

Jan. 31, 1933.

J. A. SPENCER

1,895,592

SNAP ACTING DEVICE

Filed Sept. 8, 1930

2 Sheets-Sheet 1

Fig. 1.

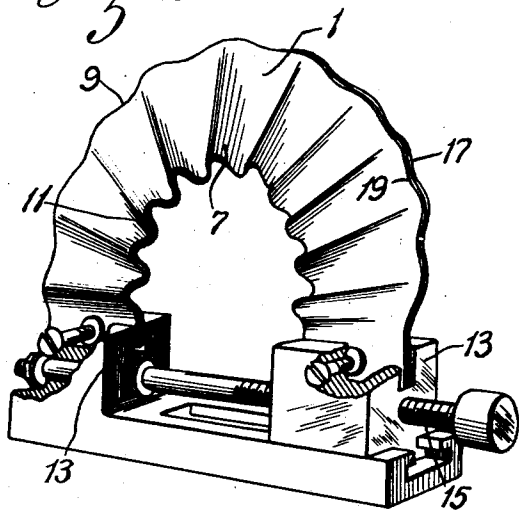


Fig. 2.

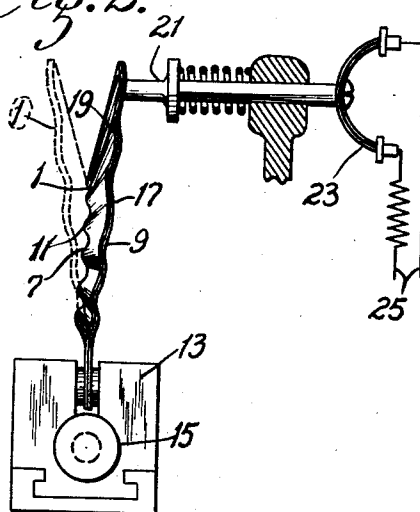


Fig. 4.

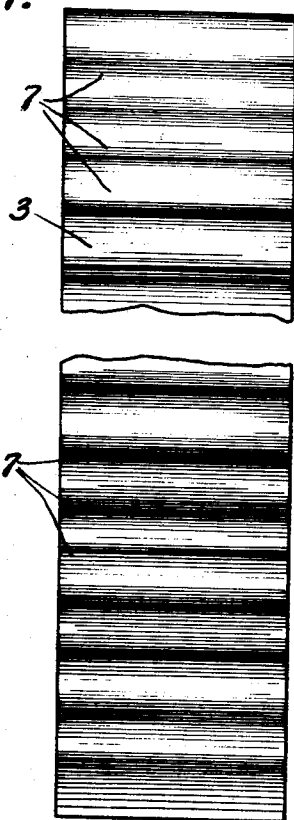
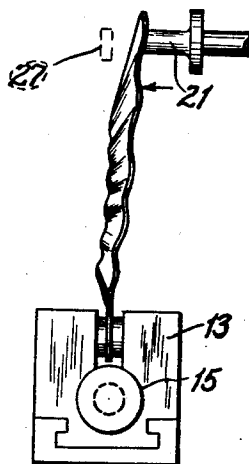


Fig. 3.



John A. Spencer,
Inventor,
By S. Haynes,
Attorney

Jan. 31, 1933.

J. A. SPENCER

1,895,592

SNAP ACTING DEVICE

Filed Sept. 8, 1930

2 Sheets-Sheet 2

Fig. 5.

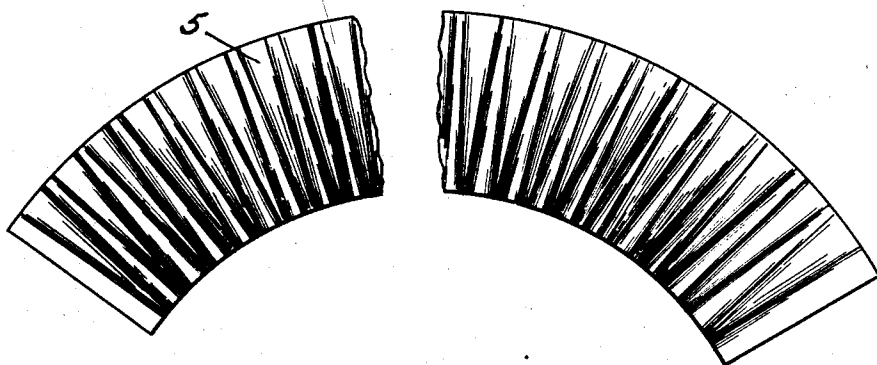


Fig. 6.

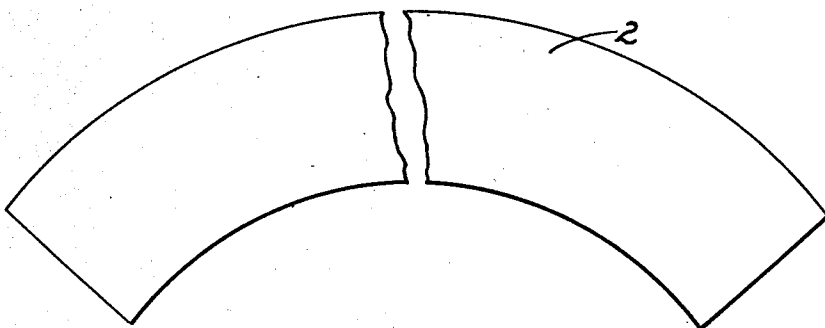
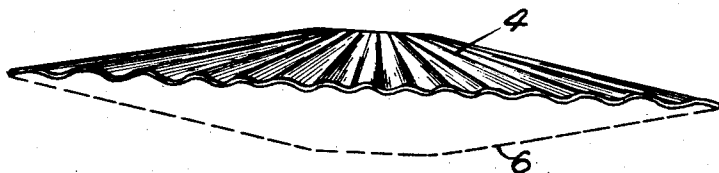


Fig. 7.



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

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 September 8, 1930. Serial No. 480,451.

This invention relates to snap-acting devices, and with regard to certain more specific features, to an adjustable device of this type.

Among the several objects of the invention may be noted the provision of a snap-acting device which may be made in the form of a thermostat or a mechanical spring; said device when in the form of a thermostat being self-acting under influence of temperature changes and being adjustable to operate over different temperature differentials and/or limits; said device when in the form of a mechanical spring being adjustable to provide various resistances; and the provision of a device of the class described which shall be compact and simple in arrangement. 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 trimetric view showing a bimetallic form of the apparatus, certain circuit elements being eliminated;

Fig. 2 is an end view of Fig. 1;

Fig. 3 is a view similar to Fig. 2, showing a single-plate form of the invention for use as a spring;

Fig. 4 is a diagram showing a blank;

Fig. 5 is a view similar to Fig. 4 showing another form of blank;

Fig. 6 is a view similar to Fig. 5 showing an uncorrugated form; and,

Fig. 7 is a side elevation showing another form.

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

Referring now more particularly to Fig. 1, there is illustrated at numeral 1 a strip of self-actuating composite, thermostatic material, shown in the drawings as bimetallic and

composite but which, it will be understood, may comprise a greater number of sheets of metal of varying thermal coefficients of expansion, or a composite sheet having infinitesimal changes in texture providing such varying coefficients, or being otherwise self-actuating upon change in temperature.

The sheet 1 is preferably first cut from a sheet while flat, its shape being such as a rectangle 3 (Fig. 4) or as a sector 5 of predetermined curvature (Fig. 5). The resulting blank is then laterally convoluted as shown at numeral 7, or it may be crimped. Thereafter it is laterally sprung or arched about the axis of its greatest cross-sectional moment of inertia so that the convolutions 7 are stretched at their outer ends 9 to assume a flatter form, whereas at their inner ends 11 they assume a deeper form (Fig. 1). Thus both the infinite radius of curvature of the strip of Fig. 4 and the finite curvature of the strip of Fig. 5 are both reduced, as shown in Fig. 1, this reduction by straining resulting in straining the convolutions as described. Thus there is effected a set of radiating convolutions 7, the depths of which decrease radially outward but the peripheral wave lengths of which increase as outward radial distance is traversed.

After straining the part 1 to the position it is held by clamps 13, one of which is slidable with respect to the other and made adjustable by means of an adjusting screw 15. Hence the sheet 1 may be variably strained with the result that variable stresses are set up therein.

If, as shown in Figs. 1 and 2, the sheet 1 is bimetallic as shown at numerals 17 and 19, or is otherwise made thermostatic, then at predetermined temperatures it will, with a snap action, assume positions such as shown by solid and dotted lines in Fig. 2. This is caused by the heating setting up stresses which in turn set up strains tending to force the sharp inner convolutions through the outer convolutions. The action is such that lateral movement, such as shown in Fig. 2, takes place first slowly and then suddenly.

The temperature at which snap action will take place may be varied by varying the ra-

dius of curvature of the strip by the mechanism shown and described, or by a similar one. The function of this mechanism is to vary the imposed strain, and inasmuch as the temperature of snapping is a function of the strain, the result of the adjustment is to vary the snap action with respect to temperature. Both temperature differential and temperature limits may be varied.

10 An example of an application of the device is shown in Fig. 2 wherein the sheet 1 is shown contacting with a spring pressed pin 21 for operating a switch 23 in a circuit 25. It will be clear that other devices could be thus operated, such as valves, trips and the like, the illustration being intended as an example only. It will be understood that the operated device may be mechanically coupled to the sheet 1 so that both strokes of operation receive energy from the sheet 1, instead of one stroke being effected by an auxiliary spring as shown.

In Fig. 3 is shown a form of the invention wherein a single non-thermostatic sheet is used. This form is intended for use as a spring resistance for use in mechanical systems. In this form force applied to the edge of the strip, for instance, in the direction of the arrow (Fig. 3) will meet with a relatively high resistance at first and this reduces over a wide range of action as dead center is reached, after which the device snaps completely over, and may then be returned in an analogous manner. Or its overcentering movement may be prevented by a suitable limiting stop 27 (dotted lines, Fig. 3), or by suitably adjusting the screw 15 for a shorter or longer radius of curvature. Then the device will function to resist applied force like the ordinary spring with the important exception that its resisting force decreases with displacement, instead of increasing as is the case with the conventional spring. Many applications may be thought of where this inverse resistance law will be found desirable, as in valve movements.

In Fig. 6 is shown the Fig. 5 device uncorrugated and numbered 2. It is to be understood that this sheet 2 (without corrugations) may be placed in the clamp of Fig. 1, or be otherwise so strained and similar results will be attained.

It will be noted that the shapes herein described include developable surfaces (see Fig. 4), which remain so under strain.

Another point to be noted is that the stresses set up by curving the sheet vary across the plane of the strip.

An advantage of the invention is a snap action of a greater amount for less temperature differential than is had with other forms.

Fig. 7 has been inserted to illustrate the point that a thermostat of this class may be made by forming a truncated cone 4 of thermostatic material, which when its tempera-

ture is changed sufficiently will snap to the dotted line position 6. The feature comprising corrugating such a cone has been described elsewhere, namely my patent application, Serial No. 463,961 filed June 26, 1930 for thermostats.

In effect, one-half of this cone comprises a portion (non-adjustable) which holds the other half, as does the clamp of Fig. 1, and yet is active itself in effecting snap action. It will be understood that this form may also be used as a spring, in which case, a single metal sheet may be substituted.

From the above, it will be seen that this invention provides a device which upon application of heat on the one hand, or force on the other, has a wide range of movement, with decreasing resistance to applied forces. These results are attained with a simple form of device which is readily adjustable.

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. In a snap-acting device, a resilient sheet initially convoluted laterally and means holding the sheet in a strained position such that the initial angular relationship of the convolutions is changed.

2. In a snap-acting device, a resilient strip initially convoluted laterally, and means for arching said strip so that the convolutions are strained in positions radial to the resulting arch.

3. In a snap-acting device, a resilient strip initially convoluted laterally, means arching said strip so that the convolutions are strained in positions radial to the resulting arch, and means for adjusting the radius of curvature of the arch.

4. A thermostatic unit comprising the combination with a self-actuating, thermostatic, convoluted strip, means securing the said strip in bent position such that the angular relationship of the convolutions is changed, and movable means for adjusting the tension under which the strip is held.

5. A thermostatic unit comprising the combination with a self-actuating, thermostatic, convoluted strip, means for securing the said strip in bent position, and movable means for adjusting the tension under which the strip is held, said convolutions being positioned radially in said bent position.

6. A thermostat comprising a flexible, convoluted self-actuating strip of thermostatic material, means for clamping the ends of the

strip to secure the strip in a curved position, such that the convolutions are positioned radially of the curve so formed, a base for supporting the clamping members, one of the said clamping members being slidable along the base, and means for sliding the slidable member.

7. A spring comprising a single sheet initially convoluted laterally, and means for arching said sheet so that the convolutions are positioned radially of the resulting arch.

8. A spring comprising a single convoluted strip, and means for securing said strip in a strained position such that the initial angular relationship of the convolutions is altered.

9. A spring comprising a single crimped strip, means for arching said strip about the axis of its greatest cross-sectional moment of inertia, and means for adjusting the radius of curvature of the arch.

10. A spring comprising a single laterally convoluted strip, means for arching said strip about the axis of its greatest cross-sectional moment of inertia and means for adjusting the radius of curvature of the arch.

11. In a snap-acting device, a sheet initially convoluted laterally and means holding the sheet in a strained position so that the stresses in the sheet are changeable across the plane thereof.

12. In a snap-acting device, a sheet initially convoluted laterally and means holding the sheet in a strained position so that the stresses in the sheet are changeable across the plane thereof, said sheet being developable.

In testimony whereof, I have signed my name to this specification this 7th day of August, 1930.

JOHN A. SPENCER.