

July 17, 1956

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2,755,362

REFRIGERATING APPARATUS

Filed Sept. 10, 1953

2 Sheets-Sheet 1

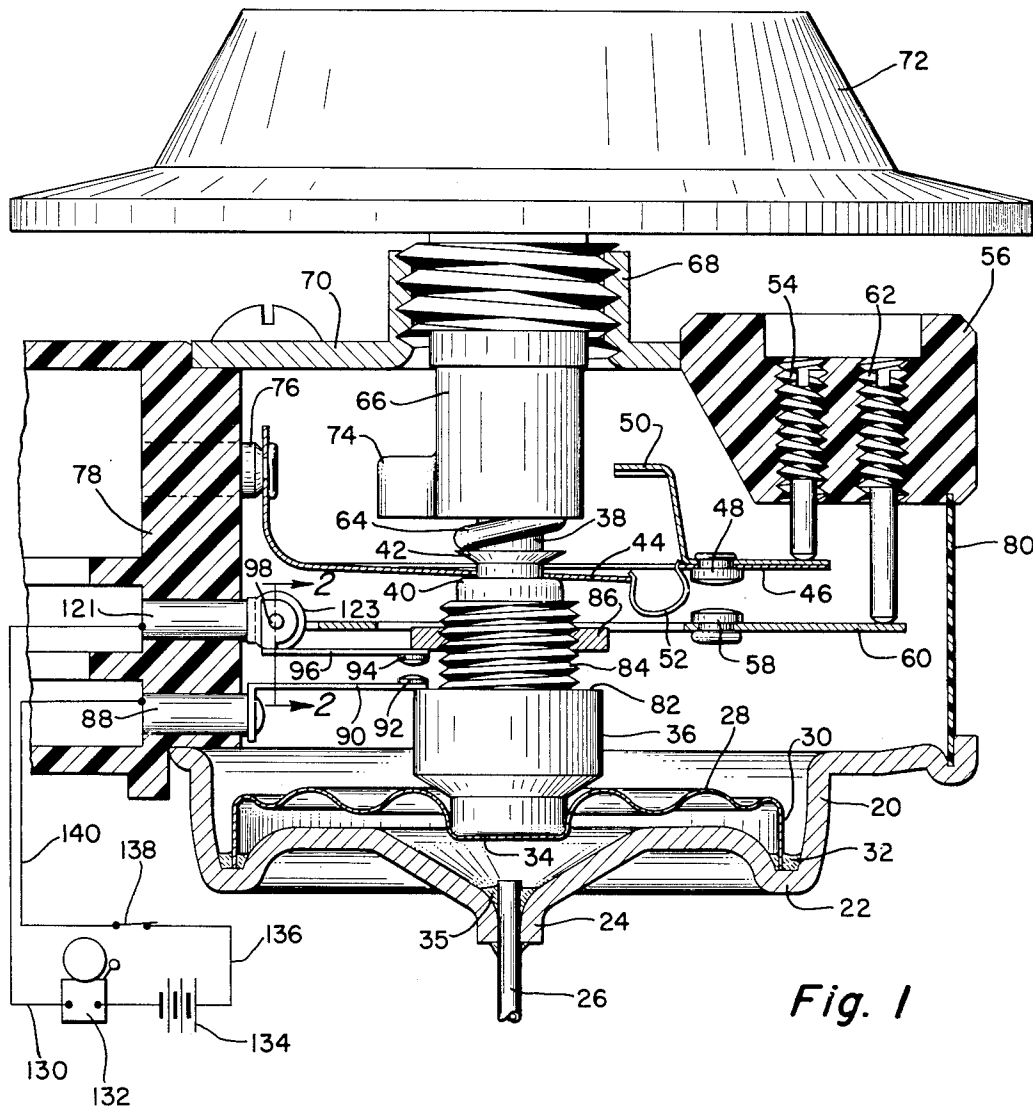


Fig. 1

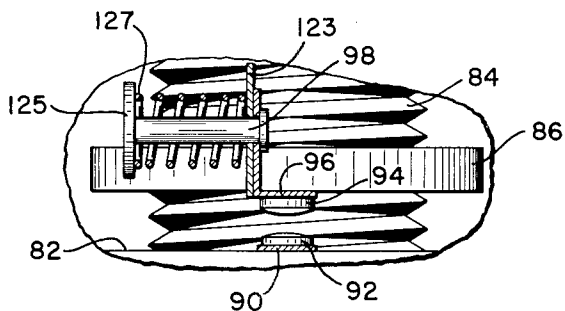


Fig. 2

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Fig. 3

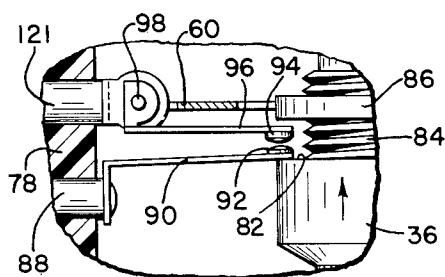


Fig. 4

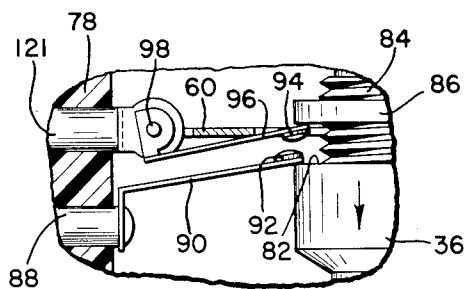
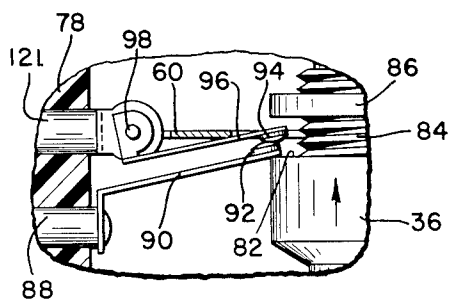
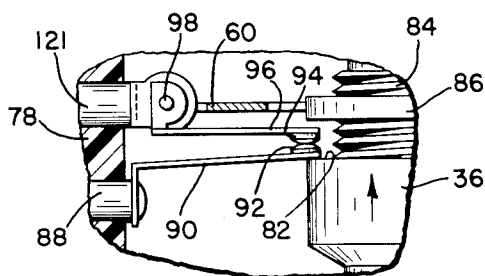


Fig. 5

Fig. 6

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REFRIGERATING APPARATUS

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Application September 10, 1953, Serial No. 379,423

7 Claims. (Cl. 200—140)

This invention relates to refrigerating apparatus and more particularly to controls with alarm switches, especially refrigerator switches for various types of freezers having an alarm system for giving a warning whenever the temperature of the frozen storage compartment rises to dangerous levels.

It has been customary to provide contacts for lighting or extinguishing the light or operating an audible warning device in conjunction with the refrigerator control switch of freezers and frozen storage refrigerator. In such systems when a large amount of unfrozen food or any large warm mass is placed within the frozen storage compartment, the warning light or audible warning device will emit a danger signal because of the resultant warming of the compartment even though the motor-compressor unit is operating at full capacity and the system is in perfect operating condition and producing its maximum refrigerating effect. Because of the operation of the warning system under such a circumstance, often unnecessary service calls are made.

It is an object of my invention to provide a warning system which will emit a warning whenever there is a change beyond a predetermined minimum limited toward a dangerous condition but in which the warning is withdrawn whenever there is a change away from the dangerous condition even though the situation is beyond the minimum limit.

It is another object of my invention to provide a refrigerator control having an auxiliary warning control which will emit a warning whenever there is a temperature rise beyond a predetermined temperature limit but which withdraws the warning whenever there is a fall in temperature even through the temperature remains beyond the minimum limit.

These objects are attained in the form shown in the drawings by providing a fluid pressure operated diaphragm which has a follower providing a lost motion connection with a blade-type toggle snap-acting switch mechanism. The movement of the diaphragm is opposed by a compression-type spring which is adjusted by a suitable adjusting screw rotated by a knob.

For my improved alarm control, the diaphragm follower is provided with an annular shoulder flanked by a threaded portion of reduced diameter on which there is threaded a nut. Between the adjacent surfaces of the shoulder and the nut are a set of contact carrying arms one of which is a spring arm which is biased by its inherent spring force against the shoulder at all times so in effect it is operably connected to the follower and the diaphragm. The other arm is pivotally mounted and is provided with a spring pressed friction connection at the pivot of the arm so that it will remain in any position to which it is forced. The nut is adjusted so that the amount of free travel of the two contact arms between the nut and the shoulder is greater than the amount of movement required by the diaphragm to move the snap-acting mechanism from either position to the other.

As a result of this arrangement, when the control is

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operating between normal temperature limits, the spring contact moves up and down with the diaphragm and the follower without reaching the other contact with the friction pivot arrangement. However, upon any abnormal rise in temperature the spring mounted contact will be carried by the shoulder to engagement with the friction mounted contact to close the alarm circuit. Any further rise in temperature will move both arms upwardly. However, any slight lowering of the temperature will allow the spring contact to move downwardly away from the other contact which will be held without movement by its friction pivot arrangement.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of the invention is clearly shown.

In the drawings:

Figure 1 is a vertical sectional view upon an enlarged scale showing one form of my invention;

Figure 2 is a fragmentary sectional view taken along the lines 2—2 of Figure 1;

Figure 3 is a fragmentary view of the alarm contacts in the associated portions of the bellows follower shown in the normal upper limit of movement of the bellows follower to which it moves at the end of the cut-on stroke and from which it starts the cut-off stroke;

Figure 4 is a view similar to Figure 3 in which the temperature has risen to the alarm stage;

Figure 5 is a view similar to Figures 3 and 4 in which the parts are shown in the position they assume under high temperature storage conditions; and

Figure 6 is a view similar to Figures 3 to 5 showing the parts in the position after the temperature has been lowered a few degrees from the high temperature storage condition shown in Figure 5.

Referring now to the drawings and more particularly to Figure 1, there is shown a refrigerator switch including a metal base 20 provided with an annular groove 22 and a depressed central portion 24 into which extends the end of a capillary tube 26. The capillary tube 26 may be connected to any suitable source of control pressure or it may be provided with a volatile liquid and have its opposite end sealed. The capillary tube 26 is sealed to the opening 24 by solder 35. A diaphragm 28 is provided within the metal base 20 and has a downwardly turned flange 30 extending into the annular groove 22. The annular groove 22 is provided with solder 32 in its lower portion which seals the embedded flange 30 to the base 20.

The diaphragm 28 is provided with a depressed center portion 34. The depressed central portion of the diaphragm 28 receives a projection at the lower end of a bellows follower 36 which is preferably formed of some suitable electrical insulating material such as a phenol-formaldehyde resin. The bellows follower 36 is provided with a reduced upper portion 38 having the spaced shoulders 40 and 42. Between the spaced shoulders 40 and 42 is a tongue 44 in the form of an inner spring blade. This tongue 44 is surrounded by a second spring blade 46 carrying a switch contact 48. The end of the blade 46 carries an arm 50. Between the end portion of the tongue 44 and the adjacent portion of the blade 46 is a C-shaped toggle spring 52 which is adapted in one position of the tongue 44 shown in Figure 1 to hold the blade 46 in contact with the pin on the lower end of the adjusting screw 54 threaded through a block 56 of electrical insulating material. When the tongue 44 is lifted by the expansion of the diaphragm 28 and the upward movement of the follower 36 and the shoulder 40, the C-shaped toggle spring 52 will cause the blade 46 to snap downwardly to place the contact 48 in contact with a normally stationary contact 58. This normally stationary contact 58 is riveted to a spring arm 60 which is biased

upwardly to hold it in contact with the pin at the lower end of the adjusting screw 62.

The expansion of the diaphragm 28 is opposed by a compression-type coil spring 64 provided within the interior of an adjustable screw 66. This screw 66 has its upper portion threaded through a flanged aperture 68 in the top plate 70. The upper portion of the screw 66 is provided with an adjusting knob 72 for rotating the screw 66 to adjust the tension of the spring 64. The screw 66 is also provided with a cam arm 74 for the purpose of engaging and camming upwardly the arm 50 so as to forcibly hold the blade 46 in its upper position against the end of the pin of the screw 54 to hold the contact 48 forceably separated from the contact 58.

The blades 44 and 46 connect to a terminal member 76 in a terminal block 78 of electrical insulating material. The blade 60 connects to a separate terminal member (not shown) also in the terminal block 78. The opposite end of the switch casing is closed by a thin plastic plate 80.

According to my invention between the shoulder 40 and the shoulder 82, the follower 36 is provided with a threaded portion 84. This threaded portion has threaded thereon a thin nut 86. The terminal block 78 has embedded therein an alarm terminal 88 to which is riveted a spring arm 90 which is biased at all times against the shoulder 82. This spring arm 90 carries a switch contact 92. This switch contact 92 through the bias of the spring arm 90 is operably connected to the follower 36 and the diaphragm 28 so that at all times it moves with these members just as if it were directly connected to the shoulder 82.

Immediately above the contact 92 is a second contact 94 carried at the end of an arm 96 which is pivoted on a pin 98 pivoted to a second alarm terminal 121. This second alarm terminal 121 is provided with an ear 123. The pivot pin 98 extends through the adjacent end of the arm 96 and the ear 123. These are held together in frictional engagement by a coil spring 127 which extends between the large head 125 of the pin 98 and the ear 123 so that the members 96 and 123 are held together between the adjacent end of the spring 127 and the small head of the pin 98 on the opposite side of the arm 96. The shoulder 82 and the adjacent face of the nut 86 form abutments which are aligned to engage the adjacent faces of the arms 90 and 96 as shown in Figures 1 to 6. The contacts 92 and 94 are also aligned so that they meet whenever they are moved toward each other.

The second alarm terminal 121 is connected by the conductor 130 to the electric bell which in turn is connected to a battery 134. The alarm circuit is completed by having the second terminal of the battery 134 connected by the conductor 136, the normally closed manual switch 138 and the conductor 140 to the alarm terminal 88. Thus whenever the switch 138 is closed any engagement of the contacts 92 and 94 will close the alarm circuit and cause the ringing of the bell 132. The bell 132 will continue to ring as long as the contacts 92 and 94 are closed. The switch 138 will be opened whenever the refrigerating system is not intended to be operated. Whenever the refrigerating system is intended to operate the switch 138 will be closed.

As a result of this arrangement, when the switch shown in Figure 1 starts operating, the diaphragm 28 will expand and move the follower 36 upwardly to lift the tongue 44 far enough that it will snap out of engagement with the shoulder 40 and into engagement with the shoulder 42 while at the same time the spring 52 will toggle and move the spring blade 46 downwardly to move the contacts 48 and 58 into engagement. This movement under normal temperature rise will not be sufficient to place the alarm contacts 92 and 94 into engagement but will move them closer together in moving

them from the position shown in Figure 1 to the position shown in Figure 3.

Normally the closing of the contacts 48 and 58 will cause the cooling of the freezer by the operation of the motor-compressor unit so that the volatile liquid in the capillary tube 26 is cooled. This cooling of the volatile liquid in the capillary tube 26 will cause the collapse of the diaphragm 28 and the downward movement of the follower 36 causing the tongue 44 to snap out of contact with the shoulder 42 and into contact with the shoulder 40 to the position shown in Figure 1. At the same time, the toggle spring 52 and the blade 46 will snap back to the position shown in Figure 1. The arm 90 and its contact 92 will move downwardly with the follower 36 while the arm 96 and its contact 94 will remain stationary since it is held in place by the frictional engagement between the ear 123 and the pivoted end of the arm 96.

Should the temperature in the freezer or frozen storage compartment rise a material amount such as 5 or 10 degrees above the normal operating limits which are normally controlled by the adjustment of the screws 54 and 62, the diaphragm 28 and its follower 36 will move upwardly beyond its normal limit of movement so as to carry the spring arm 90 and its contact 92 upwardly as shown in Figure 4 into engagement with the contact 94 on the end of the arm 96 which will be held stationary by the frictional pivot arrangement until it is forcibly moved. Any further rise in temperature after the engagement of the contacts 92 and 94 will force the arm 96 upwardly as long as the temperature rise continues.

When the apparatus is stored in the warehouse at higher temperatures, this rise will continue to an abnormally high point so that the arms 90 and 96 will continue to move upwardly to a position such as is shown in Figure 5. However, the starting and operation of the refrigerating system will lower the temperature in the freezer or food storage compartment and this will cool the capillary tube 26 and reduce the pressure of the volatile liquid between the diaphragm 28 and the base 20. This will cause the slow collapse of the diaphragm 28 to permit the follower 36 to move downwardly under the force of the spring 64. In this downward movement the spring arm 90 and its contact 92 will move downwardly with the follower 36 as is shown in Figure 6. The friction pivot arrangement however will prevent the downward movement of the arm 96 and its contact 94 with the contact 92 and the arm 90 so that at the start of the downward movement of the follower 36, the contacts will be separated and the alarm circuit will be opened.

The return of the follower 36 and the diaphragm 28 to normal operating conditions will cause the nut 86 to engage the arm 96 and carry the arm 96 back to its normal position shown in Figure 1 so as to automatically reset the arm 96. In this reset position, illustrated in Figures 1 and 3, the alarm setting is returned to its original condition so that any abnormal rise in temperature to the desired minimum alarm temperature will cause the closing of the contacts 92 and 94 to close the alarm circuit. In this way my alarm will only indicate an alarm condition whenever there is a real danger to food stuffs stored in the freezer. As long as the refrigerating system is operating properly a mere temporary abnormally high load will not cause the indication of an alarm. This alarm arrangement is completely automatic and will eliminate many unnecessary service calls and will also eliminate much unnecessary worry which was often caused by other alarm systems.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted as may come within the scope of the claims which follow.

What is claimed is as follows:

1. A control including a control means, an operating means operatively connected to the control means, a first

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contact means operatively connected to said operating means, a cooperating contact means located in the path of movement of said first contact means for cooperating with said first contact means to close an electrical circuit, friction means for normally holding said cooperating contact means wherever forced by engagement with said first contact means, said operating means having means effective in the direction of movement opposite that accomplished by the first contact means for engaging and moving said cooperating contact means toward the first contact means.

2. A control including a control means, an operating means operatively connected to the control means, said operating means being provided with a notch having oppositely facing walls substantially perpendicular to the movement of the operating means, a first contact means extending into said notch and having means normally biasing it into engagement with one of said walls, a cooperating contact means located between said first contact means and the opposite wall of said groove, and friction means for normally holding said cooperating contact means in any position to which it is forced.

3. A control including a control means movable to open and closed positions, an operating means operatively connected to the control means, said control means having a limited range of movement, said operating connection being arranged to operate said control means from either position to the other in accordance with a limited movement of said operating means, an operating contact means movable coincidentally to and operatively connected to said operating means, a floating contact means located in the path of movement of said operating contact means for engagement and disengagement therewith, said operating means being provided with abutment means located on the opposite side of the floating contact means from the operating contact means and in the path of movement of said floating contact means, said abutment means being spaced a sufficient distance from said operating contact means to provide free space between the abutment means and the operating and floating contact means greater in amount than the limited movement of the operating means required to operate said control means from either position to the other.

4. A control including a control means movable to open and closed positions, an operating means operatively connected to the control means, said control means having a limited range of movement, said operating connection being arranged to operate said control means from either position to the other in accordance with a limited movement of said operating means, an operating contact means movable coincidentally to and operatively connected to said operating means, a floating contact means located in the path of movement of said operating contact means for engagement and disengagement therewith, said operating means being provided with abutment means located on the opposite side of the floating contact means from the operating contact means and in the path of movement of said floating contact means, said abutment means being spaced a sufficient distance from said operating contact means to provide free space between the abutment means and the operating and floating contact means greater in amount than the limited movement of the

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operating means required to operate said control means from either position to the other, and friction means for normally holding said floating contact means in any position to which it is forced.

5. A control including a control means movable to open and closed positions, an operating means operatively connected to the control means, said operating means being provided with a follower of electrical insulating material, said follower being provided with a threaded portion and a shoulder projecting at one end of the threaded portion, a nut threaded onto said threaded portion in spaced relationship to said shoulder an operating contact means operably connected to and movable with said shoulder, and a floating contact means extending into the space between said shoulder and said nut in alignment with the path of movement of said operating contact means.

6. A control including a control means movable to open and closed positions, an operating means operatively connected to the control means, said operating means being provided with a follower of electrical insulating material, said follower being provided with a threaded portion and a shoulder projecting at one end of the threaded portion, a nut threaded onto said threaded portion in spaced relationship to said shoulder, an operating contact means operably connected to and movable with said shoulder, and a floating contact means extending into the space between said shoulder and said nut in alignment with the path of movement of said operating contact means, and friction means for normally holding said floating contact means in any position to which it is forced by said nut and said operating contact means.

7. A control including an operating means provided with an operative connection, a floating contact means, friction means for normally holding said floating contact means in any position to which it is forced, an operating contact means movable coincidentally to and operatively connected to said operating means, said operative connection including means for moving said operating contact means in a path which when continued sufficiently far will bring engagement with said floating contact means and continued movement along said path will force movement of said floating contact means in the same direction, said operating means being provided with abutment means located in the path of movement of said floating contact means in said same direction for moving said floating contact means in the opposite direction upon sufficient movement in said opposite direction.

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