

Dec. 19, 1933.

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1,940,267

ELECTRIC SWITCH

Filed Oct. 31, 1930

2 Sheets-Sheet 1

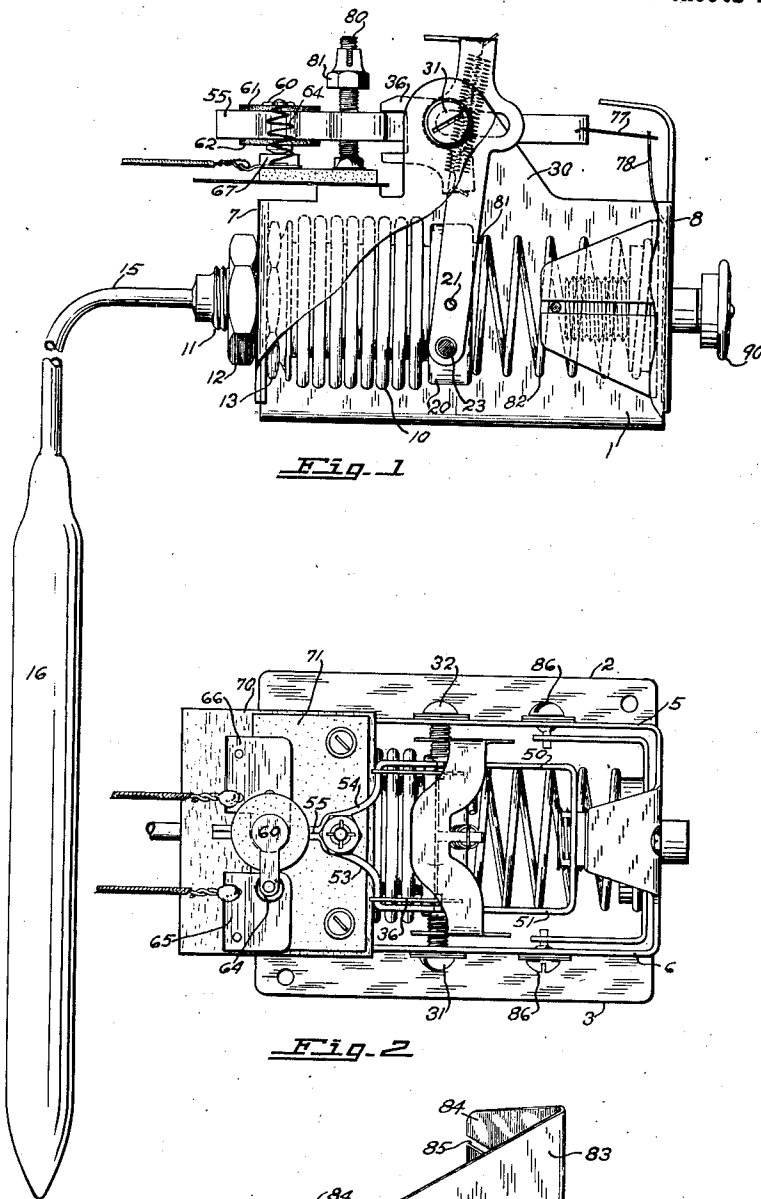


Fig. 1

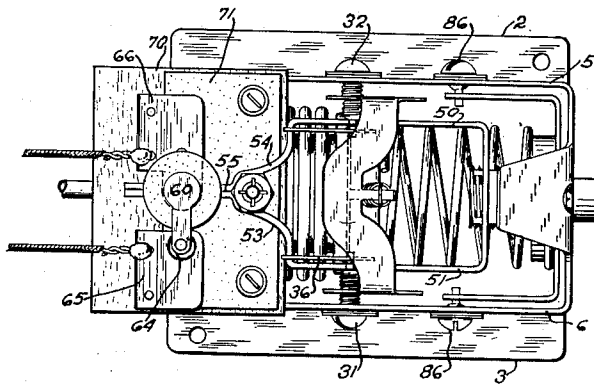


Fig. 2

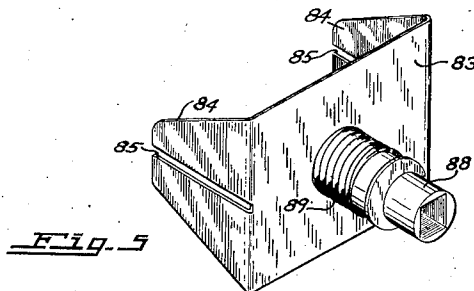


Fig. 3

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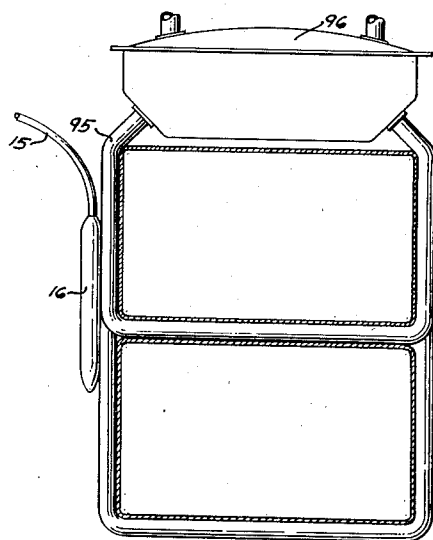


Fig. 3

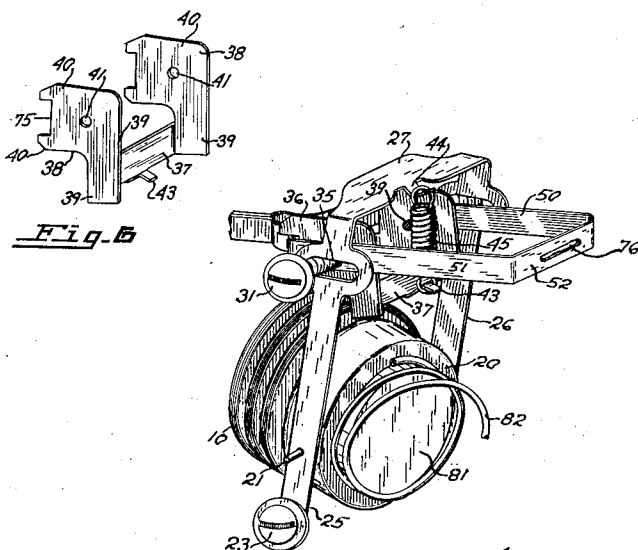


Fig. 4

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ELECTRIC SWITCH

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Application October 31, 1930. Serial No. 492,425

12 Claims. (Cl. 200—140)

This invention relates to electric switches, and particularly to a thermostatic switch for use in connection with refrigeration systems. In order to automatically control refrigerator mechanism, it is customary to provide a volatile substance such as liquid sulphur dioxide in a cartridge disposed in heat conducting relation to the portion of the refrigerating system whose temperature is to be controlled. This cartridge is in communication with a chamber having an expansible wall, usually of the bellows type and known as a syphon bellows. Suitable switching mechanism is disposed in co-operative relationship to said bellows so that as variations in temperature occur, variations in pressure within the bellows result in movement of the switching mechanism.

As is well known, the thermostatic switches must have a definite temperature range in which to operate, in order to result in the opening and closing of the switch. It is customary to associate toggle or spring biased mechanism with the switch so that the switch will be snapped from one position to another. Such mechanism usually has extreme positions of stable equilibrium with intermediate positions of unstable equilibrium. Where the temperature range within which the mechanism operates is great, the snapping positions are sufficiently separated on the opposite sides of the neutral axis of the mechanism so that stable operation of the mechanism is obtained. However, as with refrigerators, the temperature range within which the device must operate is small. This results in changing the character of the stable positions of equilibrium into more or less unstable positions and at times may cause chattering at the contacts, with consequent arcing. Such action is primarily due to the fact that the mechanism between the switch contacts and the syphon bellows only has, as a rule, one neutral axis across which some portion of the mechanism must travel to go from one stable position to the other stable position.

An object of this invention is to devise a switch mechanism in which the switching member will be positively snapped under all conditions.

An additional object is to devise a switch mechanism in which the switching member will be positively snapped from one position to another as soon as the primary actuating member is moved a predetermined distance irrespective of how small this distance may be set.

Additional objects are to devise a switch which

will not chatter, which will be simple in construction and cheap to manufacture.

In the drawings,

Figure 1 is a side elevation of the switch with its volatile liquid cartridge;

Figure 2 is a top view looking down upon the switch of Figure 1 with the cartridge omitted;

Figure 3 is a view showing the disposition of the cartridge adjacent the evaporator;

Figure 4 is a view of the pivoted members showing their relation to each other; and

Figures 5 and 6 are details.

The switch proper comprises a housing 1 provided with side flanges 2 and 3 for mounting. Housing 1 consists of side walls 5 and 6 joined by end walls 7 and 8. Wall 7 is provided with an upwardly extending slot into which is disposed a syphon bellows 10. Inasmuch as the construction of such bellows is old and well-known, further description thereof is deemed unnecessary. Bellows 10 is provided with a coupling end 11 and is firmly maintained at wall 7 by means of nuts 12 and 13 on opposite sides of wall 7.

The coupling end of syphon bellows 10 has joined thereto a flexible pipe 15 communicating with a metal cartridge 16 containing a quantity of liquid sulphur dioxide.

The free end of syphon bellows 10 is enclosed by a cap 20 provided with a pair of diametrically disposed pivots 21. Pivotaly mounted in walls 5 and 6 of the housing by means of bolts 23 and 24 is a U-shaped member having arms 25 and 26 and an intermediate section 27. It will be noted that arms 25 and 26 engage pivot bolts 23 at the ends of said arms and also engage pivots 21 at intermediate portions of said arms. The distance along arms 25 and 26 between pivots 21 and 23 is preferably small so that a small motion of cap 20, induced by the expansion and contraction of bellows 10, will suffice to move intermediate portion 27 through a substantial distance.

Side walls 5 and 6 of the housing are preferably provided with extensions 30 at the top thereof, through which project another pair of pivot bolts 31 and 32. In order to clear these bolts, arms 25 and 26 of the U-shaped member are provided with elongated slots 35. Pivotaly mounted between bolts 31 and 32 is a generally U-shaped member 36 having a cross-piece 37 provided at each end thereof with arms 38. Each of arms 38 consists of two right angle portions 39 and 40 with the pivot bolts 31 and 32 going through portion 41 of said member. Cross piece

37 is provided with a tongue 43, while connecting portion 27 is provided with a similar tongue 44. Between these two tongues there is disposed a coil spring 45 tending to pull portions 27 and 37 together. It will thus be seen that pivoted member 36 has two end positions of stable equilibrium depending upon the positions of U-shaped member 27. It is also clear that member 36 will be snapped from one position to the other by means of coil spring 45.

Pivotally mounted at 31 and 32 is a generally U-shaped member having side portions 50, 51 joined by a connecting portion 52. Side portions 50 and 51 are each provided with inwardly curved extensions 53 and 54, terminating in adjacent sections 55, to which is rigidly attached a movable electric contact 60. Insulating washers 61 and 62 on opposite sides of extensions 55 maintain said contact 60 rigidly in position. A current lead 64 connects contact 60 with the terminal 65, while another terminal 66 carries a stationary contact 67 adapted to co-operate with movable contact 60. The terminals and stationary contacts are suitably mounted on housing 1 by means of insulating strips 70 and 71.

Arms 40 of pivotal member 36 are each provided with a channel 75 in which extensions 53 and 54 play. It will be noted that the width of the channel 75 is slightly greater than the width of extensions 53 and 54; hence, sufficient motion of member 36 on pivots 31 and 32 will cause the contact bearing member to be engaged by the sides of channels 75 and be moved. In order to impart snap motion to the contact bearing member, cross portion 52 is provided with a suitable aperture 76 into which projects one end of a spring 77. Another spring 78, rigidly mounted on end wall 8 tends to buckle spring 77 and results in a toggle action between spring 77 and the contact bearing member. In order to limit the travel of movable contact 60, a bolt 80 with a stop nut 81 is provided and is adapted to engage inwardly curved extensions 53 and 54 of the contact bearing member.

It will thus be seen that as member 27 is moved on its pivots, member 36 will be snapped from one position to another. As this member is snapped, the jaws at arms 40 of this member will engage the contact bearing member at extensions 53 and 54 and cause said member to be snapped from one position to another. It is evident that by means of the lost motion connection, the dead centers or neutral axes of the two snapping systems are sufficiently separated from each other with respect to the motion of the system as a whole as to remove the possibility of chattering of the contacts.

In order to control the temperature range between which the switch will operate, an adjustable spring load may be imposed upon the sylphon bellows. Cap 20 covering the free end of the bellows is provided with a cylindrical extension 81, upon which is disposed a coil spring 82. The other end of said coil spring engages a U-shaped bearing block 83 adjustably mounted within the housing. This mounting is accomplished by having arms 84 for the bearing block slotted at 85. Guide pins 86 rigidly mounted in walls 5 and 6 of the housing are adapted to engage slots 85 and permit movement of said bearing block in a horizontal direction only. A rod 88 is rotatably mounted in end wall 8 of the housing and is provided with a threaded portion 89 engaging bearing block 83. By means of a knob 90 suitably secured to the end of rod 88,

said rod may be turned to force bearing block 83 forward or backward and adjust the compression of spring 82.

In Figure 3 the cartridge 16 is shown in heat conducting relationship to ducts 95 of an evaporator 96.

Various changes in the mounting of the various members may be made without departing from the scope of this invention.

Having thus described it, I claim:

1. An electric switch comprising a supporting housing, a sylphon bellows supported in said housing, a member mounted on said housing, means operatively associating the free end of said sylphon bellows with said member whereby said member has only two positions of stable equilibrium and intermediate positions of unstable equilibrium, said means adapted to transmit movements of said bellows to said member, an additional member mounted in said housing so that it has two positions of stable equilibrium with intermediate positions of unstable equilibrium, electric contacts adapted to be opened and closed associated with said second member, and a lost motion connection between said first and second members for transmitting motion from said first to said second member.

2. An electric switch comprising a housing, a sylphon bellows having one end thereof rigidly mounted in said housing, a member pivotally mounted to said housing and to the free end of said bellows whereby its free end may travel in response to movements of said bellows, an additional member pivotally mounted in said housing and having a resilient connection with said first member whereby said additional member has two positions of stable equilibrium and intermediate positions of unstable equilibrium, a switching member adapted to open and close contacts and pivotally mounted in said housing so that it has two positions of stable equilibrium and intermediate positions of unstable equilibrium, and a lost motion connection between said two last-named members having stable positions of equilibrium whereby motions of said bellows operate the said contact bearing member.

3. An electric switch comprising a housing, a sylphon bellows having one end thereof rigidly mounted in said housing, a U-shaped member having its free ends pivotally mounted on said housing on each side of said bellows, means operatively associating intermediate points of the arms of said U-shaped member with the free end of said bellows whereby said member may swing back and forth on its pivot with movements of said bellows, another U-shaped member pivotally mounted within said housing and having a spring connection with said first U-shaped member whereby said second U-shaped member has two positions of stable equilibrium and intermediate positions of unstable equilibrium, a contact bearing member adapted to open and close an electric circuit mounted in the housing so that it has two positions of stable equilibrium and intermediate positions of unstable equilibrium, and a lost motion connection between the two last-named members having stable positions of equilibrium.

4. An electric switch comprising a housing, a sylphon bellows having one end thereof rigidly mounted therein and having its free end adapted to move in response to temperature variation, a U-shaped member having its free ends pivotally mounted on each side of said bellows to said housing, means associating the free end of

said bellows with intermediate portions of said U-shaped member whereby movements of said bellows will swing said member on said pivots, a pair of pivots mounted above said bellows on said housing, two members mounted on said pivots, means associating one of said members with said housing and the other of said members with said U-shaped member whereby both of said pivotally mounted members have two positions of stable equilibrium and intermediate positions of unstable equilibrium, electric contacts adapted to be opened and closed by one of said two members and a lost motion connection between said two members, having the stable positions of equilibrium.

5. An electric switch comprising a housing, a syphon bellows having one end thereof rigidly mounted therein and having its other end free to move, a U-shaped member having its free ends extending downwardly and pivotally mounted on each side of said bellows to said housing, means connecting intermediate portions of said U-shaped member with the free end of said bellows whereby movements of said bellows result in movements of said member upon its pivots, adjustable spring means acting on said connecting means for governing the motion of said bellows, an additional pair of pivots mounted on said housing on opposite sides of said bellows and above said first-named pair of pivots, said U-shaped member having elongated slots through which said additional pivots project and permitting said U-shaped member to swing about its pivots, a contact bearing member mounted on said additional pivots having two positions of stable equilibrium with intermediate positions of unstable equilibrium, a second member mounted on said additional pivots having a spring connection with said U-shaped member whereby said second member has two positions of stable equilibrium and intermediate positions of unstable equilibrium, and a lost motion connection between said second member and said contact bearing member.

6. An electric switch comprising a housing, a syphon bellows rigidly mounted within said housing at one wall thereof, a lever pivotally mounted adjacent the free end of said bellows, a cap pivotally mounted in said lever and adapted to fit over the free end of said bellows whereby as said bellows contracts and expands the free end of said lever is moved in amplified ratio, and snap-acting switch mechanism adapted to be operated by the movements of said lever.

7. An electric switch comprising a housing, a syphon bellows having one end rigidly mounted in a wall of said housing and having its free end within said housing, a lever pivotally mounted on said housing adjacent the free end of said bellows, a cap pivotally mounted in said lever and adapted to fit over the free end of said bellows whereby as said bellows expands and contracts said lever is oscillated, a spring disposed within said housing, one end of said spring abutting on said cap, means for adjustably supporting the other end of said spring on said housing to vary the spring load on said bellows, and snap-acting switch mechanism mounted on said housing and operated by the free end of said lever.

8. An electric switch comprising a housing, a syphon bellows mounted within said housing at one wall thereof, a lever pivotally mounted in said housing adjacent the free end of said bellows, pivotally mounted means connecting said

free end of said bellows with said lever whereby movements of said bellows are transmitted to said lever, a coiled spring having one end thereof bearing on said pivotally mounted means, an adjustable support within said housing for the other end of said spring to vary the spring load on said bellows, a pair of pivots in said housing mounted above said bellows, two members mounted on said pivots, one of said members being resiliently connected to the free end of said lever whereby as said lever oscillates said member is snapped from one stable position to another, resilient means associated with a second member whereby said second member has two positions of stable equilibrium and intermediate positions of unstable equilibrium, a lost-motion connection between said two members, and contacts associated with said second member.

9. An electric switch comprising a housing, a syphon bellows mounted at one end thereof within said housing at one wall of said housing, snap-acting switch mechanism associated with the free end of said bellows and actuated thereby, a coiled spring mounted in line with said bellows and constituting a load thereon, a pair of pins mounted on opposite sides of said spring in said housing, a carriage having slotted ends adapted to co-operate with said pins disposed within said housing and serving as an abutment for one end of said spring, and means for moving said carriage axially of said spring to vary the load on said bellows.

10. An electric switch comprising a pivotally mounted leverage initiating system, spring means for biasing said system in one of two extreme positions, an additional leverage follower system pivotally mounted and similarly biased in one of two extreme positions, means for connecting said two systems together so that a change in position of one of said systems will result in a corresponding change in the other of said systems, pressure-responsive means associated with the initiating system, electrical switching means associated with the follower system, and means for varying the spring bias on said first named leverage system.

11. Switching means comprising an initiating leverage system pivotally mounted and being spring-biased in one of two stable positions, a follower leverage system pivotally mounted and being spring-biased in one of two stable positions, a lost-motion connection between said two systems whereby a change of state in said initiating system will result in a change of state in said follower system, thermo-responsive means associated with said initiating system and adapted to cause said system to change its state upon predetermined temperature changes, electrical switching mechanism associated with said follower system and adapted to have its electrical condition changed as said system changes its state, and means for varying one of said stable positions in the follower leverage system.

12. An electric switch comprising a housing, a syphon bellows disposed in said housing and having one end thereof movable with respect to said housing, a pivotally mounted leverage system operatively associated with the movable end of said bellows, an adjustable spring load on said bellows, an additional pivotally mounted leverage system on said housing, a lost-motion connection between said first and said second leverage system, and electrical contacts associated with said second leverage system.

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