June 14, 1966 C. S. MERTLER 3,256,413

WAFER THIN THERMOSTAT

Filed Oct. 22, 1962

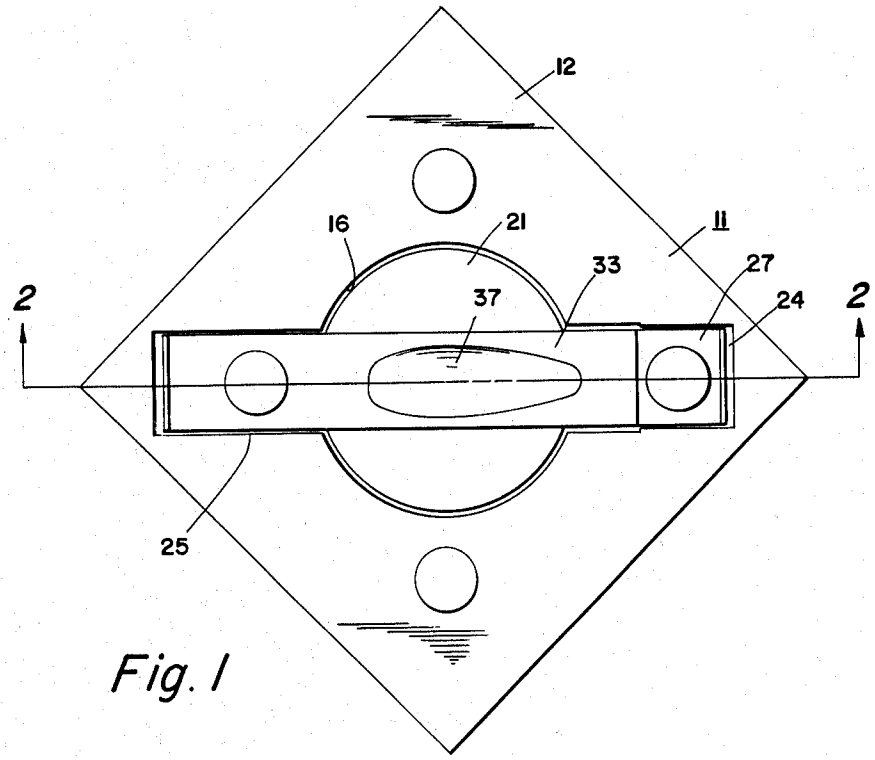


Fig. 1

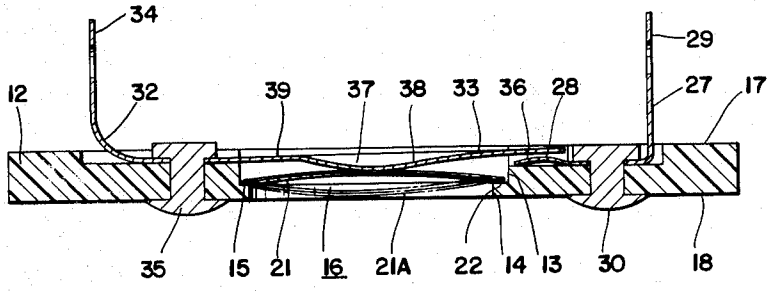


Fig. 2

INVENTOR.
CHARLES S. MERTLER
BY Woodling, Krost, Granger and Rust
ATTORNEYS

United States Patent Office 3,256,413 Patented June 14, 1966

3,256,413

WAFER THIN THERMOSTAT

Charles S. Mertler, Mansfield, Ohio, assignor to Stevens Manufacturing Company, Inc., a corporation of Ohio

Filed Oct. 22, 1962, Ser. No. 231,958
5 Claims. (Cl. 200—138)

The invention relates in general to thermostatic switches, and more particularly to a compact thermostat of high current rating in comparison to its size.

Miniature thermostats have heretofore been devised, but in general these have been limited in current carrying capacity or in voltage rating because the contact area was small or because the amount of movement of the contact did not permit high voltage operation. Also miniaturizing thermostats have generally not resulted in more economical construction because merely to make parts smaller may have saved somewhat on material cost but the cost and complexity of assembling the smaller parts generally remain the same or may even have increased.

Accordingly an object of the invention is to provide a miniature thermostat which obviates the above disadvantages.

Another object of the invention is to provide a thin wafer-like thermostat which is economical in the number of parts used and in the total manufacturing costs.

Another object of the invention is to provide a thermostat with an integral contact portion and terminal portion.

Another object of the invention is to provide a thermostat with a bimetal member which is loosely retained within the thermostat with part of this retention afforded by a bridging movable contact member.

Another object of the invention is to provide a thermostat wherein the bimetal member may be calibrated prior to assembly and the thermostat may need no further calibration after assembly.

Another object of the invention is to provide a thermostat which has a minimum of parts and which may be quickly and easily assembled using only simple jigs and fixtures.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing, in which:

FIGURE 1 is a plan view of a thermostat incorporating the invention; and

FIGURE 2 is a sectional view on line 2—2 of FIGURE 1.

The figures of the drawing show a thermostat **11** which is the preferred embodiment thereof but not necessarily the only construction. This thermostat **11** includes a base **12** of insulating material and is preferably a thin wafer of insulating material such as a phenolic insulating material. A circular wall surface **13** and another circular wall **14**, together with a circular recessed shoulder **15** therebetween, define an aperture **16** extending through the base from one face **17** to the other face **18**. A bimetal member **21**, preferably in the form of a snap-acting concavo-convex bimetal disc, is disposed in the aperture **16**, and the peripheral rim **22** thereof is adapted to engage the recessed shoulder **15**.

A rectangular recess **24** is disposed in the face **17** and merges with the aperture **16**. A second rectangular recess **25** is diametrically opposite the recess **24** and is also disposed in the face **17** to merge with the aperture **16**. A first metal member **27** is disposed in the first recess **24**. This metal member **27** is preferably in the form of an elongated metal strip and has an integral contact end **28** and a terminal end **29**. A rivet **30** is a means to fasten the intermediate portion of the first metal member **27** to the base **12**. A second metal member **32** is

also in the form of an elongated metal strip and includes an integral contact portion or contact end **33** and a terminal end **34**. A rivet **35** is a means to fasten the intermediate area of this second metal member **32** to the base **12** within the recess **25**.

The contact portion **33** is a movable contact portion and the contact end **28** is a fixed contact end for cooperation with the movable contact portion **33**. The contact end **28** may have a slightly rounded or convex contact surface **36** pressed therein as best shown in FIGURE 2. The movable contact portion **33** has pressed or stamped thereinto a stiffening depression **37** which is longitudinal of the contact portion **33** and extends for a majority of the distance diametrically across the bimetallic disc **21**. This stiffening depression provides an abutment surface **38** extending toward the bimetal disc **21** generally at the center thereof. A resilient hinge portion **39** is integral with the second metal member **32** and is disposed between the stiffening depression **37** and the second rivet **35**.

The second metal member **32** may be formed from a silver-magnesium-nickel alloy having in the order of .1 to .3 percent magnesium, .2 percent nickel, and the balance silver. It is heat-treated for hardness and good spring properties. Accordingly the inherent resiliency of this second metal member **32** and the rivet mounting thereof to the base **12** provide that the movable contact portion **33** is urged toward the fixed contact end **28**. The first metal member **27** may be made from coin silver for good electrical conductivity and good contact properties. The alloy silver and heat treatment of the second metal member **32** provide good resiliency for flexing of this metal member **32** at the hinge portion **39** and the high silver content provides good electrical conductivity, as well as good contact properties at the mutually cooperating contact surfaces.

The thermostat **11** may be provided in normally open or normally closed varieties. FIGURE 2 shows the thermostat in solid lines as the normally open switch variety and reference numeral **21A** shows the bimetal disc **21** in a dotted line position which it would assume upon snapping over center to the opposite concavo-convex position. In this position, the contacts would be closed. The thermostat may be supplied with the bimetal disc **21** in the position **21A** at normal room temperatures and with the bimetal disc **21** snapping upwardly, viewed in FIGURE 2, upon temperature rise. As such it may be used as a high limit thermostat or as a control thermostat for some electrically controlled heater.

The normally open version is similar to the normally closed version except that the bimetal disc **21** may be inverted and thus will snap in a downward direction viewed in FIGURE 2, upon temperature rise. In either case, the bimetal member co-acts with the abutment surface **38** to relatively move the contact portions into and out of engagement.

The use of the aforementioned silver alloy for the second metal member **32** permits the use of silver solder and its attendant high temperature melting point to be used for soldering connections to the terminal end **34**. This may be done without losing the spring temper of this second metal member **32**.

The bimetal disc **21** may be provided with the proper curvature so as to establish the desired snap of operating temperature. Thereafter the bimetal disc **21** may be assembled into the thermostat **11**. Since the bimetal disc **21** is not restrained physically in the normally closed version, it is possible to assemble thermostats which require no further calibration after assembling. The wall surface **13** merely loosely restrains the bimetal disc **21** in lateral directions relative to the base **12**. The shoulder

15 and the abutment surface 38 also restrain the bimetal disc 21 in directions normal to the base 12. This is a loose restraint in the normally closed version. In the normally open version shown in solid lines, there is a slight restraint placed upon the bimetal disc 21 in a direction normal to the base 12 by the inherent resiliency of the movable contact portion 33.

The entire thermostat 11 may be rapidly and economically assembled. The bimetal disc 21 may simply be dropped in place on the shoulder 15. Next the first metal member 27 may be dropped in place and the rectangular recess 24 acts as a fixture to align this first metal member 27. Next the second metal member 32 may be dropped in place and again the second recess 25 aligns the metal member 32. Next these first and second metal members may be riveted in place and again the rivets 30 and 35 may be inserted from the top of the base 12. The contact portion 33, by its position extending diametrically across the aperture 16, retains the bimetal disc 21 in place in the thermostat 11. Thus the assembly of the entire thermostat is done with ease and facility, and all from one side of the base 12. No further calibration of the thermostat is required after assembly since the operating temperature is built into the disc by the choice of material and shape thereof.

The fact that the terminals and contact portions are integral provides the advantage of ease of assembly, lower manufacturing costs and reduced electrical resistance. If the terminal portion and contact portions were separate there would be an interface therebetween to increase the electrical resistance and this would also complicate the assembly because two separate parts would have to be aligned and fastened together, as by the rivets. The present construction eliminates these extra parts and such elimination provides increased economy in manufacturing the parts and assembling the complete thermostat. Also making these parts integral aids in obtaining a very thin and compact miniaturized thermostat. The entire thermostat may be provided on a base only one inch square and 3/32 inch thick, yet retaining use of a bimetal disc which is ½ inch in diameter and with contacts rated at five amperes. Thus a large current capacity thermostat is provided for its physical size and the snap-action movement provided by the bimetal disc 21 permits sufficient contact separation at a rapid enough rate for operation at 115 volts.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. A thermostat comprising in combination,
a thin base of insulating material having two opposite faces,
an aperture extending through said base from one face to the other, a first metal member including an integral contact portion and a terminal portion,
a second metal member including an integral contact portion and a terminal portion,
means fastening said members to said base for mutual cooperation of said contact portions,
current flow through said thermostat encountering only the single interface between said contact portions,
and a bimetal member in said aperture on said base to be exposed on both faces of said base and coacting to relatively actuate said contact portions into and out of engagement.

2. A snap-acting thermostat comprising in combination,
a base of insulating material,

a first metal member including an integral contact portion and a terminal portion,
a second metal member including an integral contact portion and a terminal portion,
means fastening said members to said base for mutual coperation of said contact portions,
current flow through said thermostat encountering only the single interface between said contact portions,
a stiffening depression in said second metal member forming an abutment surface,
and a snap-acting bimetal member on said base coacting with said abutment surface to relatively actuate said contact portions into and out of engagement.

3. A thin snap-acting thermostat comprising in combination,
a flat base of insulating material,
a first single metal member including a fixed contact end and a terminal end,
first fastening means fastening said first metal member at an intermediate area to said base,
a second single metal member including a movable contact end and a terminal end,
second fastening means fastening said second metal member at an intermediate area to said base with said movable contact end disposed for cooperation with said contact end of said first metal member,
current flow through said thermostat encountering only the single interface between said contacts,
an abutment surface on said movable contact end,
a snap-acting bimetal member,
means loosely restraining said bimetal member in lateral movement relative to said base,
means including said abutment surface restraining movements of said bimetal member in directions normal to said base,
a resilient hinge portion integrally formed in said second metal member between said abutment surface and said second fastening means,
the mounting of and inherent resiliency of said movable contact end urging the outboard end thereof toward engagement with said contact end of said first strip,
and said bimetal member snapping over center to opposite concavo-convex positions upon temperature changes to engage said abutment surface and actuate said contact ends into and out of engagement.

4. A thin snap-acting thermostat comprising in combination,
a flat base of insulating material,
a wall surface defining an aperture in said base,
a shoulder in said aperture,
a concavo-convex snap-acting bimetal disc disposed in said aperture with the rim of the disc engageable with said shoulder,
first and second metal strip members each having an integral contact end and a terminal end with an intermediate area therebetween,
first fastening means fastening said first strip at said intermediate area to said base with said contact end near said aperture,
second fastening means fastening said second strip at said intermediate area to said base with said contact end disposed for cooperation with said contact end of said first strip,
current flow through said thermostat encountering only the single interface between said contact ends,
a resilient hinge portion integrally formed in said contact end of said second strip near said second fastening means,
and said bimetal disc snapping over the center to the opposite concavo-convex position upon temperature change to engage one of said contact ends and actuate same between disengaged and engaged conditions with the other of said contact ends.

5. A thin snap-acting thermostat comprising in combination,

a flat base of insulating material,

a surface defining a circular aperture extending through said base from one face to the other,

a recessed circular shoulder in said aperture,

a concavo-convex snap-acting bimetal disc disposed in said aperture with the rim of the disc in engagement with said shoulder,

a first combined contact and terminal of one integral strip of coin silver,

a first rivet fastening said first contact and terminal at an intermediate area to said base near said aperture,

a convex fixed contact pressed from said coin silver metal and disposed between said first rivet and said aperture,

a second combined movable contact and terminal of one integral strip of resilient metal,

a second rivet fastening said second contact and terminal at an intermediate area to said base at a point substantially diametrically opposite said first contact,

a movable contact portion on said second combined contact and terminal extending substantially diametrically across said aperture and with the outboard end thereof disposed for cooperation with said convex fixed contact,

current flow through said thermostat encountering only the single interface between said contact portion outboard end and said fixed contact,

an elongated stiffening depression pressed in said movable contact portion longitudinally stiffening said movable contact portion and providing an abutment surface extending toward said bimetal disc,

a resilient hinge portion integrally formed in said movable contact portion between said stiffening depression and said second rivet,

said movable contact portion having an inherent resiliency and the mounting thereof urging the outboard end thereof toward engagement with said fixed contact,

and said bimetal disc snapping over the center to the opposite concavo-convex position upon temperature change to engage said abutment portion and move said movable contact portion out of engagement with said fixed contact.

References Cited by the Examiner

UNITED STATES PATENTS

1,823,345	9/1931	Britt	200—138
2,022,907	12/1935	Worley	200—140
2,753,421	7/1956	Mertler	200—138
2,795,678	6/1957	Mertler	200—138
2,954,447	9/1960	Bolesky et al.	200—138
3,081,388	3/1963	Cox	200—138

FOREIGN PATENTS

160,082	9/1957	Sweden.
361,321	5/1962	Switzerland.

BERNARD A. GILHEANY, *Primary Examiner.*

L. A. WRIGHT, *Assistant Examiner.*