Jan. 31, 1933. J. A. SPENCER 1,895,591

SNAP ACTING DEVICE

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Fig. 1.

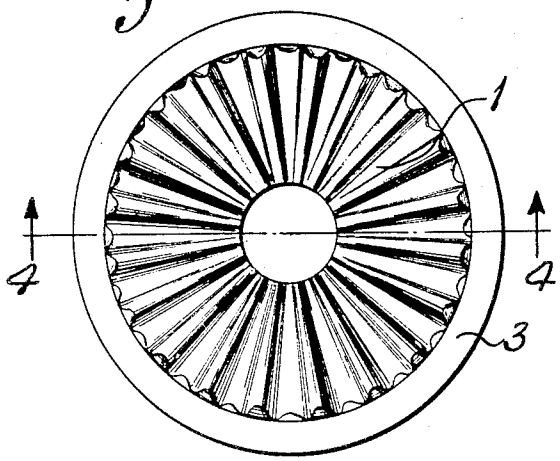

Fig. 2.

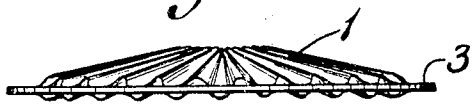

Fig. 3.

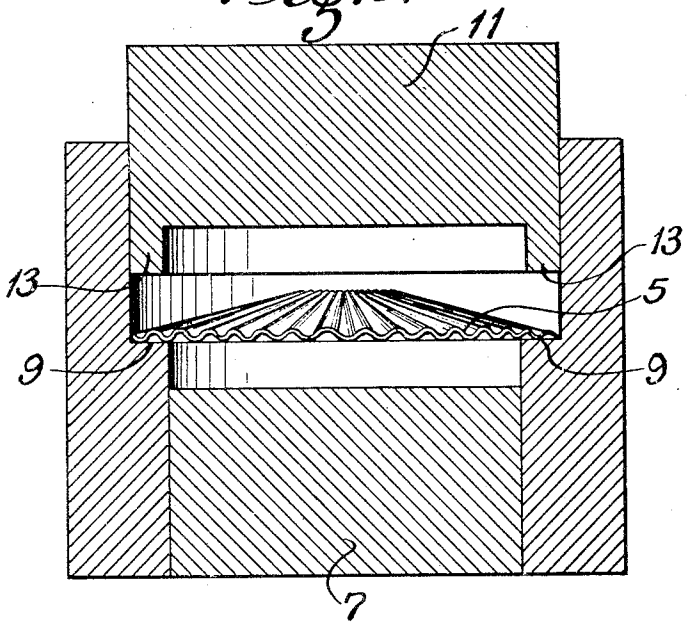

Fig. 4.

John A. Spencer,
Inventor.
Dolor V. Haynes,
Attorney

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Fig. 5.

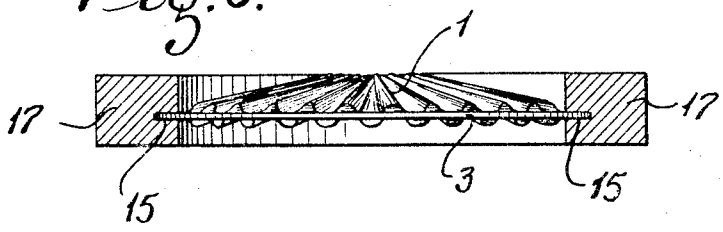


Fig. 6.

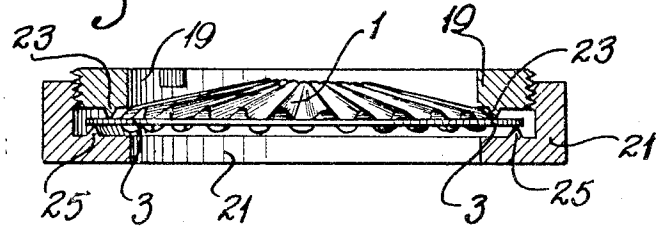
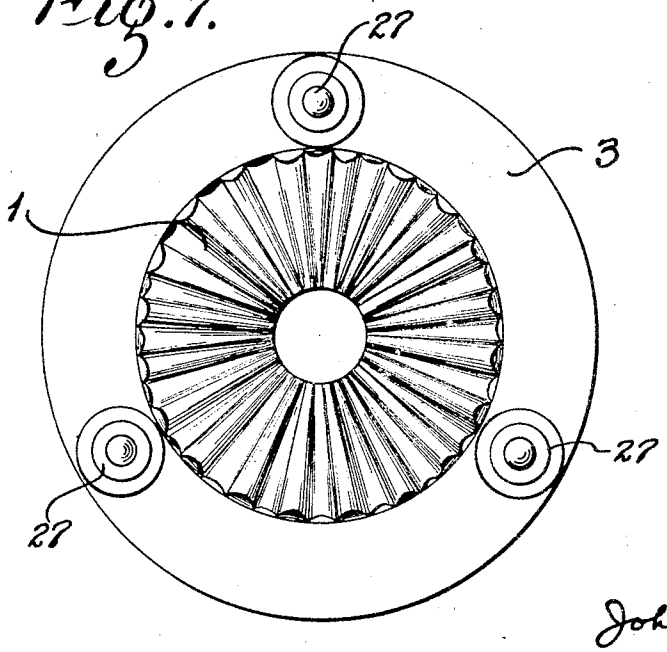


Fig. 7.



John A. Spencer,
Inventor.
Dodge G. Haynes,
Attorney

Patented Jan. 31, 1933 1,895,591

UNITED STATES PATENT OFFICE

JOHN A. SPENCER, OF NEWTONVILLE, MASSACHUSETTS, ASSIGNOR TO GENERAL PLATE COMPANY, OF ATTLEBORO, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

SNAP ACTING DEVICE

Application filed February 16, 1931. Serial No. 516,042.

This invention relates to snap-acting devices, and with regard to certain more specific features, to snap-acting, or overcentering devices, particularly thermostats composed preferably of composite metal.

Among the several objects of the invention may be noted the provision of a snap-acting device which has an increased amount of displacement between its two positions; a snap-acting device of the class described which is radially corrugated and which is provided with means for effecting a more accelerated snap action; a snap-acting device of the class described which is adapted to be held under improved conditions in a variety of mountings; a snap-acting device adapted to carry electrical contacting means thereon; a snap-acting device constituting in one embodiment a thermostat adapted for improved use in connection with temperature controlled valves, electrical switches, etc.; and the provision of a device of the class described which is economical in manufacture and simple and positive in action. Other objects will be in part obvious 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 structure hereinafter described, and the scope of the application of which will be indicated in the following claims.

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

Fig. 1 is a plan view of a snap-acting device embodying the invention;

Fig. 2 is a side elevation of the device shown in Fig. 1;

Fig. 3 is a sectional view illustrating diagrammatically the method of forming the present invention;

Fig. 4 is a cross section taken substantially on line 4—4 of Fig. 1;

Fig. 5 is a cross section showing a method of fixedly mounting the snap-acting device of the present invention;

Fig. 6 is a cross section similar to Fig. 5 showing a method of adjustably mounting the snap-acting device of the present invention; and,

Fig. 7 is a plan view of a device embodying the invention and carrying electrical contacting means thereon.

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

In my copending application, Serial No. 463,961, filed June 26, 1930, for thermostat, I have shown an improved form of snap-acting device which includes as a feature, radial corrugations, whereby an increased amount of resilient material is present in the region where displacements take place under change from one to another position. The present invention comprises an improvement over the radially corrugated device illustrated in said copending application.

The invention will be described principally by reference to its thermostatic embodiment, that is, where it performs in response to temperature changes. However, it will be understood that, even as a thermostat, the invention is fundamentally a snap-acting device.

Referring now more particularly to Fig. 1, there is illustrated at numeral 1, the interior, dished or cup or concave radially corrugated region comprising the operative portion of a thermostatic embodiment of the present invention. This portion 1 is preferably formed from a seamless cylinder of composite thermostatic metal in the manner set forth in said copending application, which comprises, briefly, longitudinally corrugating a cylinder of thermostatic metal and constricting said corrugated cylinder at one end as well as compressing it longitudinally until substantially a truncated cone or dished disc is obtained.

The term "composite thermostatic metal" is used herein as defining a material composed of materials having relatively different coefficients of thermal expansion. This type of thermostat is frequently termed "bimetallic". The principle upon which the thermostat operates is that, under varying conditions of hot and cold, one layer of the composite metal will exhibit a relatively greater or less tendency to expand than the other

layer, and thereby build up a stress in the body which the two metals form.

The stress thus set up grows with increased temperature until strains are effected whereby the disc reverses curvature with a snap. That is, if the disc or dish or the like was originally concave, relative to its original confirmation it becomes convex, or vice versa.

The radial corrugations in the present device, as in the snap-acting device of said copending application, are advantageous in that they provide an increased amount of thermostatic metal in the central portion of said disc, and, when the thermostat is brought to a condition in which it is about to snap, it effects an increase in the amount of displacement through which the center of the thermostat operates. This increased displacement is highly advantageous when the thermostat is utilized, for example, in electrical equipment, for making and breaking electrical contacts (see Fig. 7).

The present invention comprises the formation of a radially corrugated disc such as illustrated in my copending application, and the provision thereon of a substantially flat, or uncorrugated rim or circumferential portion 3. The rim is concentric with the resulting opening in the disc, said opening being substantially at the focus of the radial arrangement of corrugations. A thermostat produced according to the present invention has the following advantages:

First, the inherent tendency of the thermostat to expand radially, and thereby to decrease its kinematic efficiency, is limited and controlled by the relatively non-expansible rim or confining portion 3. That is, with thermostats of the type shown in said copending application, there is a tendency upon heating for straightening of the sinuous edge, with the result that the constrictive function of the periphery is reduced as snap action occurs. Hence the thermostat functions more sluggishly than if the edge were to maintain a more constant restrictive characteristic. The flat rim portion 3 of the present invention, having no corrugations therein, has substantially no tendency to stretch, and it accordingly better serves as a restricting or confining or binding means for the remainder of the thermostat. That is to say, there are no undulations in the periphery to provide resiliency.

Second, the flat rim 3 provides more adequate facility for mounting said thermostat, as for example, in an annular groove 15 in an abutting member 17 (see Fig. 5), for the reason that the rim 3 need not be originally formed with any sinuous curvature, and accordingly need not substantially change its shape as the thermostat changes from hot to cold position. Further, it is inherently more simple to hold a flat surface than to hold a corrugated surface.

The snap-acting device of the present invention may be formed with facility from a device made in accordance with the disclosure of said copending application, as illustrated diagrammatically in Fig. 3. In Fig. 3, numeral 5 represents a radially corrugated thermostat of the general type shown in said copending application. In order to form the thermostat of the present invention, the thermostat 5 is placed in a press 7, which has an interior annular shoulder 9 formed therein. The annular shoulder 9 is sufficient in size to accommodate the thermostat 5, and extends radially inward to the extent determined by the desired width of the flattened rim portion 3.

Movably received in the press 7 is a die 11 having a depending annular flange 13, the width of which is substantially the same as the width of the shoulder 9 desired.

It will be seen that by bringing the portion 11 down upon the press 7, with a thermostat 5 therein, in such manner that compression is effected between the flange 17 and the shoulder 9, that the edge of the thermostat 5 is compressed and swaged to secure the flattened rim portion 3, as desired.

It will be seen that the rim portion 3 may be made of any suitable dimensions to effect the desired result.

Fig. 5, as has been indicated, illustrates a means for clamping or holding the rim 3 in a groove 15 of an abutment member 17, in a fixed manner. This Fig. 5 form of mounting is advantageous in cases where the thermostat is inoperative within a definite temperature range and no adjustment of such range is necessary. When adjustment of the temperature range of operation is desirable, a mounting of the general type shown in Fig. 6 is advantageously utilized. In Fig. 6, adjustment is secured by threading a collar 19 into a threaded cap portion 21. The portions 19 and 21 carry, respectively, concentric beads or ridges 23 and 25, between which the rim 3 of the thermostat is secured. It will be seen that by threading the portions 19 and 21 together, the beads 23 and 25 exert a tripping pressure on the thermostat, thereby tending to increase or decrease the concavity of said thermostat to a greater or less extent, and thereby regulating the temperature differential and temperature range at which the thermostat operates or snaps.

Fig. 7 illustrates an embodiment of the present invention particularly adapted for use with electrical apparatus. It will be seen that the rim portion 3 has been formed sufficiently wide to carry thereon one or more contacting buttons or the like 27, which serve, in suitable mountings, to make and break electrical contacts with the operation of the thermostat.

It will be apparent that the present invention has many other uses and applications.

For example, the substantially flat rim or edge of the present invention permits its use in valves, where it can be positioned to close a valve seat and effect a quick stopping of flow. Other uses will also be apparent.

It is to be understood that I am aware that a substantially flat rim has a slight capacity to stretch but it is to be noted that such capacity is much less than the corresponding capacity in an undulatory or sinuous rim. In the case of the flat rim the stretch effects only a tensile stress, whereas in the undulatory rim a bending movement is effective. My improvement comprises arranging the metal in the periphery so that it is not subjected to bending movements and hence is much more constrictive in its action. Hence the improved increased speed attained in the snap action. It is to be understood that the invention refers to binding rims of the class set forth or analogous ones performing the same functions.

If the invention is to be employed as a simple mechanical snap-acting or overcentering device, or spring, it will readily be seen that the use of composite thermostatic metal is unnecessary, although possible. In such instances, a sheet of single resilient metal may be used with success. The action of the device as an overcentering element needs no further description, as it varies from the thermostatic element only in that applied external forces replace the self-engendered thermostatic forces in effecting the change of shape desired.

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 carrying out 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 thermostatic unit comprising a disc of composite thermostatic material formed of at least two materials of differing coefficients of thermal expansion, said disc being substantially radially corrugated, and a substantially flat, uncorrugated region at the periphery of said disc.

2. A thermostatic unit comprising a radially corrugated sheet of composite thermostatic material, said sheet being provided with a confining rim of uncorrugated material.

3. A thermostatic unit comprising a cupped disc of bimetallic material having substantially radial corrugations therein, said disc being adapted to assume a position of opposite curvature under influence of temperature variations, and a confining portion at the periphery of said sheet, said portion being integral with the unit.

4. A thermostat comprising a sheet of composite thermostatic metal, corrugations therein and means for confining expansion laterally of said corrugations.

5. A thermostat comprising a sheet of composite thermostatic metal, corrugations therein and means for confining expansion laterally of said corrugations comprising a portion positioned counter to the corrugations which is free of said corrugations.

6. A thermostat comprising a sheet of composite thermostatic metal, corrugations therein and means for confining expansion laterally of said corrugations comprising at least one portion positioned counter to the corrugations, said corrugations being radially arranged.

7. A thermostat comprising a sheet of composite thermostatic metal, corrugations therein and means for confining expansion laterally of said corrugations comprising at least one portion positioned counter to the corrugations, said corrugations being radially arranged, said portion being circularly arranged and said sheet having an opening therein.

8. A thermostat comprising a sheet of composite thermostatic metal, corrugations therein and means for confining expansion laterally of said corrugations comprising at least one portion positioned counter to the corrugations, said corrugations being radially arranged and said portion being circularly arranged at the periphery of said sheet, the sheet having an opening therein substantially concentric with said portion and substantially at the focus of said radial arrangement.

9. In combination, a thermostat and a mounting therefor, said thermostat comprising a sheet of composite thermostatic metal having substantially radial corrugations therein and a portion free of said corrugations confining said corrugations, said mounting having a groove therein, and said portion cooperating with said groove.

10. In combination, a thermostat and a mounting therefor, said thermostat comprising a sheet of composite thermostatic metal having corrugations therein and a portion free of said corrugations confining said corrugations, said mounting comprising adjustable means engaging said confining portion and adapted to apply varying strains thereto.

11. In combination, a thermostat and a mounting therefor, said thermostat comprising a sheet of composite thermostatic metal having corrugations therein and a portion free of said corrugations confining said corrugations, said mounting comprising adjustable members, and concentric beads on said adjustable members engaging said confining portion and adapted to apply varying strains thereto.

12. A thermostat comprising a concave disc of composite thermostatic material, radial corrugations therein and a peripheral portion free of said corrugations.

13. A thermostat comprising a concave disc of composite thermostatic material, radial corrugations therein and a peripheral portion free of said corrugations, said peripheral portion being integral.

14. A thermostat comprising a concave disc of composite thermostatic material, radial corrugations therein, a peripheral portion free of said corrugations, and an adjustable fulcrum adapted to support the thermostat at said peripheral portion.

15. A snap-acting device comprising a disc of resilient material having radial corrugations therein, the plane of the central portion of said disc being displaced from the plane of the peripheral portion thereof, and means confining expansion laterally of said corrugations comprising means positioned counter to said corrugations at the periphery of said disc, the said disc being suitably resilient, whereby upon suitable actuation thereof, it overcenters to assume a position of opposite configuration.

16. A snap-acting device comprising a disc of resilient material having radial corrugations therein, the plane of the central portion of said disc being displaced from the plane of the peripheral portion thereof, and means confining expansion laterally of said corrugations comprising means positioned counter to said corrugations at the periphery of said disc, the said disc being suitably resilient, whereby upon suitable actuation thereof, it overcenters to assume a position of opposite configuration, said confining means being integral with the disc itself.

17. A snap-acting device comprising a disc of resilient material having radial corrugations therein, the plane of the central portion of said disc being displaced from the plane of the peripheral portion thereof, and an uncorrugated peripheral region on said disc, the said disc being suitably resilient, whereby upon suitable actuation thereof, it overcenters to assume a position of opposite configuration.

In testimony whereof, I have signed my name to this specification this 30th day of January, 1931.

JOHN A. SPENCER.