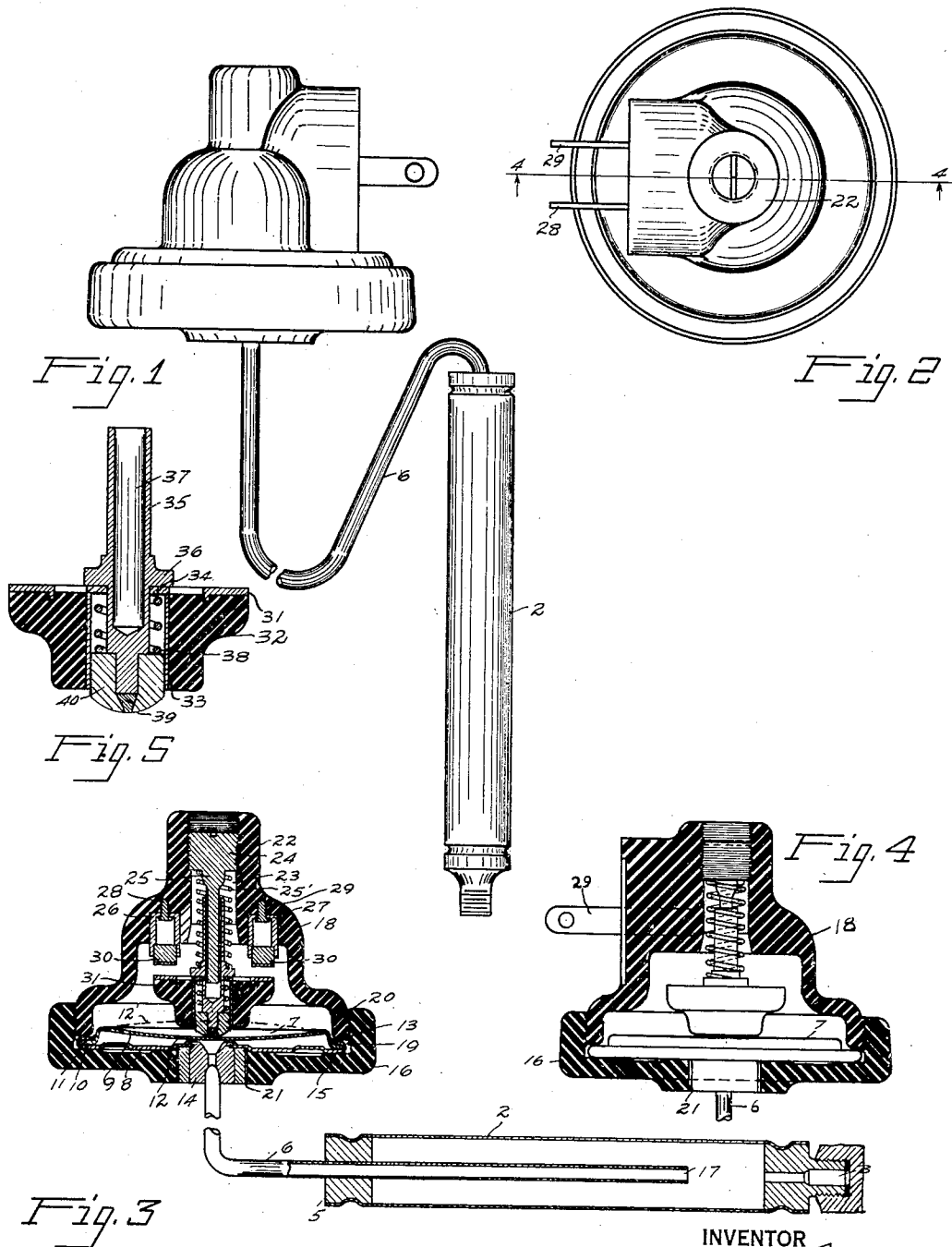


Nov. 11, 1930.

E. J. LEVY, NOW BY JUDICIAL CHANGE OF NAME E. L. MAYO
THERMOSTATIC SWITCH
Filed Aug. 31, 1928

1,781,288



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UNITED STATES PATENT OFFICE

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THERMOSTATIC SWITCH

Application filed August 31, 1928. Serial No. 303,195.

My invention relates to thermostatic electrical switches and relates particularly to thermostatic electrical switches of the type adaptable for use in temperature regulating systems, and more particularly for use in a refrigeration system.

An object of my invention is to provide for the positive operation of an electric switch immediately when a predetermined change of temperature is effected.

Another object of my invention is to provide a thermostatic switch wherein the movable parts are so enclosed as not to be affected by contact with the fluid medium in which the switch mechanism may be immersed.

Another object of my invention is to provide a switch in which all of the movable parts may be very inexpensively assembled together and which will require no careful or frequent adjustment in order to insure that the electrical switch elements thereof will properly operate.

Another object of my invention is to provide a relatively inexpensive switch mechanism of the class described but which will be very positive in operation and reliable in use.

Other objects of my invention and the invention itself will become apparent from the following description of an embodiment of my invention and in which description reference will be had to the accompanying drawings forming a part of this specification.

Referring to the drawings:

Fig. 1 illustrates in elevation, a mechanism embodying my invention, comprising a temperature sensitive bulb, and a fluid pressure operated electrical switch together with a tubular conduit interconnecting the bulb;

Fig. 2 is a plan view of the switch shown in Fig. 1;

Fig. 3 is a vertical medial sectional view of the device of Fig. 1;

Fig. 4 is a view taken on the line 4—4 of Fig. 2; and

Fig. 5 is an enlarged view of the switch contactor.

Referring now to the different figures of drawing, in all of which like parts are designated by like reference characters, the tem-

perature-sensitive bulb, illustrated at 2, may be of any approved design, and is adapted to contain a quantity of a fluid, such as ether, mercury or the like, adapted to be expanded when heated and contracted when cooled. After the fluid is placed into the bulb, the bulb is sealed in any suitable way, such as by soldering the inlet opening 3, or by providing a cap for the inlet opening, or both.

Through the end wall 5 of the bulb, is projected a tubular conduit 6 having an open end 17, and adapted to communicate the effects of fluid pressure existing in the bulb 2 to a fluid pressure expansible cell 7, which, in the embodiment illustrated, comprises a pair of formed disks 8 and 9 secured together at their ends. Both the forms of the disks may be varied somewhat. In the embodiment illustrated, the disk is in the form of a shallow saucer having a rim flange 10 with a reentrant wall 12, and the disk 8 is more nearly planular with annular stiffening grooves, preferably provided intermediate its center and its rim.

The disks are preferably secured together by enfolding the rim flange 10 of the disk 9 by an intumed border portion 11 of the disk 8. The disk 9 is normally dished inwardly in its central portion 12 but is adapted to reverse the direction of dishing whenever the pressure within the cell 7 exceeds a predetermined pressure, as indicated by the dotted lines 12'. Preferably an annular fillet 13 of solder will hermetically seal the cell in its edge portions. A coupling element 14 serves to effect communication between the tube 6 and the interior of the cell 7.

The cell thus formed is adapted to be clamped between an annular shoulder 15 of a cup-shaped casing cap 16, and the annular edge surface of a cap-shaped casing 18, the cap being secured to the casing by interengaging screw threaded portions 19 and 20 by the cap and casing, respectively, and the cell by its peripheral flange comprising the disk flanges 10 and 11, is tightly clamped therebetween.

The coupling element 14 projects through a central opening 21 of the cap. The cap and casing are preferably made of phenolic

condensation material and the casing comprises a stem portion 22 initially provided with a central bore 23 screw threaded in the portion 24 adjacent its mouth, to receive the exteriorly threaded head of a guide rod 25, which is adapted to be adjustably screw threaded into the bore to adjustably compress a helical spring 25', for a purpose later to be more fully explained.

At 26 and 27, electrical contact supporting metallic caps project forwardly toward the mouth of the casing, which contains the cell 7, and have their base portions embedded during the molding of the casing in the molding material thereof. Like spaced metallic electrical terminals 28 and 29, likewise have portions embedded in the casing, and are soldered or otherwise secured to the contact supports 26 and 27, respectively, and project from the casing for attachment to an electrical plug socket of the ordinary types commonly in use.

Metallic electrical contact pieces 30 are rigidly supported by the contact supporting caps 26 and 27, being preferably driven tightly within the opening ends of such supports. The contacts 30 are, therefore, rigidly mounted in the casing on either side of the guide rod 25 and spaced therefrom.

A reciprocable switch blade 31 of annular form rigidly carried on an insulating block 32, is adapted to span the contacts 30 to make and break an electrical circuit connection between them upon axial reciprocation of the block. The block comprises a bushing 33 having at one end an annular entrant flange 34, through which a relatively reciprocable stem 35 projects. The stem 35 has an annular radially extending flange 36 engageable with the bushing flange 34 and has an axial bore 37 extending throughout most of its length, the bore 37 adapted to receive the guide rod 25, and the flange 34 adapted for engagement by an end of the helical spring 25'.

The stem 35 is provided with an enlarged head 40 fitting loosely within the bore of the bushing 33, and a helical spring 38 is held compressed between the stem head 40 and the bushing flange 34 to tend to maintain the stem flange 36 in spring pressed contact with the bushing flange. The stem 35 is reciprocable on the guide rod 25 against the pressure of the spring 25' and the spring 38 is made somewhat stiffer and less easily compressible than the spring 25' so that when pressure is exerted on the rounded button end 39 of the stem, the spring 25 will first yield with but slight or no relative movement of the stem 35 and insulating block 32 which carries the annular switch blade 31. However, when the switch blade 31 engages the rigidly mounted contacts 30, a sufficient pressure being exerted upon the button end 39 of the stem, the stem will then move inwardly

relative to the button and the switch blade supported by the button, with the effect of intensifying the pressure of contact had between the blade 31 and the contacts 30, metallicly bridged by the blade.

The stem 35 intermediate its flange 36 and head 40 is preferably made sufficiently small in diameter as to permit a certain amount of lateral movement of the bushing flange 34 and the stem and in order that the block may tilt sufficiently to insure positive contact being had between the annular blade 31 and both of the contacts 30 at all times, and independently of the precise levels to which said contacts project, and independently of any lack of axial alignment between the stem 35 and the axis of the casing 18. Further lateral movement of the block is obtained by the guide rod 25 being slightly smaller than the bore 37 to allow a slight clearance space therebetween. The block, comprising within the term also the stem 35 and associated parts, being placed in the casing with the stem 35 telescoped over the rod 25 and the rounded button end 39 of the stem, disposed in contact with the central portion of the dished disk 9 of the cell 7, and the other parts being in relative condition of assembly illustrated in Fig. 3, the switch is ready for operation.

Upon a predetermined increase in temperature, the fluid in the bulb 2 will expand, effecting an increase of fluid pressure in the bulb, the tube 6, and the cell 7, until upon a predetermined temperature, the inwardly dished disk 9 will suddenly reverse its direction of dishing to the dotted line position illustrated at 12', and the force effected thereby being a very powerful one because of the amount of potential energy stored in the expansion cell prior to the movement of the disk to reverse its form, the stem 35 by the engaged button 39, will be projected axially to move the block 32 axially of the casing to effect positive resilient pressure maintained engagement between the annular metallic switch blade 31 and the metallic electrical contact pieces 30, to effect an electrical connection between the terminals 28 and 29.

The spring 38 will be compressed a certain amount, depending upon the amplitude of axial movement of the central bore 12 of the disk 9, and the pressure of the spring 38 will, therefore, be effective to effect a more positive contact between the blade 31 and the contacts 30.

Now upon a predetermined lower pressure being subsequently effective upon the bulb 2, the reverse action will take place, and the disk 12 will be suddenly restored to its reentrant dished form, and the spring 25 will be effective to assist in its return to such form, accomplishing altogether a very abrupt and practically instantaneous "opening" of the contacts to break the circuit previously closed

by the engagement of the blade 31 with the contacts 30. This switch breaking action is extremely rapid and practically eliminates all undesirable "arcing" and subsequent deterioration at the contacts, commonly had in previous switches of certain types with which I am familiar, and accomplishes a degree of efficiency in operation commonly had, except in switch structures much more expensive to build and to maintain.

Having thus described my invention in a certain embodiment, I am aware that numerous and extensive departures may be made from the embodiment herein illustrated and described but without departing from the spirit of my invention.

I claim:

1. In a fluid pressure operated electrical switch, in combination with a casing, a fluid pressure cell disposed within the casing comprising a concavo-convex wall and a holder therefor, the wall being adapted to reverse the direction of its concavo convexity upon predetermined variations in fluid pressure in a wall of the cell, a pair of electrical contact elements supported in the casing, a block adapted to be reciprocated toward and from the contact elements, a switch blade supported on that side of the block disposed toward the contact elements, said block comprising a portion relatively telescopable with a portion of the casing to loosely guide the reciprocable block, and a spring effecting pressure to press the block towards the cell.

2. In a fluid pressure operated electrical switch, a fluid pressure cell comprising a wall of inherently resilient material in the form of a disk, means engaging the edges of the disk and continuously exerting pressure on the edges inwardly toward the center of the disk, said disk being constrained thereby to take one or the other of two concavo convex forms, a second wall adapted with the first wall to confine an expansible fluid in the cell, a switch blade, a switch contact engageable by the blade, said contact and blade being adaptable when in engagement to close a gap in an electric circuit, means engageable with said concavo convex wall and movable there-with adapted to move the blade to engagement with the contact when said wall is caused to reverse its concavo convexity by increase in pressure of the fluid in the cell, and a spring adapted to maintain said means in contact with the concavo convex wall in either of its alternate positions, and resilient means adapted to communicate motion to said blade from said wall engaging means.

3. In a fluid pressure operated electrical switch mechanism, the combination with a fluid pressure cell having a concavo convex wall, of an electrical switch mechanism comprising a switch blade, a support therefor and a contact engageable by the blade when moved responsive to movements of its sup-

port, said support comprising a portion engageable with said wall near its central portion and responsive to movements of said wall induced by variations in the pressure of fluid in the cell, spring means adapted to continuously exert pressure on the support tending to keep it in engagement with said wall, and separate spring means between said support and said blade whereby said support may be continued to be moved by said wall after engagement of said blade with said contact.

4. In a fluid pressure operated electrical switch mechanism, the combination with a fluid pressure cell having a concavo convex wall, of an electrical switch mechanism comprising a switch blade, a support therefor and a contact engageable by the blade when moved responsive to movements of its support, said support comprising a portion engageable with said wall near its central portion and responsive to movements of said wall induced by variations in the pressure of fluid in the cell, spring means adapted to continuously exert pressure on the support tending to keep it in engagement with said wall, and separate spring means between said support and said blade whereby said support may be continued to be moved by said wall after engagement of said blade with said contact, said blade being in the form of an annulus, said support extending axially through the annulus and a casing supporting said contact and said cell, guide means projecting from a wall of the casing, said guide means and said support having relatively telescoping guide portions.

5. In a fluid pressure operated electrical switch, a fluid pressure cell comprising two metal plates having their marginal rims secured together, said rims forming a stiffening ring, an enclosing casing frame clamping the cell by said ring, electrical contacts mounted in the frame, each spaced from an outer face of one of said plates, an annular switch blade disposed intermediate the contacts and said plate, said last named plate being of concavo convex form and of inherently resilient material adapted to be snapped outwardly upon a predetermined pressure of fluid in the cell and to return to inwardly depressed form upon a predetermined relief of such pressure, and means adapted to communicate outwardly directed movement of the central portion of said plate to said switch blade to move it axially into engagement with the contacts.

6. In a fluid pressure operated electrical switch, a fluid pressure cell comprising two metal plates having their marginal rims secured together, said rims forming a stiffening ring, an enclosing casing frame clamping the cell by said ring, electrical contacts mounted in the frame, each spaced from an outer face of one of said plates, an annular

switch blade disposed intermediate the contacts and said plate, said last named plate being of concavo convex form and of inherently resilient material adapted to be snapped outwardly upon a predetermined pressure of fluid in the cell and to return to inwardly depressed form upon a predetermined relief of such pressure, and means adapted to communicate outwardly directed movement of the central portion of said plate to said switch blade to move it axially into engagement with the contacts, and a compression spring normally urging said switch blade to non-contact engaging position, adapted to be overpowered by said plate upon a predetermined fluid pressure in the cell.

7. In a fluid pressure operated electrical switch, a fluid pressure cell comprising two metal plates having their marginal rims secured together, said rims forming a stiffening ring, an enclosing casing frame clamping the cell by said ring, electrical contacts mounted in the frame, each spaced from an outer face of one of said plates, an annular switch blade disposed intermediate the contacts and said plate, said last named plate being of concavo convex form and of inherently resilient material adapted to be snapped outwardly upon a predetermined pressure of fluid in the cell and to return to inwardly depressed form upon a predetermined relief of such pressure, and means adapted to communicate outwardly directed movement of the central portion of said plate to said switch blade to move it axially into engagement with the contacts, said motion communicating means comprising a resilient element adapted to permit movement of the central portion of the plate to more completely expanded form, after said blade has reached its ultimate switch contact engaging position.

8. In a fluid pressure operated electrical switch, a fluid pressure cell comprising two metal plates having their marginal rims secured together, said rims forming a stiffening ring, an enclosing casing frame clamping the cell by said ring, electrical contacts mounted in the frame, each spaced from an outer face of one of said plates, an annular switch blade disposed intermediate the contacts and said plate, said last named plate being of concavo convex form and of inherently resilient material adapted to be snapped outwardly upon a predetermined pressure of fluid in the cell and to return to inwardly depressed form upon a predetermined relief of such pressure, and means adapted to communicate outwardly directed movement of the central portion of said plate to said switch blade to move it axially into engagement with the contacts, said motion communicating means comprising a resilient element adapted to permit movement of the central portion of the plate to a more completely

expanded form, after said blade has reached its ultimate switch contact engaging position, said motion communicating means comprising a guiding portion and a switch blade carrying portion, said portions being relatively telescopable, said yielding means comprising a compression spring interposed between parts of said telescoped portions, and adapted to communicate motion from the guiding portion to the switch blade carrying portion.

9. In a fluid pressure operated electrical switch, a casing, a fluid pressure cell comprising a pair of metallic plates secured together and supported in the casing by their rims, an electrical switch comprising a blade and a contact in the casing disposed at the outer side of one of the plates, said plate being of inherently resilient material and constrained to concavo convex form by its peripheral rim portion and adapted to take inwardly deflected or outwardly deflected form, depending upon the pressure of fluid contained between the plates, said plate and switch contacts adapted to be brought together by snap movement of the central portion of said plate to its outwardly deflected form responsive to the pressure of fluid within the cell.

10. In a fluid pressure operated electrical switch, a casing, a fluid pressure cell comprising a pair of metallic plates secured together and supported in the casing by their rims, an electrical switch comprising a blade and a contact in the casing disposed at the outer side of one of the plates, said plate being of inherently resilient material and constrained to concavo convex form by its peripheral rim portion and adapted to take inwardly deflected or outwardly deflected form, depending upon the pressure of fluid contained between the plates, said plate and switch contacts adapted to be brought together by snap movement of the central portion of said plate to its outwardly deflected form responsive to the pressure of fluid within the cell, and means intermediate the moving element of said switch and the moving portion of said plate adapted to resiliently absorb motion of the plate toward switch operating position in excess of that required to operate the switch.

11. In an electrical switch mechanism, the combination with a pair of switch contacts, a supporting casing therefor, a fluid pressure cell comprising two metal plates having marginal rims secured together to form a stiffening ring constraining the plates against outward expansion, one of said plates being constrained thereby into concavo convex form, an annular switch blade adapted to be axially reciprocated upon a predetermined pressure of fluid in the cell by the resultant snap movement of the central portion of said concavo convex disk

taking an alternate outwardly expanded form, and yielding means associated with said switch adapted to effect resiliently maintained engagement between the switch blade and said contacts preliminary to a snap movement of the central portion of the disk consequent upon a reduction of pressure of fluid in the cell, and associated means adapted to disengage said blade and contacts upon movement of predetermined rapidity of said plate central portion.

12. In a fluid pressure operated electrical switch, a fluid pressure cell comprising two metal plates having their marginal rims secured together, said rims forming a stiffening ring, an enclosing casing frame clamping the cell by said ring, electrical contacts mounted in the frame, each spaced from an outer face of one of said plates, an annular switch blade disposed intermediate the contacts and said blade, said last named plate being of concavo convex form and of inherently resilient material adapted to be snapped outwardly upon a predetermined pressure of fluid in the cell and to return to inwardly depressed form upon a predetermined relief of such pressure, and means adapted to communicate outwardly directed movement of the central portion of said plate to said switch blade to move it axially into engagement with the contacts, and a compression spring normally urging said switch blade to non-contact engaging position, adapted to be overpowered by said blade upon a predetermined fluid pressure in the cell, and means to vary the pressure exerted by said spring.

13. In a fluid pressure operated electrical switch, a fluid pressure cell comprising two metal plates having their marginal rims secured together, said rims forming a stiffening ring, an enclosing casing frame clamping the cell by said ring, electrical contacts mounted in the frame, each spaced from an outer face of one of said plates, an annular switch blade disposed intermediate the contacts and said plate, said last named plate being of concavo convex form and of inherently resilient material adapted to be snapped outwardly upon a predetermined pressure of fluid in the cell and to return to inwardly depressed form upon a predetermined relief of such pressure, and means adapted to communicate outwardly directed movement of the central portion of said plate to said switch blade to move it axially into engagement with the contacts, and a compression spring normally urging said switch blade to non-contact engaging position, adapted to be overpowered by said blade upon a predetermined fluid pressure in the cell, and means to vary the pressure exerted by said spring, and a guide for the switch blade to limit it to axial movement.

14. In a fluid pressure operated electrical

switch, a fluid pressure cell comprising two metal plates having their marginal rims secured together, said rims forming a stiffening ring, an enclosing casing frame clamping the cell by said ring, electrical contacts mounted in the frame, each spaced from an outer face of one of said plates, an annular switch blade disposed intermediate the contacts and said plate, said last named plate being of concavo convex form and of inherently resilient material adapted to be snapped inwardly upon predetermined degrees of pressure of fluid in the cell and to return to outwardly expanded form upon a predetermined increase of such pressure, and means adapted to communicate movement of the central portion of said plate to said switch blade to move it axially into engagement with the contacts, said motion communicating means comprising a resilient element adapted to permit movement of the central portion of the plate to a more completely expanded form, after said blade has reached its ultimate switch contact engaging position, and means comprising said resilient element adapted to hold said blade in contact engaging position during the initial part of the inward movement of said blade central portion, and other means adapted to effect a snap movement of the blade, to disengage it from the contacts upon a further more rapid movement of the central portion of the disk.

In testimony whereof I hereunto affix my signature this 20th day of August, 1928.

EDWARD J. LEVY,

Now by Judicial Change of Name Edward Levy Mayo.