

1

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CONTROL DEVICE

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This invention relates to control devices and more particularly to a device providing for the actuation of a pair of control elements utilizing independent control point adjustments with only a single condition sensing means.

One embodiment of my invention utilizes the independent control point adjustment for a combination fan and limit control with but a single sensing element and power head. This, therefore, will mean a combination fan and limit control that is more economical to manufacture.

Therefore, an object of my invention is to provide a control device in which there is independent adjustment of the control point actuation of two control elements actuated by a single power head and condition sensing element.

Another object of my invention is to provide a combination fan and limit control with independent control point adjustment and one sensing element.

Further objects of my invention will become evident upon inspection of the following drawings, specification and claims.

Figure 1 is a diagrammatic perspective illustrating the principle of my invention.

Figure 2 is a plan view of one embodiment of my invention.

Figure 3 is an elevation of the embodiment of Figure 2 taken along line 3—3 of Figure 2.

Referring now to Figure 1, a floating lever 10 is actuated by a condition sensing means 11 and is engaged by the end 14 of shaft 15 which is connected thereto. Condition sensing means 11 is shown as a power head 16 in which a diaphragm is actuated by a sensing fluid through capillary tube 18. Power head 16 is fixed in a frame indicated diagrammatically as 20. Expansion or contraction of the diaphragm due to a condition change will cause axial movement of the shaft 15.

A compression spring 22 acts between frame 20 and lever 10 and engages lever 10 on a line parallel to but displaced from the axis of shaft 15. A pair of independently adjustable abutments 25 and 26 threadedly engage frame 20 and are positioned for cooperation with lever 10. A pair of abutments 28 and 29 are fixed by frame 20 and are positioned for cooperation with lever 10. Another pair of adjustable abutments 30 and 31 threadedly engage frame 20 and are positioned for cooperation with lever 10.

With the lever 10 positioned as shown and biased by spring means 22 into engagement with shaft 15 and abutments 28 and 29, a change in condition to cause expansion of the diaphragm will cause upward movement of shaft 15 against the bias of spring means 22 pivoting lever 10 about the axis formed by abutments 28 and 29. This movement will continue until lever 10 has pivoted sufficiently to engage the abutment 26 which is adjusted closer to lever 10 than is abutment 25 whereupon continued movement of shaft 15 will cause movement of lever 10 about the pivotal axis established by abutments 28 and 26. Further pivoting about the axis formed by abutments 28 and 26 will cause lever 10 to move away from abutment 29 and toward

2

abutment 25. After engagement of abutment 25 by lever 10 the pivotal axis of lever 10 will have shifted to that formed by abutments 25 and 26. Further pivoting about the axis formed by abutments 25 and 26 will cause lever 10 to move away from abutment 28. Abutments 28 and 29 may be switch contacts and the portion of lever 10 engaged thereby may be cooperating contacts which may be insulated from the lever 10 if desired.

In case of an undesirably low condition value or a collapse of power head 11 spring means 22 will move lever 10 downward about abutments 28 and 29 until lever 10 engages abutment 30 which is adjusted closer to lever 10 than is abutment 31 at which point lever 10 will pivot about abutments 30 and 28 disengaging lever 10 from abutment 29. Further pivoting about the axis formed by abutments 30 and 28 will cause lever 10 to engage abutment 31. After engagement of abutment 31 the pivotal axis of lever 10 will have shifted to that formed by abutments 30 and 31. Further pivoting of lever 10 about the axis formed by abutments 30 and 31 will cause lever 10 to pivot away from abutment 28. The undesirably low condition value at which abutments 28 and 29 will be disengaged from lever 10 can be independently adjusted by positioning of abutments 30 and 31.

The principle of my invention will operate for any interchange of positions between abutments 28, 29, and adjustable abutments 25, 26 and power head 16 and adjustable abutments 30, 31. As can be seen from the above discussion and Figure 1, the point 14 of application of the power head 11 to lever 10, engagement of abutment 26 with lever 10 and engagement of abutment 29 with lever 10 lie substantially in a line and likewise point 14, engagement of abutment 25 and engagement of abutment 28 with lever 10 lie substantially in a line. Theoretically, the angle between these lines can be anything except 0° or 180°.

With 14, 26, and 29 in alignment and 14, 25, and 28 in alignment the adjustment of 26 will have no effect on condition value separating lever 10 from 28 and adjustment of 25 will have no effect on condition value separating lever 10 from 29.

The elements forming the lower control point adjustment can be out of line without affecting the independent control point adjustment if the elements forming the higher control point adjustment are in line. Thus 26 can be displaced from alignment with 14 and 29 without its adjustment affecting condition value at which lever 10 separates from abutment 28. The three points of the high side of course do not have to be in line for the instrument to function but then there will be interdependence of settings.

In the general use of domestic forced warm air furnaces it is desirable to provide thermostatic control of both the fan motor and burner circuits, in which the fan switch "makes" and the high limit switch "breaks" on temperature rise.

An embodiment of my invention for use as a combination fan and limit control is shown in Figures 2 and 3 in which the floating lever 110 is engaged by power head 116 at the end 114 of a shaft 115. Diaphragm 117 and casing 119 of power head 116 define a chamber 121 which receives sensing fluid through capillary tube 118 from a temperature sensing bulb (not shown). Casing 119 is attached to frame 120 and positions power head 116 with respect to frame 120. Diaphragm 117 engages a pad 123 on shaft 115 and upon a temperature change the resultant volume change in chamber 121 will cause movement of shaft 115 and resulting movement of lever 110. A spring 122 is positioned at one end by an extension 124 of frame 120. The other end of spring 122 cooperates with lever 110 and biases it against shaft 115 and power head 116. A pair of screws 125 and 126 threadedly

engage extension 124 of frame 120. and are positioned for cooperation with lever 110. Switches 128 and 129 are positioned by frame 120 such that their actuator plungers are positioned for cooperation with lever 110. Plunger 132 of switch 128 may be seen in Figure 3. Lever 110, positioned as shown, is biased by spring means 122 into engagement with shaft 115 and screw abutments 125 and 126. A rise in temperature will cause an increase of volume in chamber 121 with a resultant deflection to the left as seen in Figure 3 of diaphragm 117 and shaft 115. This will cause counter clockwise rotation of lever 110 about screw abutments 125 and 126 causing actuation of switches 128 and 129. The position of screw abutments 125 and 126 can be adjusted by levers 133 and 134 which cooperate with indicia of temperature 135 and 136 on extension 124 of frame 120. The position of screw 125 will determine the temperature at which switch 128 will be actuated and the position of screw 126 will determine the position at which switch 129 will be actuated.

Adjustable screw 130 is provided as a fail-safe feature. If diaphragm 117 ruptures, spring 122 will bias lever 110 about the actuators of switches 128 and 129 until lever 110 engages screw 130; at this point lever 110 will pivot about screw 130 causing lever 110 to leave actuator 132 of switch 128 and as switch 128 is the high limit control, actuation of it will turn the system off.

In the embodiment shown in Figures 2 and 3 the point 114, screw 126 and the actuator of switch 129 are in alignment, and the point 114, screw 125 and the actuator 132 of switch 128 are in alignment. Therefore, levers 133 and 134 may be adjusted to independently select the temperatures at which the limit and fan switches will be actuated.

The operation of the embodiment of the invention shown in Figures 2 and 3 differs from that of Figure 1 in that the switches 128 and 129 have an inherent over-travel and their plungers may be moved inwardly for some distance after the switch has been operated. Operation of the switches at the control points selected by levers 133 and 134 is nevertheless the same as described in connection with Figure 1.

In the broad usage of my invention various components may be varied, changed or substituted for without changing the spirit of my invention. For example, the spring bias means is shown as one spring in a specific location. Obviously, one or more spring means may be used in any of many locations. Also if instead of abutments or switches for control elements 28 and 29 other types of actuators for control elements such as potentiometers are used the device would function by pivoting about the axis formed by screws 25 and 26. The actuation of the control element substituted for abutment 28 would be controlled by the position of screw 25, and the actuation of the control element substituted for abutment 29 would be controlled by the position of screw 26.

I do not intend to limit my invention to the embodiments shown but only as defined in the appended claims.

I claim as my invention:

1. In a condition responsive device a pair of control elements, condition sensing means, lever means, spring means normally biasing said lever means into cooperation with said control elements and said condition sensing means, a pair of abutments each being adapted to engage said lever means to determine the condition value at which said lever means pivots about one of said abutments actuating one of said control elements.

2. In a condition responsive device a pair of control elements, condition sensing means, lever means, spring means normally biasing said lever means into cooperation with said control elements and said condition sensing means, a pair of abutments each being adapted to engage said lever means to determine the condition value at which said lever means pivots about one of said abutments actuating one of said control elements, and means for adjustably positioning each of said abutments to de-

termine the point of actuation of each of said control elements.

3. In a condition responsive device a pair of control elements, condition sensing means, lever means, spring means normally biasing said lever means into cooperation with said control elements and said condition sensing means, a pair of abutments each being adapted to engage said lever means to determine the condition value at which said lever means pivots about one of said abutments actuating one of said control elements, said one of said abutments and said one of said control elements actuated by pivotal movement of said lever about said one of said abutments and the point of cooperation of said condition sensing means on said lever means being substantially in a straight line.

4. In a condition responsive device a pair of control elements, condition sensing means, lever means, spring means normally biasing said lever means into cooperation with said control elements and said condition sensing means, a pair of abutments each being adapted to engage said lever means to determine the condition value at which said lever means pivots about one of said abutments actuating one of said control elements, for each of said abutments adjusting means and cooperating indicia of condition value indicating the condition value at which each of said control means will be actuated.

5. In a condition responsive device, lever means, first and second abutments engaging said lever means at spaced points to establish a pivotal axis for said lever means, condition responsive means engaging said lever means at a point removed from said pivotal axis and adapted to pivotally move said lever means on condition change, a plurality of control elements disposed to be actuated by pivotal movement of said lever means, and means for adjustably positioning each of said abutments.

6. In a condition responsive device, lever means, first and second abutments engaging said lever means at spaced points to establish a pivotal axis for said lever means, condition responsive means engaging said lever means at a point removed from said pivotal axis and adapted to pivotally move said lever means on condition change, a control element disposed to be actuated by pivotal movement of said lever means, and means for adjustably positioning each of said abutments.

7. In a condition responsive device, lever means, first and second abutments engaging said lever means at spaced points to establish a pivotal axis for said lever means, condition responsive means engaging said lever means at a point removed from said pivotal axis and adapted to pivotally move said lever means on condition change, two control elements disposed to be actuated by pivotal movement of said lever means, each of said elements being disposed substantially in line with said condition responsive means and one of said abutments, and means for adjustably positioning each of said abutments.

8. In a condition responsive device, a frame, first and second spaced abutments in said frame, lever means engaging said abutments, condition responsive means engaging said lever means and adapted on condition change to pivotally move said lever means about the axis established by said abutments, a first control means actuated by a point on said lever in line with said first abutment, a second control means actuated by a point on said lever in line with said second abutment, adjusting means for each of said abutments carried by said frame, and cooperating indicia of condition value on said frame and on said adjusting means indicating the condition value at which each of said control means will be actuated.

9. In a condition responsive device lever means, first and second abutments positioned for cooperation with said lever means, condition sensing means cooperating with said lever means at a point removed from said abutments, a spring means cooperating with said lever means opposing said condition sensing means, a control element actuated by pivotal movement of said lever, and the point of cooperation on said lever of said control element, one

5

of said abutments and said condition sensing means being substantially in a straight line.

10. In a condition responsive device lever means, first and second abutments positioned for cooperation with said lever means, condition sensing means cooperating with said lever means at a point removed from said abutments, a spring means cooperating with said lever means opposing said condition sensing means, first and second control elements actuated by pivotal movement of said lever, and the point of cooperation on said lever of one of said control elements, one of said abutments and said condition sensing means being substantially in a straight line and means for adjustably positioning each of said abutments to determine the point of actuation of each of said control elements.

11. In a condition responsive device lever means, a pair of abutments positioned for cooperation with said lever means, condition responsive means engaging said lever means at a point removed from said abutment and adapted to pivotally move said lever means on condition change about either of said abutments, a plurality of control elements disposed to be actuated by pivotal movement of said lever means, each of said elements being actuated upon pivotal movement of said lever means about one of said abutments, and means for adjustably positioning each of said abutments to determine the point of actuation of each of said control elements.

12. In a condition responsive device a control element, condition sensing means, lever means, spring means normally biasing said lever means into cooperation with said control element and said condition sensing means, a pair of abutments each being adapted to engage said lever means to determine the condition value at which said lever means pivots about said abutments actuating said control elements.

13. In a condition responsive device a control ele-

6

ment, condition sensing means, lever means, spring means normally biasing said lever means into cooperation with said control element and said condition sensing means, a pair of abutments each being adapted to engage said lever means to determine the condition value at which said lever means pivots about said abutments actuating said control elements, and means for adjustably positioning each of said abutments to calibrate and determine the point of actuation of said control element.

14. In a control device, a frame, a lever in the form of a plate; a condition responsive device on said frame having an output shaft engaging one side of said plate, said shaft moving normal to said plate upon a change in condition; first and second abutments adjustable in said frame and adapted to engage said plate at spaced points equal distance from said shaft, said abutments being adjustable normal to said plate; cooperating indices of condition value on said frame and said abutments; first and second elements to be controlled, said elements engaging said plate and being displaced from said shaft and said abutments, the points of engagement of said shaft, said first abutment and said first element being in a first straight line, the points of engagement of said shaft, said second abutment, and said second element being in a second straight line; and spring means acting between said frame and said plate biasing said plate about said shaft in a direction to engage both of said abutments.

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