Feb. 12, 1946. A. B. NEWTON 2,394,714

CONTROL DEVICE

Filed Dec. 4, 1942

Fig. 1.

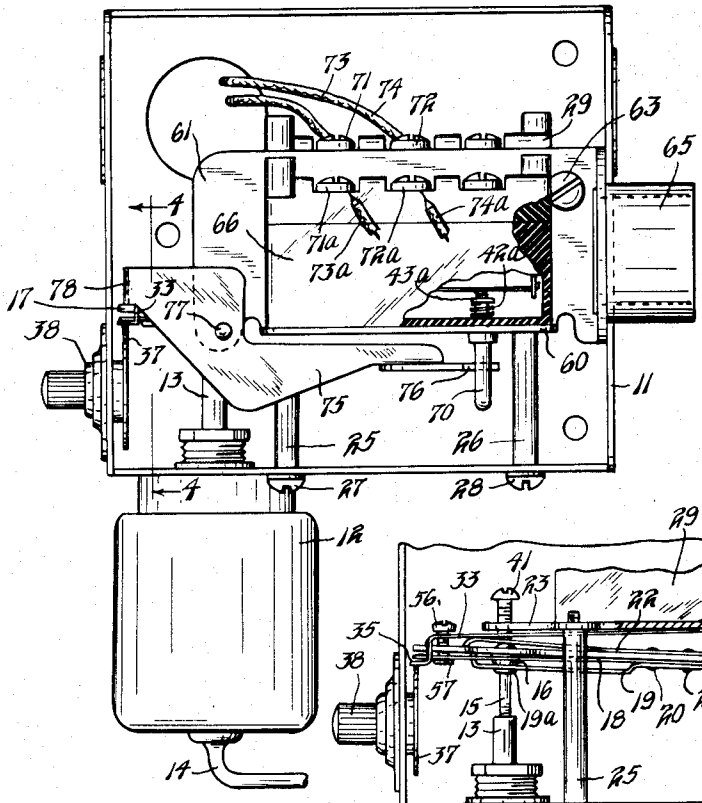


Fig. 3.

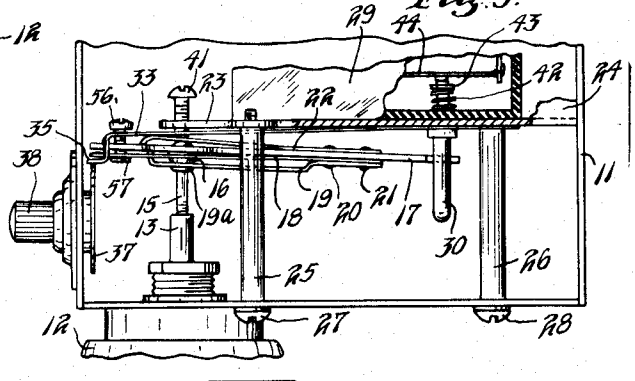


Fig. 2.

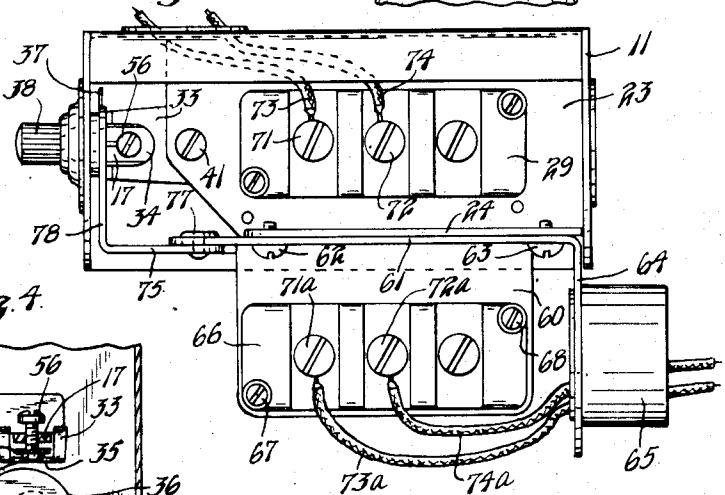
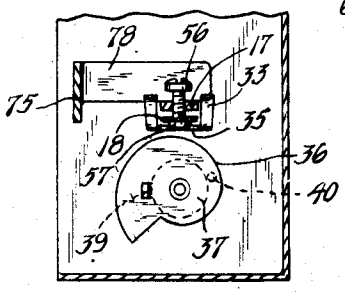


Fig. 4.



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2,394,714

CONTROL DEVICE

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Application December 4, 1942, Serial No. 467,837

10 Claims. (Cl. 200—81.5)

The present invention relates to control devices and is directed more particularly to such devices of the floating lever type. The device herein disclosed may be adapted to regulate the operation of refrigeration apparatus of the type employing a motor driven compressor and a motor driven fan as in conventional temperature conditioning systems well known in the art.

An object of the invention is to provide a single manually adjustable member for adjusting the temperature setting of the control device and means whereby upon adjustment of the said single member, the fan and compressor motor of a refrigeration apparatus may be together and separately adjusted in and out of operation.

Another object of the invention is to provide a novel control device including a floating lever having a condition responsive means for actuating the lever in a first sense and a manually adjustable means for actuating the lever in a second sense, so as to actuate a pair of control devices and the said manually adjustable means arranged so as to control the actuation of one of the said control devices by the said lever upon movement of the lever by the condition responsive means in the first sense.

Another object of the invention is to provide a novel pivotal stop for the said floating lever whereby the said floating lever may be manually adjusted for regulating the operation of a pair of control devices.

A further object of my invention is to provide a floating lever and condition responsive means for actuating the floating lever intermediate the opposite ends thereof so as to operate the control device at one end thereof and manually operable means for actuating the lever at the other end so as to operate control devices through both ends of the said floating lever.

Other objects and advantages of this invention are set forth in the following description, taken with the accompanying drawing and the novel features thereof are pointed out in the appended claims. The disclosure, however, is illustrative only and I may make changes in details, especially in matters of shape, size and arrangements of parts within the principle of my invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

In the accompanying drawing, wherein like reference characters indicate corresponding parts of the various figures,

Figure 1 is a side elevation with the side plate removed of a device embodying the invention.

Figure 2 is a top plan view of the device shown in Figure 1,

Figure 3 is a fragmentary side elevation of the device shown in Figure 1 with the auxiliary switch together with the actuating arm for such switch removed and showing the floating control lever.

Figure 4 is a fragmentary sectional view of the device shown in Figure 1 taken along the lines 4—4 and looking in the direction of the arrows.

Referring to the drawing, numeral 11 indicates a housing to which is attached a pressure chamber 12 of conventional type in which there is mounted a suitable pressure responsive means such as a bellows for actuating a movable stem 13. A tubular member 14 serves as a pressure inlet to the chamber 12. The tube 14 may lead from a bulb, not shown but of conventional type, containing a fluid medium responsive to temperature change whereby upon a rise in temperature the fluid medium will expand or change pressure causing the pressure responsive mechanism within the chamber 12 to force the stem 13 upwardly in a conventional manner, and upon a decrease in temperature such temperature responsive medium will decrease the pressure upon the pressure responsive member in the chamber 12 so as to cause the stem 13 to move in an opposite or downward direction. Similarly, the tube 14 may be connected if desired to the suction pressure line of a refrigeration apparatus whereby, upon a rise in such pressure the stem 13 will be moved upwardly by the pressure responsive means and upon a fall in such pressure stem 13 will be moved downwardly in the opposite direction. Such pressure lines are of course well known in the art, and it is not deemed necessary to go into a detailed explanation of the operation thereof.

Screw-threadedly engaged in the stem 13 is a rod 15 extending vertically from the stem 13 and having fixedly mounted at the opposite end a ball bearing member 16 as best shown in Figure 3.

Member 16 is disposed loosely within an opening in a floating operating lever 17. Member 16 is similarly disposed in an opening formed in a press-back spring member 18 which is attached at one end to the floating lever 17. One end of spring press-back blade member 18 is fastened between the lever 17 and one end of a resilient leaf spring 19 by rivets 20 and 21 which in turn fasten at the upper or opposite side of the lever 17 one end of a leaf spring 22. The leaf 19 is suitably bent so as to extend substantially parallel along the lower side of the floating lever 17. There is formed in the leaf spring 19 a suitable seat portion 19a within which is positioned the lower portion of the ball member 16. The free end of the leaf 19 is suitably bent so as to extend through an aperture formed in the spring blade 18 so as to engage at the free end the lower side of the floating lever 17. At the opposite or upper side of the floating lever 17 extends the leaf 22 which bears upon the upper portion of the ball member 16 and is bent at the free end so as to

engage the upper side of the said lever 17. The leaf members 19 and 22 are formed of suitable resilient material so that with the ball bearing member 16 positioned between the two leaf members 19 and 22 there is formed a strain release connection between the operating rod 15 and the floating lever 17.

Mounted in the casing 11 is an angle bracket 23 having an upwardly extending side portion 24. The bracket 23 is supported within the casing 11 by the tubular members 25 and 26 through which there is disposed the elongated screws 27 and 28 for fastening the tubular members 25 and 26 between the angle bracket 23 and the bottom of the casing 11 for supporting the bracket 23.

Mounted on the bracket 23 is a snap action switch mechanism indicated by the numeral 29 and which is shown as of a type completely enclosed within a casing and may be of a type such as discussed in Patent No. 2.318,734, issued May 11, 1943, to Albert E. Baak. The switch 29 may be actuated by a pin 30 which extends through a suitable aperture formed in the bracket 23. A suitable slot is formed in the actuation pin 30 for receiving one end of the floating lever 17.

As shown in Figure 3, there is further fastened on the supporting bracket 23 at the underside thereof an arm 33. The arm 33 extends substantially parallel to the floating lever 17 and has formed at the free end thereof a downwardly extending portion which is provided with a slot 34 in which is positioned the free ends of the floating lever 17 and the resilient press-back spring blade 18, the same being arranged so as to engage a flange portion 35 formed at the extreme free end of the arm 33 which is bent at an acute angle to the downwardly bent portion of the said arm, as best shown in Figure 3.

The flange portion 35 is arranged so as to engage a cam surface 36 formed on an adjustable cam 37 as shown in Figure 4. As will be explained, the adjustment of the cam 37 will determine the temperature or condition value at which the floating lever arm 17 will actuate the snap action switch 29 through the pin 30. The dial 38 is rotatably mounted on the outer surface of the casing for adjustment of the cam 37. Suitable indicating means are provided on the dial 38 calibrated for indicating the temperature or condition value of the adjustment of the cam 37. As shown in Figure 4, the adjustment of the cam 37 is limited by the lug 39 mounted on the cam 37 and arranged so as to engage the pin 40 mounted on the casing 11 in such a manner as to limit the rotative movement thereof.

Screw-threadedly engaged in the bracket 23 is an adjustable screw 41 which passes through a suitable aperture formed in the arm 33 and engages the upper leaf 22 upon the extreme upward movement thereof in response to the shaft 15, thereby limiting upward movement of the floating lever 17 in response to pressure change in the chamber 12. It will be seen that the floating lever 17 will have an upward movement in response to such movement of the shaft 15. Further the lever 17 will pivot about the engaging end of screw 41 while being held in place by the ball bearing member 16 upon the extreme upward actuation of the flange 35 through the cam 37, causing movement of the arm 33 in a clockwise direction as viewed in Figure 3, so as to in turn actuate the said lever 17. The purpose of this double movement of the lever 17 will be explained hereinafter.

A coil compression spring 42 is placed around the pin 30 within the cover for the snap action switch mechanism 29 and this spring seats on a flange 43 of the pin 30 at one end and against the underneath side of the cover 29 at the other end. The spring 42 is arranged to exert a force on the pin 30 sufficient to hold the switch 29 in an actuated position so as to close a circuit between terminals 71 and 72 of said switch. The flange 43 cooperates with a raised portion of a switch actuating arm 44 in a manner fully explained in Patent No. 2,318,734, issued May 11, 1943, to Albert E. Baak.

The spring 42 is so designed as to exert in the position shown in Figure 3 a tension on the floating lever arm 17 which has a greater biasing effect than that exerted on the arm 17 by the spring blade 18 upon engaging the flange 35.

Thus upon the rod 15 moving downward from the position shown in Figure 3, the end of the floating lever 17 nearest the cam 37 will move downwardly first, until movement of this end of the floating lever 17 is stopped by the cam 37. Additional downward movement of the rod 15 will then cause the opposite end of the floating lever 17 to move so as to actuate the switch 29 in such a manner as to open the circuit between terminals 71 and 72 of the switch 29 against the biasing force of the spring 42.

The switch 29 as previously described, may be of a type such as disclosed in the said Patent No. 2,318,734, issued May 11, 1943, to Albert E. Baak wherein upon actuation of the switch 29 to a position so as to open the circuit between terminals 71 and 72 a snap action effect results whereby the switch mechanism exerts an increased counter biasing effect upon the spring 42 so that the spring 42 exerts a biasing force upon one end of the lever 17 which will be less than that exerted at the opposite end or end nearest the cam 37. Thus upon the lever 17 being actuated upward by the rod 15 after the opening of the circuit between terminals 71 and 72, as previously described, the end of the floating lever 17 nearest the cam 37 will move upwardly preceding the movement of the opposite end of the lever 17.

A screw 56 is provided screw-threadedly engaged in the floating lever 17. A portion of the screw 56 projects through a suitable aperture formed in the spring blade 18 in disengaging relationship therewith. A head portion 57 mounted at the lower end of the screw 56 is adapted to engage the lower side of the spring blade 18 and thereby limit the downward tension exerted by the spring blade 18. Thus, upon the floating lever 17 being moved upwardly until the spring blade 18 is flexed into engaging relation with the head 57, the biasing force exerted by the spring blade 18 upon the lever 17 will then cease, causing the spring 42 to move the switch actuating end upward upon additional upward movement of the rod 15 until the switch 29 is in turn under the force of the spring 42 returned to a position where the circuit between terminals 71 and 72 is closed.

It will thus be readily seen that by adjusting through the screw 56 the position of the head 57, the differential between the condition value at which the control device 29 is actuated to an open and closed position may be readily adjusted.

It is to be understood that other types of switches having similar characteristics could also be substituted for the switch 29 without interfering with the above described operation of the lever 17. Thus for example the switch 29 could be a magnetic snap action switch of the self return type in which the contacts are attracted to-

gether with a greater force as the contacts are brought more closely together.

As previously explained, the temperature or condition value at which the switch mechanism 29 may be actuated upon movement of the rod 15 may be readily controlled by adjustment of the cam 37. Further, the switch 29 may be manually operated by adjustment of the cam 37 to the high portion thereof. Such adjustment will cause the high portion of the cam 37 of Figure 4 to engage the flange 35 of the arm 33 forcing the floating lever 17 to pivot about the screw 41 one end of which screw 41 engages the leaf spring 22 and forms a bearing point so that such lever 17 under force of the adjustment of the cam 37 will pivot in a positive clockwise direction about the ball bearing 16 as shown in Figure 3. Such adjustment will cause the switch pin 30 to move downward, opening the circuit between contacts 71 and 72 which may be suitably connected so as to control the operation of a refrigerator compressor motor through electrical conductors 73 and 74.

Fastened to the upstanding portion 24 of the angle bracket 23 is a second angle bracket 60 having an upstanding portion 61 which is connected to the portion 24 by the screws 62 and 63. A second angular portion 64 projects from the portion 61 at a right angle thereto and has formed thereon a tubular member 65. Mounted on the bracket 60 is a snap action mechanism 66 which is fastened to the bracket 60 through elongated screws 67 and 68. Projecting through a suitable aperture formed in the bracket 60 is a switch actuating pin 70 for controlling the snap action mechanism 66. The snap action mechanism 66 may be of like construction as the snap action mechanism 29 previously described. It is therefore not deemed necessary to explain in detail the operation of the snap mechanism 66. It is pointed out however that the downward movement of the pin 70 will open switch contacts controlling the circuits to contacts 71*a* and 72*a*, and that inward movement of the pin 70 due to tension of a return spring 42*a* acting upon flange 43*a* in a manner similar to spring 42 shown in Figure 3 will cause suitable contacts to close the circuit between contacts 71*a* and 72*a*. Suitable electrical conductors 73*a* and 74*a* are connected respectively to the terminals 71*a* and 72*a* in circuit with a fan for a temperature conditioning system not shown. Thus, upon a downward movement of the pin 70 the circuit controlling the said fan motor will be opened, while upon upward movement of the pin 70 the circuit will be closed. In order to control the operation of the pin 70, I have provided an arm 75 having a projecting member 76 positioned in a suitable slot formed in the pin 70. The arm 75 is pivotally connected at 77 to the upstanding portion 61 of the bracket 60. A portion 78 of the arm 75 is bent at a right angle thereto so as to pass immediately over the end of the floating lever 17 positioned above the cam 37. Thus, upon rotative movement of the cam 37 to the extreme high portion a pivotal movement of the floating lever 17 previously explained will cause an upward movement of the portion 78 and the downward or clockwise pivotal movement of the projecting member 76 mounted at the opposite end of the arm 75. Such movement of the member 76 will cause the switch actuating pin 70 to be forced downwardly opening the contacts controlling the fan motor, as previously explained. Upon release of the portion 78 by the floating lever 17 by proper adjustment of the cam 37, return spring 42*a* mounted within the switch mechanism 66 as previously explained will cause the contacts controlling the fan motor circuit to be closed. The lever 78 is so arranged with respect to the floating lever 17 that upon clockwise rotative movement of the cam 37 to the high portion thereof, the switch mechanism 29 controlling the compressor motor will be first to open and then upon additional clockwise rotative movement of the cam 37 the switch mechanism 66 will be opened controlling the fan motor. Correspondingly, upon rotative movement of the cam 37 to the low portion thereof or in a counter-clockwise direction, as shown in Figure 4, the portion 78 of the arm will be first released to cause the switch contacts of the fan motor to be closed and then upon additional movement of the cam 37 the floating lever 17 will be moved so as to close the switch contacts controlling the compressor motor of the refrigeration apparatus provided the temperature is above that for which the dial is then set. The compressor will then be operated by the temperature control in response to pressure changes in the pressure chamber 12. It will thus be seen that I have provided in the single cam mechanism 37 convenient means whereby the condition value at which the switch mechanism 29 may be opened and closed may be readily adjusted and further there is provided in the novel cam mechanism 37 convenient means whereby the switch mechanism 29 may be manually controlled separately or together with the switch mechanism 66. Further, it will be seen since the flange portion of the bifurcated member 33 bears at all times upon the cam 37, any side thrust exerted by the cam 37 on the adjustment thereof will be taken up by the member 33 and will not be conveyed to the floating lever 17. Thus, the accuracy of operation of the floating lever 17 will not be impaired through any side thrust which may be exerted by the cam 37 since such side thrust will be taken up by the member 33.

As various changes and modifications of this invention may occur to those who are skilled in the art, I wish it to be understood that I intend to be limited only by the scope of the appended claims and not by the specific embodiment disclosed.

I claim as my invention:

1. In a device of the character described, comprising, in combination, a floating lever, a first control device operated by one end of said floating lever, condition responsive means for actuating said floating lever at a point intermediate the opposite ends thereof, a manually movable member for limiting the movement of the other end of said floating lever so as to determine the condition value at which said first control device may be operated by said lever in response to said condition responsive means, and said manually movable member arranged for independently pivoting said floating lever, a control member operably engaged by said floating lever upon said independent pivotal movement, a second control device actuated by said control member upon such engagement, and said first control device actuated by said floating lever upon said independent pivotal movement of said floating lever, whereby the operation of said first and second control devices may be regulated.

2. In a device of the character described, comprising, in combination, a floating lever, a first switch operated by one end of said floating lever, a rod pivotally connected at one end to said floating lever at a point intermediate the op-

posite ends of said floating lever, condition responsive means for actuating said rod, an adjustable cam for limiting the movement of the other end of said lever in one direction so as to regulate the condition value for operation of said switch, said adjustable cam arranged for directly pivoting said lever in an opposite direction for the actuation of said first switch, adjustment means for said cam and indicator means for cooperation with said adjustment means whereby the condition value for operation of said switch may be determined, and a second switch actuated by said other end of said lever upon pivotal movement of said lever in said opposite direction.

3. In a device of the class described, comprising in combination, a first control device, a second control device, a member for actuating said control devices, first means for actuating said member in a first sense, a variable stop for limiting the actuation of said member in response to said first means in such a manner as to cause said member to actuate said first control device upon actuation of said member in a first sense, and said variable stop arranged for actuating said member in a second sense for causing the successive actuation of said first and second control devices independently of said first means.

4. In a device of the character described, comprising, in combination, a floating lever, a first control device operated by the floating lever, condition responsive means for actuating said floating lever, a manually movable member for limiting the movement of the lever in one direction so as to determine the condition value at which said first control device may be operated by said lever in response to said condition responsive means, stop means for limiting the movement of the floating lever in the other direction, said movable member arranged for independently pivoting said floating lever about the stop means, a control member, a second control device actuated by said control member, the movable member upon such independent movement so as to pivot the lever about the stop means actuating the first control device, and then upon farther movement of the movable member engaging the control member for actuating the second control device.

5. In a device of the character described, comprising, in combination, a floating lever, a first control device operated by said floating lever, condition responsive means for actuating said floating lever, a manually movable member for limiting the movement of the lever so as to determine the condition value at which said first control device may be operated by said lever in response to said condition responsive means, said manually movable member arranged for independently pivoting said floating lever, a control member, a second control device actuated by said control member, the movable member upon independent movement in a first direction actuating the lever for moving the first control device to inoperative position, then upon further movement of the movable member in the first direction actuating the control member thereby moving the second control device to inoperative position, then upon movement of the movable member in a second direction actuating the control member for moving the second control device to operative position, and the movable member upon farther movement in the said second direction actuating the first control device to operative position.

6. In a device of the character described, comprising, in combination, a floating lever, a first switch operated by one end of said floating lever, a rod pivotally connected to said floating lever at a point intermediate the opposite ends of the floating lever, condition responsive means for actuating said rod, an adjustable cam for limiting the movement of the other end of said lever in one direction so as to regulate the condition value for operation of said switch, said adjustable cam arranged for directly pivoting said lever in an opposite direction moving said first switch to inoperative position, and a second switch actuated by said other end of said lever upon pivotal movement of the lever in said opposite direction.

7. In a device of the character described comprising a control member, a control device operated by said control member, condition responsive means moving the control member for actuating the control device under a first condition, the condition responsive means actuating the control member for moving the control device to operative position under a second condition, adjustable means for independently varying the second condition for determining the condition value at which the control device may be operated in response to the actuation of said control member by the condition responsive means, means interposed between the adjustable means and the control member for preventing the transfer of side thrust from the said adjustable means to the control member.

8. In a device of the character described, comprising, in combination, a floating lever, a first control device operated by one end of said floating lever, a rod pivotally connected to said floating lever at a point intermediate the opposite ends of the floating lever, condition responsive means for actuating said lever, adjustable means adjacent the other end of the floating lever for limiting the movement of the said other end of the lever in a first direction so as to regulate the condition value for operation of said control device, said adjustable means arranged for directly pivoting said lever in a second direction moving said first control device to inoperative position, and a second control device actuated by the other end of said lever upon pivotal movement of the lever in said second direction.

9. In a device of the class described, comprising in combination, a first control device, a second control device, a member for actuating said control devices, first means for actuating said member in a first sense for causing actuation of the first control device, and second means for actuating said member in a second sense for causing the actuation of said first and second control devices independently of the first means.

10. In a device of the class described, comprising in combination, a first control device, a second control device, a member for actuating said control devices, first means responsive to a condition for actuating said member for causing actuation of the first control device, and second means including a manually rotatable element for actuating said member for causing the actuation of the first and second control devices independently of the first means.

ALWIN B. NEWTON.