April 3, 1956 R. C. WAPPNER 2,740,866

TEMPERATURE CONTROLLED SWITCH

Filed Feb. 27, 1951

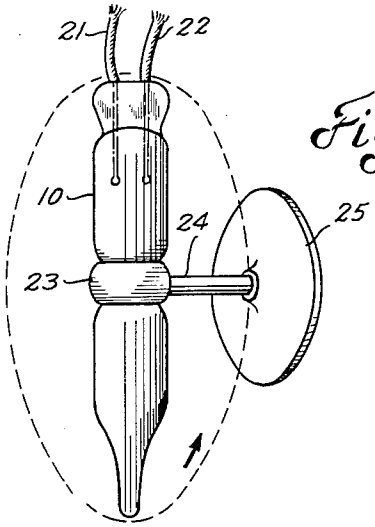


Fig.-1

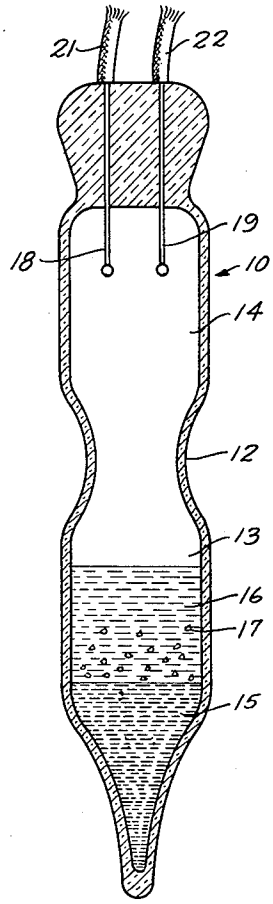


Fig.-2

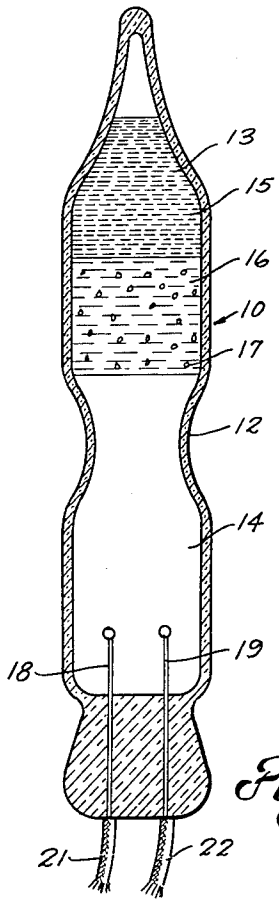


Fig.-3

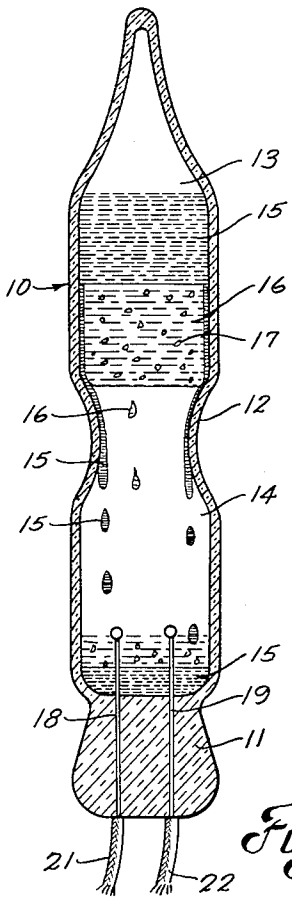


Fig.-4

Inventor
Ralph C. Wappner

Tom Walker
Attorney

United States Patent Office 2,740,866
Patented Apr. 3, 1956

2,740,866

TEMPERATURE CONTROLLED SWITCH

Ralph C. Wappner, Springfield, Ohio, assignor to The Ohio Thermometer Company, Springfield, Ohio, a corporation of Ohio

Application February 27, 1951, Serial No. 213,007

11 Claims. (Cl. 200—142)

This invention relates to temperature controlled switch devices, particularly suitable for use in food freezing chests in conjunction with apparatus for signaling or otherwise giving warning of temperature rise in the chest above a selected critical value.

It is of course the purpose of such apparatus to enable the householder or other user of the chest to remedy the difficulty which resulted in the rising temperature, before food spoilage occurs. A temperature controlled or responsive switch for use in such apparatus should be constructed for easy setting, be reliable and substantially foolproof in operation, and be able to carry out its intended function unaffected by frost formation and very low temperatures. It is thought that the instant switch device achieves these ends in a better and more facile manner than any similar device heretofore known.

The object of the invention is to simplify the construction as well as the means and mode of operation of such switches, whereby they may not only be economically manufactured, but will be more efficient and reliable in use, adaptable to a wide range of applications, having relatively few parts and be unlikely to get out of repair.

A further object of the invention is to provide a switch of the type described which is unaffected by formation of frost crystals.

A further object of the invention is to provide a switch which is accurate in its response to change in temperature.

A further object of the invention is to provide in such a switch a means for insuring operation at a predetermined temperature whether the temperature be increasing or decreasing.

A further object of the invention is to provide a switch which may be easily set, and when set requires no further attention.

A further object of the invention is to provide a switch in which there are substantially no moving mechanical parts.

A further object of the invention is to provide a switch possessing the advantageous structural features, the inherent meritorious characteristics and the mode of operation herein mentioned.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention intended to be protected by Letters Patent consists of the features of construction, the parts and combinations thereof, and the mode of operation, as hereinafter described or illustrated in the accompanying drawings, or their equivalents.

In carrying out such objects there has been evolved a practical embodiment of the invention wherein a signal switch for use in freezing chests includes a tube mounted for swinging motion to reversed positions, flexible electrical leads introduced into the tube through the wall thereof and separated from one another, an electrically conductive fluid material in the tube which flows from end to end of the tube in response to reversing thereof, such material bridging and interconnecting the leads in one of the reversed positions of the tube and flowing out

of contact with the leads in the other position of the tube, and a congealable liquid in the tube flowable with the conductive material but relatively lighter than the conductive material so as to remain on the top thereof, the congealable liquid solidifying at low temperatures to form a plug in the tube holding the conductive material in a selected end of the tube irrespective of the position of the tube, the liquid decongealing at some predetermined high temperature for escape of the blocked conductive material.

Referring to the drawing, wherein is found the preferred but obviously not necessarily the only form of embodiment of the invention,

Fig. 1 is a view in perspective of a temperature controlled switch in accordance with the invention combined with mounting means for installation in a freezing chest or the like;

Fig. 2 is a view of the switch device in longitudinal section, showing it as positioned in the initial setting of the switch, conditioning it for operation;

Fig. 3 is a view similar to Fig. 2 but showing the device turned 180 degrees or reversed, being thus set to the position occupied in the operating or set position of the switch, and

Fig. 4 is a view similar to Fig. 3, showing the switch during the temperature rise to and beyond the selected critical value.

Like parts are indicated by similar characters of reference throughout the several views.

In the illustrative embodiment shown in the drawing, the switch comprises a tube **10** made of glass or a like non-conductor of electricity. The opposite ends of the tube are closed, one end presenting a tapered or pointed formation and the other end being formed with a relatively thick base portion **11**. Intermediate its ends the tube is pinched in to present a reduced diameter waist portion **12**, such portion defining in the tube what may be termed upper and lower wells **13** and **14**, the expressions "upper" and "lower" being in respect of the base **11**.

Inside the tube **10** are first and second flowable materials **15** and **16**, which in their total volume approximately fill one of the wells **13** and **14**. The material **15** is an electrically conductive substance, for example mercury. The material **16** is a congealable liquid, being composed of water and alcohol or commercial anti-freeze solution, combined in proportions designed to produce freezing and thawing of the liquid material at a selected temperature. For a catalytic action to induce both freezing and thawing more precisely at the selected temperature, the liquid material **16** carries in solution a number of small crystals **17** which may, for example, be glass.

The tube **10** is interposed in an electrical signal circuit, and for this purpose there is molded into the base **11** thereof two electrically conductive prongs **18** and **19** which may be, as here shown, simply leads from flexible electric wires **21** and **22**. The prongs or leads **18** and **19** extend longitudinally through the base **11** and project in parallel separated relation into the well **14**. Being thus physically disconnected, there can be no flow of electrical current from one lead to the other in the absence of a bridging or interconnecting medium. Such a bridging medium is supplied by the conductive material **15** which, when it collects in the well **14**, floods or encompasses both leads **18** and **19**. Thus, the conductive material **15** represents a means whereby a circuit may alternatively be closed and opened through the electric wires **21** and **22**. If the tube **10** is held in the upright position of Fig. 4, the conductive material **15** collects in the bottom of well **14** and closes the circuit across the contact points represented by the leads **18** and **19**. By turning the tube 180 degrees the reverse position of Fig. 2 is achieved and in the course thereof the conductive material **15** will run

out of the well 14 and into the well 13, thus disconnecting leads 18 and 19 and opening the circuit through wires 21 and 22. The liquid material 16 ordinarily flows with the conductive material 15 but does not mix therewith and being relatively lighter collects and remains on top thereof. The freezing or congealing of the liquid material 16 will result in formation of a plug adjacent the waist portion 12 of the tube preventing flow of the conductive material 15 from one well to the other irrespective of the position of the tube.

In the use of the switch in a freezing chest or the like, the electric wires 21 and 22 are connected in a suitable signaling circuit and the tube 10 is mounted in the chest. In mounting the tube 10 it is arranged for swinging motion, for example, as shown in Fig. 1 where the waist portion 12 receives a strap 23 from which projects a rod 24 rotatable in a mounting disc 25. In setting the device for operation, the tube is first adjusted to the position shown in Figs. 1 and 2 wherein the conductive material 15 and the liquid material 16 collect in the well 13 with the liquid material supported on the conductive material in overlying relation thereto. The circuit through the leads 18 and 19 and the wires 21 and 22 accordingly is at this time open. The tube is allowed to remain in this position until the low or lowering temperatures in the freezing chest reduce the liquid material 16 to a congealed mass. The tube then may be swung to the position of Fig. 3 wherein the conductive material 15 tends to flow by gravity into the well 14 and close a circuit across the leads 18 and 19, but is prevented from doing so by the material 16 which acts as a plug holding the conductive material in the upper well 13.

Now so long as the temperature in the freezing chest remains below the degree selected as critical, the signaling circuit remains open, the congealed plug of material 18 continuing to hold the material 15 away from leads 18 and 19. In the event, however, that the temperature in the freezing chest rises to and exceeds the critical degree, the liquid material 16 will begin to thaw and allow the conductive material 15 to escape downward into the well 14, as illustrated in Fig. 4. When a sufficient quantity of the material 15 has collected in the bottom of the well 14 an electrical connection is established between the leads 18 and 19 closing a circuit thereacross and through the wires 21 and 22 to energize a signaling device.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise but one of several modes of putting the invention into effect.

Having thus described my invention, I claim:

1. A temperature controlled switch for repeated use in a food freezing chest or the like, including a tube closed at its ends, separated electrical leads projecting into one end of said tube through the wall thereof, a quantity of mercury or like solution in said tube which when in said end of the tube encompasses said electrical leads and establishes an electrical connection therebetween, and a quantity of a relatively light congealable fluid in said tube normally flowable with said mercury like solution but maintaining its separate identity and operative as a plug in said tube when congealed to restrict the movement of said mercury or like solution.

2. A temperature controlled switch for repeated use in a food freezing chest or the like, including a tube closed at its ends, separated electrical leads projecting into one end of said tube through the wall thereof, an electrically conductive fluid material in said tube effective when collected in said one end of the tube to electrically connect said leads, the reversing of the position of said tube causing said material to flow to and from said one end of the tube, and a second fluid material relatively lighter than the first said fluid material and normally flowable therewith but maintaining its separate identity, said second fluid material being congealable in said tube at a predetermined low temperature to restrict the movement of said electrically conductive fluid material therein.

3. A temperature controlled switch for repeated use in a food freezing chest or the like, including a tube closed at its ends, separated electrical leads projecting into one end of said tube through the wall thereof, an electrically conductive fluid material in said tube flowable from end to end thereof in response to endwise reversing of the tube and effective when collected in said one end of the tube to electrically connect said leads, and temperature responsive means normally flowable with said fluid material but congealable as a separate entity in said tube for controlling the movement of said fluid material.

4. A temperature controlled switch according to claim 3, characterized in that said last named means is a liquid of different specific gravity than said fluid material and congealable at a predetermined low temperature to form a plug in said tube.

5. A temperature controlled switch for repeated use in a food freezing chest or the like, including a tube closed at its ends, separated electrical leads projecting into one end of said tube through the wall thereof, electrically conductive means movable in said tube from end to end thereof in response to endwise reversing of the tube and acting when in said one end of the tube to bridge and interconnect said leads, and a liquid in said tube normally movable with said conductive means but maintaining its separate identity and congealable at a predetermined low temperature to interpose a restriction to the movements of said electrically conductive means.

6. A temperature controlled switch for repeated use in a food freezing chest or the like, including a tube closed at its ends, separated electrical leads projecting into one end of said tube through the wall thereof, a quantity of electrically conductive fluid materials in said tube flowable from end to end thereof in response to endwise reversing of the tube and acting when in said one end of the tube to bridge and interconnect said leads, and a quantity of a congealable liquid in said tube of different specific gravity than said fluid material normally flowable with said fluid material but maintaining its separate identity and said congealable liquid having a predetermined freeze and thaw temperature to thereby render the movements of said fluid material subject to temperature control.

7. A temperature controlled switch for repeated use in a food freezing chest or the like, including a closed tube of electrically non-conductive material, said tube presenting a relatively heavy base portion and a reduced diameter waist portion, said waist portion in effect dividing the interior of the tube into upper and lower wells, separated electrical leads extending through said base portion into said lower well, a flowable electrically conductive material in said tube, which when in said lower well bridges and connects said leads, said tube being reversible in an endwise direction to cause said conductive material to run out of the lower well and into the upper well and so disconnect said leads, a relatively lighter liquid in said tube congealable at a predetermined temperature to form a plug precluding movement of said conductive material from one well to another, said liquid decongealing at said predetermined temperature to permit flow of the conductive material.

8. A temperature controlled switch according to claim

7, characterized by a catalyst in said congealable liquid in the form of glass crystals.

9. A signal switch or like device for use in freezing chests including a tube mounted for endwise swinging motion to reversed positions, flexible electrical leads introduced into said tube through the wall thereof and separated from one another, an electrically conductive fluid material in said tube which flows from end to end of the tube in response to reversing thereof, said material bridging and interconnecting said leads in one of said reversed positions of the tube and flowing out of contact with said leads in the other position of the tube, and a congealable liquid in said tube flowable with said conductive material but relatively lighter than said conductive material so as to remain on the top thereof, said congealable liquid solidifying at low temperatures to form a plug in said tube holding said conductive material in a selected end of the tube irrespective of the position of the tube, said liquid decongealing at a predetermined high temperature for escape of the blocked conductive material.

10. A temperature controlled switch for repeated use in a food freezing chest or the like, including a tube closed at its ends, separated electrical leads projecting into one end of said tube through the wall thereof, an electrically conductive fluid material in said tube effective when collected in said one end of the tube to electrically connect said leads, the reversing of the position of said tube causing said material to flow to and from said one end of the tube, a second fluid material in said tube normally flowable with the conductive fluid material and congealable in said tube at a predetermined low temperature to restrict the movement of said conductive fluid material therein, and a catalyst carried in said second fluid material to aid in precipitating congelation of said second fluid material at the selected low temperature.

11. A temperature controlled signal switch for repeated use in a food freezing chest or the like, including a tube closed at its ends and having a reduced diameter waist portion, a swivel mount for said tube engaging the waist thereof and permitting said tube to be rotated about said mount to alternate inverted positions, said waist defining opposed wells in the ends of said tube, an electrically conductive fluid material in said tube normally flowable with said conductive fluid and congealable at a predetermined low temperature value to form a plug precluding movement of said conductive material from one well to another, and flexible electrical leads attached to said tube and received in spaced relation in one well thereof to be bridged by said conductive fluid when in said one well, said switch device being adjusted to a first position in which lowering temperature values form said plug in overlying confining relation to said conductive material and being then adjusted to an inverted position in which said plug holds said conductive material from flowing by gravity out of confined position, and said tube being readjustable back to said first position for a reforming of said plug after rising temperatures have reduced said plug and permitted flow of conductive material thereby.

References Cited in the file of this patent

UNITED STATES PATENTS

922,883	Giese	May 25, 1909
982,822	Hughes et al.	Jan. 31, 1911
1,645,201	McBrien	Oct. 11, 1927
2,315,425	Hill et al.	Mar. 30, 1943
2,453,177	Abramson	Nov. 9, 1948

OTHER REFERENCES

Industrial and Engineering Chemistry, Analytical Edition, vol. 11, page 509 (1939).