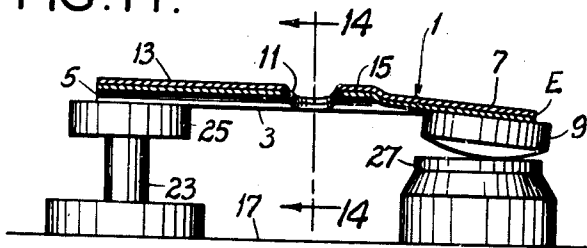


FIG. 14.

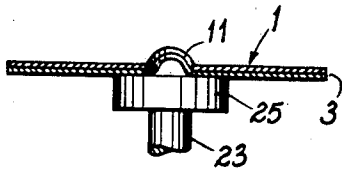


FIG. 12.

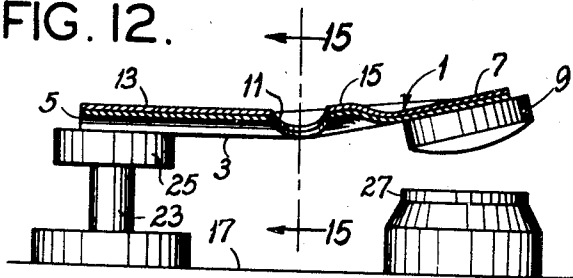


FIG. 15.

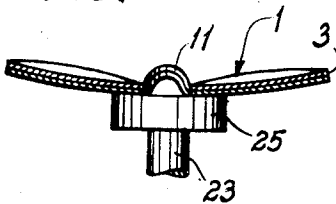
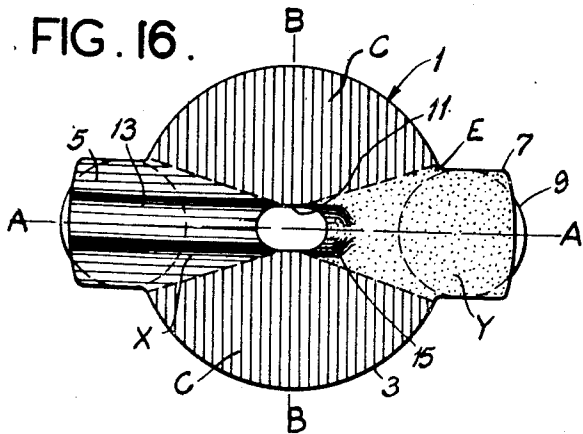


FIG. 16.



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UNITED STATES PATENT OFFICE

2,487,684

SNAP-ACTING SPRINGING AND
THERMOSTATIC PLATE

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Application September 19, 1946, Serial No. 697,879

21 Claims. (Cl. 200—138)

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This invention relates to snap-acting plates and, with regard to certain more specific features, to snap-acting control devices including inherently snap-acting temperature-responsive means adapted to operate switches, valves and the like.

This application is a continuation-in-part of my copending application for snap acting plate, Serial No. 642,269, filed January 19, 1946, subsequently abandoned. The invention disclosed herein is an improvement upon the snap-acting plates disclosed in that application and in the coassigned, copending application of Harold M. Wilson for Snap-acting springing and thermostatic plates, Serial No. 668,865, filed May 10, 1946.

Among the several objects of the invention may be noted the provision of improved inherently snap-acting plates, particularly thermostatic discs, which respond to suitable actuation with an improved snap or abrupt motion and which have low inherent creep and a decreased ratio of creep to actual snap motion; the provision of snap-acting control devices embodying plates of this class which may be easily and economically adjusted and calibrated; and the provision of controls of this class which, though of simplified economical construction, are reliable and accurate in operation. Other objects will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which several of various possible embodiments of the invention are illustrated,

Fig. 1 is a top plan view of an inherently snap-acting device of the present invention;

Fig. 2 is a front elevation of the snap-acting device of Fig. 1;

Fig. 3 is a cross section taken substantially along line 3—3 of Fig. 1;

Fig. 4 is a side elevation on a reduced scale of a thermostatic switch embodying the snap-acting device of Fig. 1;

Fig. 5 is a view similar to Fig. 4 and showing an alternative position of the snap-acting element;

Fig. 6 is a left-hand elevation of Fig. 4;

Fig. 7 is a view similar to Fig. 1, but showing another embodiment of the invention;

Fig. 8 is a view similar to Fig. 2, but showing said other embodiment;

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Fig. 9 is a view similar to Fig. 3, but showing said other embodiment;

Figs. 10—12 are central vertical longitudinal sections through the disc of Fig. 1 illustrating various configurations thereof during its opening cycle;

Figs. 13—15 are central transverse sections taken respectively on lines 13—13, 14—14 and 15—15, of Figs. 10—12 respectively; and,

Fig. 16 is a diagrammatic plan view of the disc of Fig. 1 illustrating various zones thereof.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

As illustrated herein, the invention is embodied in a dished, bimetallic, thermostatic plate in the form of a disc adapted to snap from one configuration (Fig. 4) to another (Fig. 5) upon change of temperature, and employed as a moving contact member in a switch. It will be understood, however, that the invention may be embodied in any type of snap-acting plate, whether a bimetallic, thermostatic plate or a monometallic spring plate which is operated by externally applied force, rather than by inherent stresses caused by temperature change. It will also be understood that the invention may be employed as a control member in devices other than switches, such as snap-acting valves and the like.

The copending applications referred to above disclose a snap-acting plate, specifically a dished, bimetallic thermostatic disc employed as a moving contact member in a thermostatic switch. The disc has a projecting mounting ear which is welded to a bendable support and another projecting free ear carrying a contact. This contact engages a fixed contact when the disc is relatively cold. When the disc is heated above a certain temperature, it snaps to an opposite configuration to open the contacts. When the disc cools, it snaps back to its original position or configuration to close the contacts. The temperature at which the disc snaps to open the contacts is higher than that at which it snaps to close them. The difference between these temperatures is referred to as the temperature differential of the disc.

A characteristic of a disc of this class is that upon heating (or cooling) the temperature-induced stresses therein cause an initial creeping movement of the free part of the disc prior to its snapping to its opposite configuration. Such creeping movement is undesirable as it reduces the usefulness of such discs in controls where snap action without creep is desirable. In

switches, for example, snap action with minimum creep is desirable to reduce arcing.

Prior to the single-ribbed disc disclosed in said copending applications, it was attempted to eliminate initial creeping movement by prestressing the disc by forcefully bending its support in such manner as to force the free end of the disc against a fixed surface. While this substantially reduced initial creep in the opening cycle of the disc, it also resulted in substantial loss of usable snap motion resulting from the bending of the flexible disc adjacent its mounting.

The ribbed disc disclosed in said copending applications avoided this difficulty to a considerable extent in that the rib formed in the disc stiffened a considerable part of the disc over its mounting portion and permitted the disc support to be bent to eliminate inherent initial creep without causing undue loss of usable snap motion. As disclosed in said copending applications, the rib in the disc extends from the outer end of the mounting ear to a central aperture in the disc. In producing the switch in which this disc is employed, a bendable support for the disc is bent to cause the movable contact to engage the fixed contact with sufficient initial pressure to pre-stress the disc to eliminate inherent creep and, at the same time, to insure that the disc will snap and open the contacts at the proper temperature. Proper adjustment of the disc involves extensive apparatus and time-consuming procedure.

It will be noted that the rib of the disc disclosed in said copending applications extends from the outer end of the mounting ear only to the central aperture in the disc. Thus, it stiffens the disc in the plane of snap movement only out to the center of the disc. I have found that the provision of means for stiffening the disc in a zone beyond the center of the disc, this zone extending to some extent laterally on opposite sides of the plane of snap movement, considerably reduces inherent creep of the free end of the disc and simplifies the procedure for adjustment of the switch in the course of its calibration.

Referring now to the drawings, Figs. 1-3 illustrate one embodiment of the snap-acting plate of this invention. There is generally indicated at 1 a permanently set, dished, resilient, snap-acting plate formed of a composite or compound thermostatic bimetal. The plate comprises a round disc 3 having a mounting ear 5 projecting radially outward on one side and another ear 7 projecting radially outward on the diametrically opposite side. Ear 5 provides means for conveniently mounting the plate 1 as a cantilever on an adjustable supporting stud to be described. A contact element 9 is affixed as by welding on the under side of ear 7. The disc 3 is preferably provided with a central aperture 11.

Extending from the outer end of the mounting ear 5 to the central aperture is a stiffening deformation in the form of a radial, raised reinforcing rib 13. This rib radially stiffens the disc to minimize flexing of that portion of the disc between the mounting ear 5 and the central aperture in the radial plane through said rib and ear. The disc is also formed with another stiffening deformation in the form of a short, raised, reinforcing rib 15 extending radially outward from the aperture, preferably in alignment with and in extension of rib 13 beyond the center of the disc. Rib 15 is preferably of substantially lesser length than the radius of the disc. This rib 15 provides means for stiffening the disc to

minimize creeping flexing of that portion of the disc between the central aperture and the ear 9 in the radial plane through said rib and ear.

As illustrated, the configuration of that portion of the disc 3 apart from the ribs 13 and 15 is that of a non-developable surface, for example, a portion of a spherical surface. Ribs 13 and 15 have the configuration of a developable surface, for example, a cylindrical surface. The snap-acting plate thus comprises a metallic sheet which has been formed to have in part a discontinuous developable surface extending from the edge of the sheet beyond its center, this developable surface surrounded by a non-developable surface (except at the edge of the plate). The reentrant boundary of the non-developable surface is not necessarily a sharply defined boundary. It may change gradually from its non-developable character into the developable character of ribs 13 and 15.

Figs. 4-6 illustrate a switch in which the above described snap-acting plate is employed as a moving contact member. The switch includes a base 17 of electrical insulating material such as Bakelite or Micarta. Studs 19 and 21 are fixed in the base adjacent its ends, as by riveting or the like. These studs project from the top and bottom of the base and their lower ends are threaded to serve as connecting terminals. The upper end of stud 19 is made adjustable by being formed with a stem 23 of reduced cross section, readily capable of being bent upon application of a reasonable amount of force thereto by a suitable tool. Stud 19 has a flat head or table 25. A contact 27, which is the fixed contact of the switch, is secured on the upper end of stud 21 in any suitable manner. The snap-acting plate is mounted on the stud head 25 by spot welding. The relative heights of the head 25 and the upper end of stud 21 above the base are preferably so related that, when plate 1 is welded to the head, contact 9 is lightly touching the contact 27 as shown in Fig. 4.

The plate 1 in this arrangement forms an electrical resistance self-heating element. When a current above a predetermined value passes through the plate it is heated to its snapping temperature and snaps from the Fig. 4 position to the Fig. 5 position to open the contacts 9 and 27. Adjustment to eliminate what little initial creep may be inherent in the free end of the plate and to set the plate to snap the contacts open at the desired snapping temperature is made simply by passing current through the plate to heat it and snap it open, whereupon the stem 23 is bent by means of the suitable tool until the contact 9 is spaced the proper distance from contact 27.

I have found that the above-described disc of this invention is subject to much less inherent creeping movement at the contacts than the disc in said copending applications and other prior discs. A possible explanation for this advantageous characteristic of this disc is as follows:

As illustrated in Fig. 16, the longitudinal plane of unconfined free snap motion of the free end of the disc is designated by the lines A-A. The stiffening means provided by ribs 13 and 15 is discontinuous at the central aperture 11. This, in effect, divides the disc into two relatively articulated portions, one to the left, the other to the right of the transverse line B-B through the discontinuity in the stiffening means. The portion to the right of this line is free to flex relative to

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the portion to the left about this line B—B as an approximate axis of articulation.

Rib 13 stiffens the disc in a sector or segmental zone, for example, designated X shown by horizontal shading in Fig. 16. This sector or segmental zone includes the mounting ear 5. This rib substantially prevents flexing of that portion of the disc in sector X in the plane A—A, so that this portion X is substantially immovable upon change in temperature. This is illustrated in Figs. 10–15 which show various phases in the opening cycle of the disc. Figs. 10 and 13 show the disc cold. Figs. 11 and 14 show the disc heated to a temperature just below snapping temperature. Figs. 12 and 15 show the disc heated above its snapping temperature and snapped to the configuration opposite to that of Fig. 1. It will be noted that in each of these positions the rib 13 and portions of the disc immediately laterally adjacent thereto constituting sector X (Fig. 16) have not changed position appreciably (compare also Figs. 4 and 5).

Rib 15 stiffens the disc in a sector or segmental zone, for example, designated Y and shown by stippling in Fig. 16. This sector, diametrically opposite sector X, includes free ear 7. This rib 15 reduces flexing within that portion of the disc included in sector Y near the plane A—A in relation to the amount of its entry into the sector, with consequent reduction of creeping of this portion of the disc in this plane upon change in temperature. This is illustrated in Figs. 10–12 which show how the ribbed portion of the disc in sector Y (Fig. 16) remains substantially flat throughout the cycle, even when the disc has snapped.

The lateral wings C of the disc, indicated by vertical shading in Fig. 16, are unconfined and free to flex upon temperature change. As the disc is heated, these wings creep upward from the downwardly concave configuration of Fig. 13 to the substantially flat configuration of Fig. 14. During this interval, however, sectors X and Y are restrained from substantial movement because of the stiffening effects of ribs 13 and 15, consequently there is substantially little or no creeping of the free end E of the disc (note Figs. 10 and 11). When the temperature of the disc rises above its snapping temperature, wings C snap up above the more or less flattened position of Fig. 14 and snap the entire portion of the disc to the right of line B—B (Fig. 16) upward to the Fig. 12 position, this portion flexing relative to the left portion of the disc upon the axis of articulation B—B. This simply angles the region Y upward (note Figs. 11 and 12).

Thus, by providing means for stiffening the disc in its plane of free snap movement A—A, this stiffening means having a transverse discontinuity therein so as to enable the disc to flex about an axis of articulation transverse to plane of free snap movement, inherent creeping movement of the free end of the disc is effectively minimized. Thus, creep is substantially confined to the lateral wings C without substantially affecting the total snap distance of the free end of the disc. The free end of the disc has unconfined free snap motion because of the discontinuity in the stiffening means at the central aperture 11.

The simplicity of adjustment and calibration of the disc of this invention over the prior art discs apparently stems from the reduction of inherent creep of the free end of a disc. With inherent creeping movement of the free end of the disc substantially reduced, to calibrate the disc

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properly it is merely necessary to heat the disc to snapping temperature so that it opens, then to bend stem 23 until the contact 9 is spaced from contact 27 a distance equal to the unconfined or free snap distance of the free end of the disc. This involves a simple linear measurement and enables experienced operators to adjust discs very rapidly.

In manufacturing the plates, they are preferably blanked out flat from a flat metal sheet. Ribs 13 and 15 are then formed integrally in the flat disc blank by stamping in a forming press. This results in an intermediate ribbed flat blank which is substantially devoid of temperature differential. Subsequently, the intermediate ribbed flat blank is dished permanently to set in the desired temperature differential, i. e., to establish the temperature at which the disc snaps from one configuration to the other. The absence of temperature differential in the intermediate ribbed flat blank is advantageous from a production standpoint since it is desirable to perform the dishing operation on a blank which is flat and has no temperature differential therein.

This advantage is not attained with the disc of the said copending applications wherein the disc is stiffened by only a single rib. When a flat disc blank is stamped to form only a single rib therein extending to the central aperture in the disc, the blank of necessity becomes dished to some extent, due to stresses resulting from the stamping operation. The result is an intermediate blank having some dish and some temperature differential therein which must be compensated for in the subsequent dishing operation. The substantial absence of temperature differential in the intermediate ribbed flat blank of this invention is apparently due to the formation of rib 15 eliminating the inherent stresses tending to dish the disc set up by the deformation of the disc in forming rib 13.

Figs. 7–9 illustrate a modification of the above described form of snap-acting plates of this invention. There is indicated at 31 a permanently set, dished, snap-acting thermostatic plate composed of composite thermostatic bimetal. This plate comprises a round disc 33, a mounting ear 35, and an ear 37 carrying a contact element 39, the disc having a central aperture 41. A radial raised rib 43 extends from the mounting ear 35 to the central aperture. With respect to these features, the disc is identical to that of the Fig. 1 form. Instead of having another rib extending from its central aperture, however, the disc of Figs. 7 and 9 is embossed, as indicated at 45, to form what I refer to as a "dimple" within the zone Y (Fig. 16) to stiffen that portion of the disc to the right of its axis of articulation. This boss or dimple 45 performs the same function as the rib 15 of the Fig. 1 form. It also takes out any temperature differential set in the disc by stamping in the rib 43 in forming the intermediate flat ribbed blank. It will be noted that in this form the surface of the boss 45 is non-developable whereas rib 43 is of developable configuration.

Either form of the invention thus provides a snap-acting plate for use in snap-acting control devices having low inherent creep and a decreased ratio of creep to actual snap movement and which facilitates calibration of the control devices so that they may be accurately, yet quickly and economically, produced. It will be understood that the invention is applicable to monometallic spring plates as well as to the bimetallic thermostatic plates particularly dis-

closed herein. It is also obviously applicable to composite thermostatic plates formed of more than two metallic layers.

While I have particularly disclosed the disc as provided with ears, substantially the same advantageous results may be attained with a disc which does not have ears. Such a disc would be cantilever-mounted by means of a portion of its area adjacent its edge and the contact 9 (or 39) would be secured to the diametrically opposite portion of the disc. It will also be understood that the ribs 13 and 15, or rib 43 and boss 45, may be depressed instead of raised. It is also contemplated that the ribs and boss may be elements separate from the plate and secured thereto as by welding or the like, rather than being formed integrally from the material of the plate, and that the plate may be formed without a central aperture, provided that some other form of discontinuity is employed instead of the hole.

The terms "developable" and "non-developable" are used herein according to their usual geometric meanings. For example, a spherical form for disc 3 or 33 is "non-developable," and a cylindric or conic or even a rectangular form for ribs 13 and 15 or rib 43 is "developable." These are merely exemplary of the numerous geometrical form in these categories. The term "permanently set" is used herein according to its usual meaning in the field of strength of materials, meaning a permanent change in form occasioned by stressing of material beyond its elastic limit.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A snap-acting device comprising a dished resilient disc having an ear projecting radially outward therefrom for cantilever mounting of said disc, a reinforcing rib extending radially in the segmental zone of said disc including said ear, and means for stiffening the segmental zone of said disc diametrically opposite said first-mentioned zone.

2. A snap-acting device comprising a dished resilient disc having an ear projecting radially outward therefrom for cantilever mounting of said disc, a reinforcing rib extending radially in the segmental zone of said disc including said ear, and means for stiffening the segmental zone of said disc diametrically opposite said first-mentioned zone, said means comprising a second rib substantially aligned with and spaced from said first-mentioned rib.

3. A snap-acting device comprising a dished resilient disc having an ear projecting radially outward therefrom for cantilever mounting of said disc, a reinforcing rib extending radially in the segmental zone of said disc including said ear, and means for stiffening the segmental zone of said disc diametrically opposite said first-mentioned zone, said means comprising a boss formed in said disc in said second-mentioned zone.

4. A snap-acting temperature-responsive device comprising a dished disc of composite thermostatic metal having at least one ear projecting radially outward therefrom, a rib extending radially across the ear and disc and terminating short of the center of the disc for radially stiff-

fening that portion of the disc adjacent said ear, and reinforcing means substantially aligned with and diametrically spaced from said rib for radially stiffening that portion of the disc beyond said rib.

5. A snap-acting temperature-responsive device comprising a dished disc of composite thermostatic metal having at least one ear projecting radially outward therefrom, a rib extending radially across the ear and disc and terminating short of the center of the disc for radially stiffening that portion of the disc adjacent said ear, and reinforcing means substantially aligned with and diametrically spaced from said rib for radially stiffening that portion of the disc beyond said rib, said means comprising a rib in extension of said first-mentioned rib.

6. A snap-acting temperature-responsive device comprising a dished disc of composite thermostatic metal having at least one ear projecting radially outward therefrom, a rib extending radially across the ear and disc and terminating short of the center of the disc for radially stiffening that portion of the disc adjacent said ear, and reinforcing means substantially aligned with and diametrically spaced from said rib for radially stiffening that portion of the disc beyond said rib, said means comprising a boss formed in said disc beyond said rib.

7. A snap-acting temperature-responsive device comprising a dished disc of composite thermostatic metal having at least one ear projecting radially outward therefrom and a central aperture, a rib extending radially from the outer end of the ear to the central aperture, and reinforcing means substantially aligned with and diametrically spaced from said rib for radially stiffening that portion of the disc beyond said rib.

8. A snap-acting temperature-responsive device comprising a dished disc of composite thermostatic metal having at least one ear projecting radially outward therefrom and a central aperture, a rib extending radially from the outer end of the ear to the central aperture, and reinforcing means substantially aligned with and diametrically spaced from said rib for radially stiffening that portion of the disc beyond said rib, said means comprising a second rib extending radially from said aperture substantially aligned with said first-mentioned rib.

9. A snap-acting temperature-responsive device comprising a dished disc of composite thermostatic metal having at least one ear projecting radially outward therefrom and a central aperture, a rib extending radially from the outer end of the ear to the central aperture, and reinforcing means substantially aligned with and diametrically spaced from said rib for radially stiffening that portion of the disc beyond said rib, said means comprising a boss formed in the disc beyond said aperture and substantially in the line of said rib.

10. A control device comprising a base, an adjustable support mounted on said base, a dished, resilient snap-acting plate having a portion thereof adjacent its edge fixed to said support and having a free end portion opposite said fixed portion, and reinforcing means for stiffening the plate extending across the plate substantially in the line of said fixed and free portions while leaving the lateral portions of said plate free to creep, said reinforcing means having a longitudinal discontinuity therein.

11. A control device comprising a base, an adjustable support mounted on said base, a

dished, resilient snap-acting disc having an ear projecting outward therefrom and fixed to said support, a reinforcing rib extending radially in the segmental zone of said disc including said ear, and means for stiffening the segmental zone of said disc diametrically opposite said first-mentioned zone.

12. A thermostatic switch comprising a base, an adjustable stud mounted on said base, a dished thermostatic disc having a mounting ear projecting radially outward therefrom and secured to said stud and a second ear diametrically opposite said mounting ear, a contact carried by said second ear and cooperating with a contact mounted on said base, said disc having reinforcing rib means for stiffening the portion of the disc extending from the mounting ear to the approximate center of the disc against flexure in the plane normal to the ears, and a stiffening deformation in the portion of the disc intermediate its center and the second ear.

13. A thermostatic switch comprising a base, a bendable stud mounted on said base, a dished thermostatic disc having a mounting ear projecting radially outward therefrom and secured to said stud and a second ear diametrically opposite said mounting ear, said disc having a central aperture, a contact carried by said second ear and cooperating with a contact mounted on said base, a rib formed in said disc extending from the outer end of the mounting ear to the central aperture, and a rib formed in said disc extending from said aperture toward said second ear.

14. A thermostatic switch comprising a base, a bendable stud mounted on said base, a dished thermostatic disc having a mounting ear projecting radially outward therefrom and secured to said stud and a second ear diametrically opposite said mounting ear, said disc having a central aperture, a contact carried by said second ear and cooperating with a contact mounted on said base, a rib formed in said disc extending from the outer end of the mounting ear to the central aperture, and a boss formed in said disc intermediate said aperture and second ear.

15. A snap-acting element comprising a permanently set dished disc having a central hole, an integral stiffening rib formed of the material of the disc and extending substantially radially from an edge of the disc to the hole, and a boss formed in the disc substantially in line with the rib and radially outward of the hole, the disc being inherently snap-acting and capable of retaining a dished shape independently of the effect of the rib and boss.

16. A snap-acting thermostatic element comprising a compound thermostatic plate having a permanently set dished portion, a first reinforcement for stiffening a sector of the dished portion against flexure in the radial plane of the sector, and a second reinforcement spaced from the first reinforcement and positioned within that sector of the dished portion which is diametrically opposite the first-mentioned sector; the dished portion being inherently snap-acting and capable of retaining a dished shape independently of the effect of the reinforcements.

17. A snap-acting thermostatic element comprising a sheet of compound thermostatic metal having a permanently set dished portion, a rib extending from the edge of the plate inward toward the center of the dished portion for stiffening a sector of the dished portion including the rib against flexure in the radial plane of the rib, and a stiffening deformation spaced from the inner end of the rib and positioned within that sector of the dished portion which is diametrically opposite the first-mentioned sector, the dished portion being inherently snap-acting and capable of retaining a dished shape independently of the effect of the rib and deformation.

18. A snap-acting thermostatic element comprising a permanently set dished disc of compound thermostatic metal having an integral reinforcing rib formed of the material of the disc and extending substantially radially from the edge of the disc inward toward the center thereof for stiffening a sector of the disc including the rib against flexure in the radial plane of the rib, and a stiffening deformation formed in the disc substantially in line with the rib and spaced from the radially inner end thereof, the disc being inherently snap-acting and capable of retaining a dished shape independently of the effect of the rib and deformation.

19. A snap-acting thermostatic element comprising a permanently set dished disc of thermostat bimetal having a central hole, an integral stiffening rib formed of the material of the disc and extending substantially radially from an edge of the disc to the hole, and a second integral stiffening rib formed of the material of the disc extending radially outward from the hole substantially in line with the first-mentioned rib, the disc being inherently snap-acting and capable of retaining a dished shape independently of the effect of the ribs.

20. A snap-acting thermostatic element comprising a permanently set dished disc of thermostat bimetal having a central hole, an integral stiffening rib formed of the material of the disc and extending substantially radially from an edge of the disc to the hole, and a boss formed in the disc substantially in line with the rib and radially outward of the hole, the disc being inherently snap-acting and capable of retaining a dished shape independently of the effect of the rib and boss.

21. A control device as set forth in claim 10 wherein the plate is formed of compound thermostatic metal.

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