

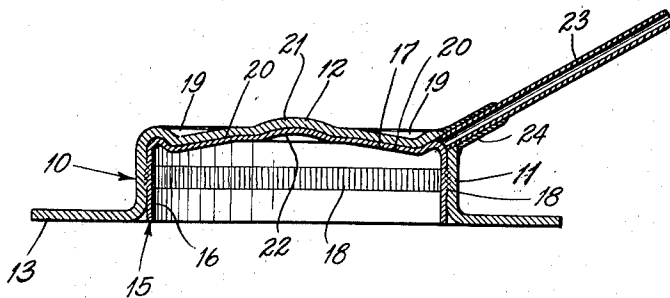
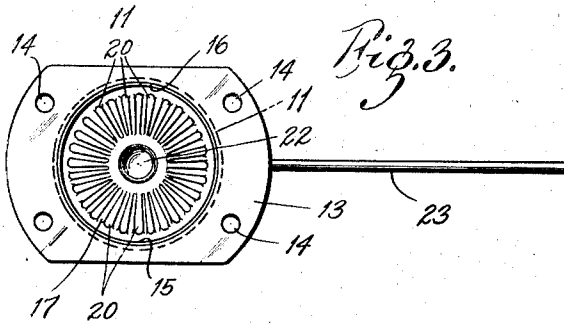
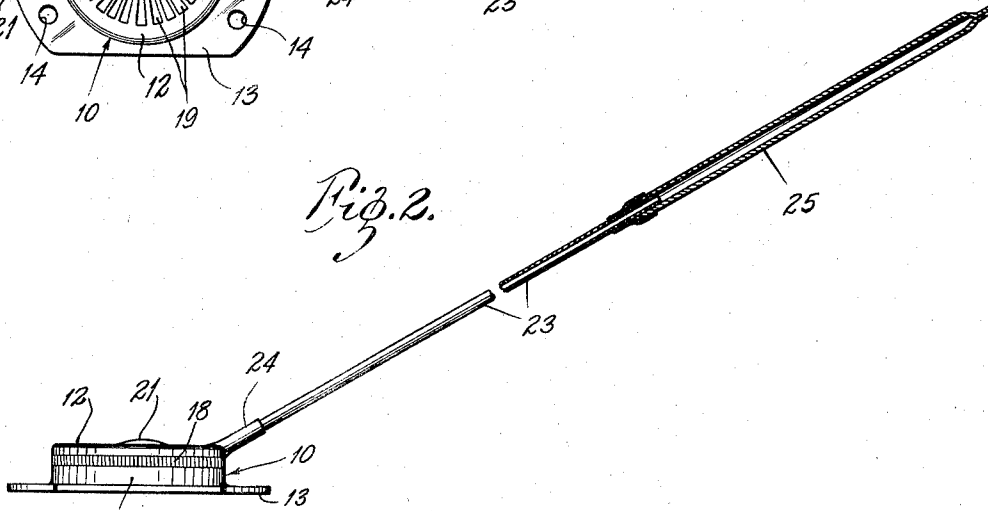
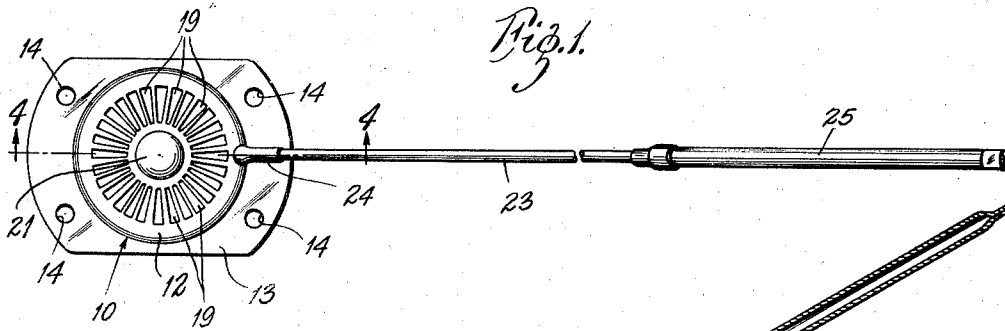
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2,203,841

THERMORESPONSIVE DEVICE

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2,203,841

THERMORESPONSIVE DEVICE

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3 Claims. (Cl. 297-9)

The present invention involves a thermostat device.

The objects of the invention are to provide a device of this kind employing the principles of a solid charge acting between normally contiguous diaphragms; and in such device to attain greater strength, compactness and convenience.

In the drawing:

Fig. 1 is a plan view of the device.

Fig. 2 is a side elevation, partly in section.

Fig. 3 is a bottom view.

Fig. 4 is a section on the line 4-4 of Fig. 1.

The device embodies a first and rigid cup-shaped member 10 having a side wall 11 and an end wall 12. From the side wall 11 at the open end there extends a flange 13 having holes 14 to receive screws for attachment of the thermostat on a suitable mounting base containing the operated mechanism. This flange 13 likewise adds strength to the device.

Fitted telescopically within the cup-shaped member 10 is a flexible cup-shaped member 15 having a side wall 16 and an end closure wall 17. The sides 11 and 16 are welded together so as to insure that they will interfit and permit the two members to be contiguous throughout. Complementary domes 21 and 22 may be formed in the two members.

It will be seen that the end wall 12 of the rigid member and the end wall 17 of the flexible member are normally somewhat conical, the apices being opposite the direction of movement of the wall 17. Consequently, when the end wall 17 first moves away from the end wall 12, it assumes a planar shape, after which it passes into the shape of a cone the apex of which is opposite that of the end wall 12. By this design, the flexible wall is first compressed radially slightly, and then is put under tension. However, the strain of the member is much less than if the starting shape were flat, since then all movement would increase the tension, which would necessarily have a higher value than the compression or tension of the design shown.

Extending at an angle from the edge of the member 10 is a tube 23 secured to the member by means such as solder 24, this tube communicating with the space between the two members. A bulb 25 may be secured to the end of the tube 23.

The bulb 25, the tube 23 and any space that

may exist, despite efforts to the contrary, between the two members is adapted to be completely filled with some thermally-responsive material, preferably of the liquid type. When this material heats and expands, it causes the flexible end portion 17 of the flexible cup-like member 15 to move away from the end portion 12 of the rigid member 10. The actuated mechanism, such as switches and the like, will be provided with an element extending adjacent the dome 22 of the flexible member to receive motion imparted to this dome by expanding liquid. There need be no fixed connection between these operated elements and the diaphragm because their relationship is fixed by the fact that the outer cup member 10 is rigid and has its flanges fixed to the base of the operated structure.

The tube extending at an angle from the edge provides several advantages. Ordinarily such tubes extend axially out from the diaphragm. This requires them to be bent at sharp angles in a large number of usages. The present structure eliminates the necessity of such sharp angles. Furthermore, this structure permits greater compactness in the assemblies. A third advantage relates to the purging of these assemblies of entrained gases. When an assembly of this type is placed in the centrifuge, with the tube 23 extending radially from the axis of such centrifuge, whirling of the centrifuge produces centripetal forces upon the entrained gases, all of which have components driving the gases into the tube and thereafter inwardly along the tube to escape at the bulb. Where the tube extends axially of the cup-shaped members, double rotation is necessary in order to force gas entrained between the diaphragms to the center thereof, whence it may exhaust along the tube, such as explained in my copending application Serial No. 87,016, filed June 24, 1936, now Patent No. 2,135,839, dated November 8, 1938. The method of making thermostats of the present kind is described in my copending application Serial No. 116,700, filed December 19, 1936, now Patent No. 2,160,280, dated May 30, 1939.

As appears in the drawing, the joint 18 between the cup-like member 10 and cup-shaped member 15 is spaced toward the outer edges of said members and away from the end walls 12 and 17. During flexing of the end wall 17 upon expansion of the fluid, the bend between the end wall 17 and side wall 16 becomes more acute. However, as the end wall extends outward, it draws the portion of the side wall 16 above the weld 18 away from the corresponding portion of the side

wall 12, as permitted by the outward displacement of the weld. This reduces, by distribution, the tension at the bend.

There is also a tendency to bulge around the actuated element of the operated mechanism referred to, which is reduced by the radial corrugations as noted. It will be understood that the present device is to be used in relatively high pressures, so that if the operated mechanism offers greater resistance than the flexibility of the diaphragm metal, the latter will bulge rather than displace the actuated element. This, however, is avoided by the corrugations. The extending of the corrugations to the edge of the end wall 17, without leaving any space in which bulging might take place, further eliminates this undesirable factor.

What I claim is:

1. In a device of the kind described, a first cup-like member, a second flexible cup-like element sized to fit closely within the member, the end wall of said element being joined to the side wall in a bend, the side wall of the element being joined to the side wall of the member in a seal extending around the said walls, the seal being spaced from the bend at the junction of the end wall whereby the end wall and a part of the side wall are free to move relative to the member, a fluid filling the device between the member and element and adapted to displace the end wall of the element away from the corresponding wall of the member, and means in the end wall extending substantially to the side wall to resist bulging thereof under action of the fluid and to cause the deformation of the element to occur mainly in its area adjacent the bend, the seal being spaced from the junction of side and end walls of the element a distance sufficient to permit a part of the side wall to be distorted by displacement relative to the adjacent wall of the member upon such displacement of the end wall to relieve the bending stresses at said junction.

2. In a device of the kind described, a first cup-like member, a second flexible cup-like element sized to fit closely within the member, the end wall of the element being joined to the side wall in a bend, the side walls of the element and member being sealed together, a tube extending from the junction of side and end walls of said member outward at an angle to the axis of the same, fluid filling the tube and any space between the member and element, and radial corrugations in the end wall of the element extending substantially to the side wall to resist bulging and acting to concentrate the deformation of the element at the bend, the seal between the member and element being spaced from the junction of side and end walls a sufficient distance to permit part of the side wall of the element to be distorted by displacement from the adjacent side wall of the member upon displacement of the end wall of the element by the liquid, to relieve the bending stresses at said junction by partial dissipation thereof from the bend into the free portion of the side wall.

3. A closed thermal unit including a first cup-like member having a bottom wall, and a side wall extending from said bottom wall at substantially a right angle, defining between the side wall and the bottom wall a pronounced edge, a tube extending from the said edge at an acute angle to the axis of the cup and hence at an angle to both the bottom and side walls, a second cup-like element of a size and shape to fit within the first and to have its side and end walls contiguous to the corresponding walls of the said member, means sealing the side wall of the member to the side wall of the element to form with the tube an enclosed chamber, a liquid entirely filling the chamber, and the entrance of the tube into the chamber being so located that all parts of the chamber communicate therewith without reentrant pockets.

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