United States Patent [19]

Kautz

[11] **3,820,049**

[45] **June 25, 1974**

[54] **CONDITION CONTROL APPARATUS**

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[22] Filed: **Oct. 11, 1973**

[21] Appl. No.: **405,368**

[52] **U.S. Cl.** **337/319,** 337/307

[51] **Int. Cl.** **H01h 37/22**

[58] **Field of Search** ..... 337/319, 320, 318, 306, 337/307, 327, 365, 390, 330; 200/83 P

[56] **References Cited**

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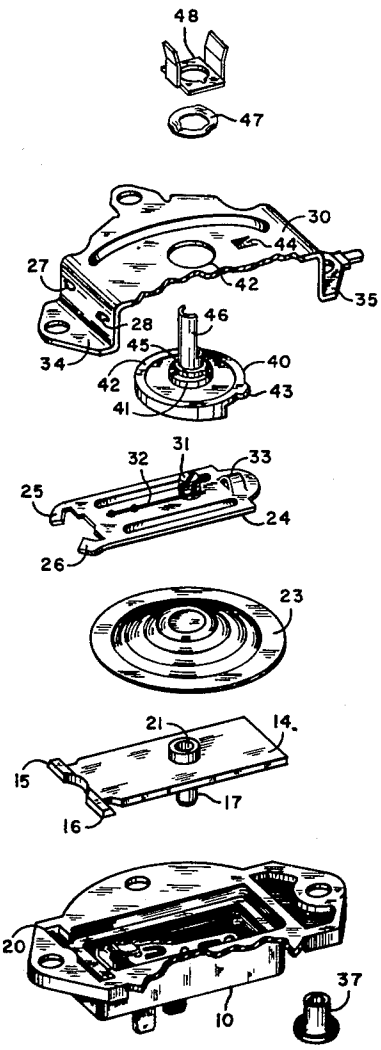
[57] **ABSTRACT**

A temperature responsive control assembly combination designed for ease of automatic assembly and in which the motion transducer is an expansible power vessel comprising a pair of flexible diaphragms welded together and containing within, a limited fill of a temperature responsive volatile fluid. The dual diaphragm is positioned between two relatively parallel lever arms, one lever arm being a unitary cover plate-operator of the switch and the second lever arm being pivotally mounted into slots in the assembly outer frame. A helical cam mounted in the outer frame positions the second lever arm to provide a setpoint adjust. A threaded stud in the second lever arm provides for calibration.

5 Claims, 2 Drawing Figures



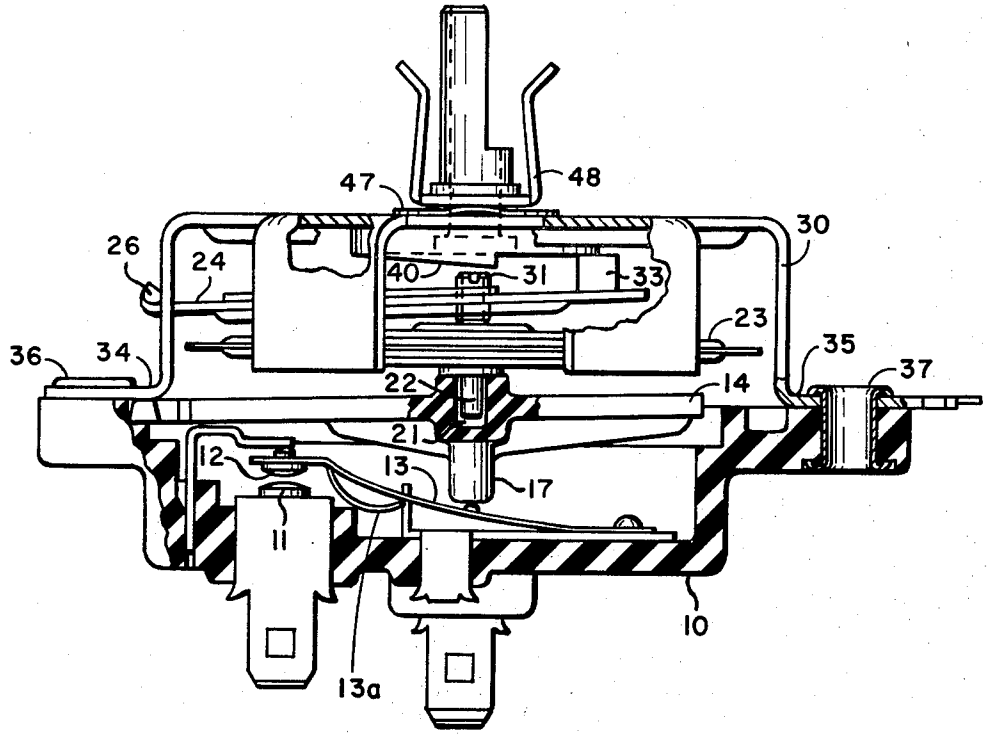


FIG. 1

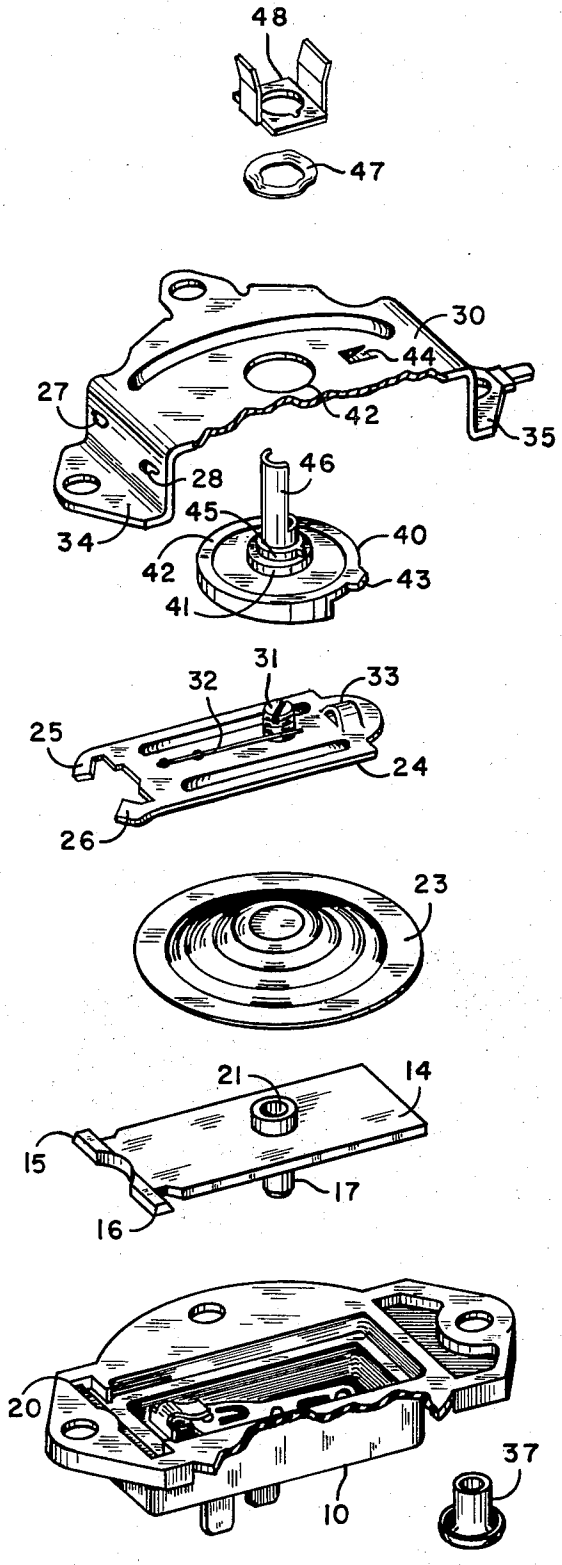

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FIG. 2

CONDITION CONTROL APPARATUS

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to the field of thermostatic switches. More particularly it relates to such a device having as an operator an expandable dual diaphragm which has a limited fill of a volatile fluid, such as one of the Freons, which is predominately a liquid at the lower end of the desired temperature control range and which is predominately a vapor at the upper limit of the range. The diaphragm is mounted between a pair of relatively parallel arms each pivotally mounted at one end. The assembly is designed to provide a simplified operating mechanism that will be both reliable and inexpensive to manufacture.

The use of fluid charged bellows and diaphragms as the thermostat motor has been well known for a number of years. The present combination, however, provides for ease of automatic assembly and requires no unusually precise components in the combination.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an assembly drawing and partial crosssection of the condition responsive control; and,

FIG. 2 is an exploded view of FIG. 1.

DESCRIPTION

The drawing as shown in FIG. 1 is an assembly view with partial cutaway and partial cross-section to more clearly picture various components of the assembly. Reference may concurrently be made to the exploded pictorial view of FIG. 2. A molded plastic switch body 10 has a fixed switch contact 11 and a movable contact 12 on spring metal arm 13 which normally biases the contacts apart or open as shown.

This conventional snap switch mechanism is of the general type shown in the McGall U.S. Pat. No. 1,960,020. The contact arm comprises a thin leaf spring supported at the right end in cantilever fashion, the other end being free to move between two stops. A portion 13*a* of the leaf spring is bowed in compression to cause the leaf spring to move with a snap action when force is applied to it near its supported end.

A switch coverplate 14 operates as a lever arm and has ears 15 and 16 at one end of the coverplate which act as the pivot point for the lever arm. The ears 15 and 16 of the coverplate are a closed free fit, similar to a hinge in action, into a slot 20 of the switch body and the ears are overlaid and confined in the slot by an outer frame to be described below. The coverplate 14 is also the switch actuator and has unitary with it a switch actuating button 17 which bears against the spring arm 13. As the coverplate is depressed, the button 17 depresses spring arm 13 and the contact 12 closes against contact 11.

The coverplate 14 also includes in its upper surface a recess 21 which receives and positions a stud 22 of a dual diaphragm enclosed vessel 23. The dual diaphragm expansible power element 23 is made of a pair of flexible diaphragms which are sealed together at the perimeter, as by welding or other suitable sealing procedure. The diaphragm halves may be stamped from stainless steel. The dual diaphragm encloses a limited fill of a volatile fluid which vaporizes with temperature increase, thereby increasing the internal pressure and causes the dual diaphragm element to expand. The dual diaphragm is retained in proper position by the axial stud 22 being seated in the recess 21.

Located above the dual diaphragm element is another lever arm 24. The arm 24 has a pair of ear-like members 25 and 26 which are installed through slots 27 and 28 of the steel outer frame 30. The ear-like members fit loosely in the slots so that the lever arm 24 pivots from and at the point of the slots 27 and 28. A calibration stud or screw 31 of the arm 24 bears on the upper side of the diaphragm element 23 opposite stud 22. A spring wire 32 acts as a rotational restraint for screw 31. Arm 24 also includes a cam rider projection 33. It may be seen that the diaphragm 23 is positioned between a pair (14 and 24) of lever arms, which lever arms are relatively parallel to one another and which are both hinged or pivoted at the left end. While these lever arms are in relatively parallel planes it will be understood that as the diaphragm expands and contracts between them, there will be movement of lever arm (switch cover) 14 with respect to arm 24.

The lever arm 14 has been disclosed as having a recess 21 to receive the positioning stud 22 of the diaphragm. Equally as well the diaphragm can be reversed and a recess can be placed in arm 24, particularly by using a calibration screw 31 having a recess to receive the stud 22.

The outer frame 30, which is in the form of a bridge bracket, has a pair of mounting platforms 34 and 35 which abut with the face of switch body 10, the frame and body being held together with suitable fastening means, such as eyelets 36 and 37. A helical cam 40 has a cylindrical shoulder 41 which is inserted through a hole 42 in the top of the frame 30, so that the flat face of the cam is flush against the inside surface of the frame. A projecting tab 43 on the perimeter of the cam cooperates with a shear-formed tab 44 on the frame which acts as a cam stop. Extending above shoulder 41 is a smaller diameter shoulder 45 and a shaft 46, all of which are unitary with the cam. A spring in the form of a wave washer 47 and a washer 48 are installed over shaft 46 and shoulder 45 and the edge of shoulder 45 is rolled to load the wave washer so as to provide rotational restraint as well as retain the cam in the frame. An axial bore through the cam and shaft allows the introduction of a screwdriver through the cam to the calibration screw 31.

In operation the spring 13 urges upwardly the switch cover 14, the diaphragm 23, and the lever arm 24. The upward travel of the lever arm 24 is stopped by cam rider 33 bearing against the cam 40. A rotation of the cam 40 adjusts the position of arm 24. At the low end of the cam surface a notch, not shown, provides a positive off for the switch by allowing the arm 24 to move sharply upward. At any given setting of the cam, the position of arm 24 and thus the upper surface of diaphragm 23 is fixed. The lower surface of the diaphragm and thus the switch over-actuator 14 position is a function of the temperature to which the diaphragm is exposed. As the temperature increases in the operating range of the apparatus the diaphragm fill will vaporize increasing the internal pressure and expanding the diaphragm whereby switch actuator 14 is moved downwardly against spring arm 13 tending to cause switch contacts 11 and 12 to close.

The embodiments of the invention in which an exclusive property or right is claimed are defined as follows:

1. A thermostat assembly comprising a two section housing, the first section being a switch housing and the second section being in the shape of a bridge-like frame, a first lever arm in the form of a switch coverplate for said switch housing, said coverplate having integral therewith a switch actuating projection which extends into said switch housing, said coverplate having ear-like mounting means on one end thereof cooperating with slot means in said switch housing allowing said coverplate to pivot towards and away from said switch housing to actuate switch contacts;

a second lever arm positioned relatively parallel to said first lever arm and having a pair of ear-like members projecting through slot means of said bridge-like frame and being pivotable at said ear-like members;

expansible dual diaphragm means having a partial fill of a temperature responsive volatile fluid, said means being mounted between said first and second lever arms;

a projecting stud means on said diaphragm means and a stud means receiving recess in one of said lever arms for locating said diaphragm means;

helical cam means mounted in said second housing section and having less than 360° rotation, said cam means bearing against said second lever arm, the rotating of said cam adjusting the position of said second lever arm as a function of said rotation;

adjustable calibration means in said second lever arm making contact with said diaphragm means; and

fastening means for securing together said two section housing.

2. The invention according to claim 1 in which said first lever arm includes said recess for receiving said diaphragm stud means.

3. The invention according to claim 1 in which said adjustable calibration means comprises a threaded stud, and said second lever arm has a threaded hole axially aligned with said diaphragm into which said threaded stud in inserted, the adjustment of said stud in said lever arm providing calibration of said assembly.

4. The invention according to claim 1 in which said second housing section overlays the opening of the slot means of said first section thereby retaining said ear-like mounting means of said switch coverplate in said slot means.

5. The invention according to claim 3 in which said switch actuating projection, said projecting stud means, said stud receiving recess, said adjustable calibration means and said helical cam means are axially aligned.

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