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F. D. JOESTING

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CONTROL MECHANISM

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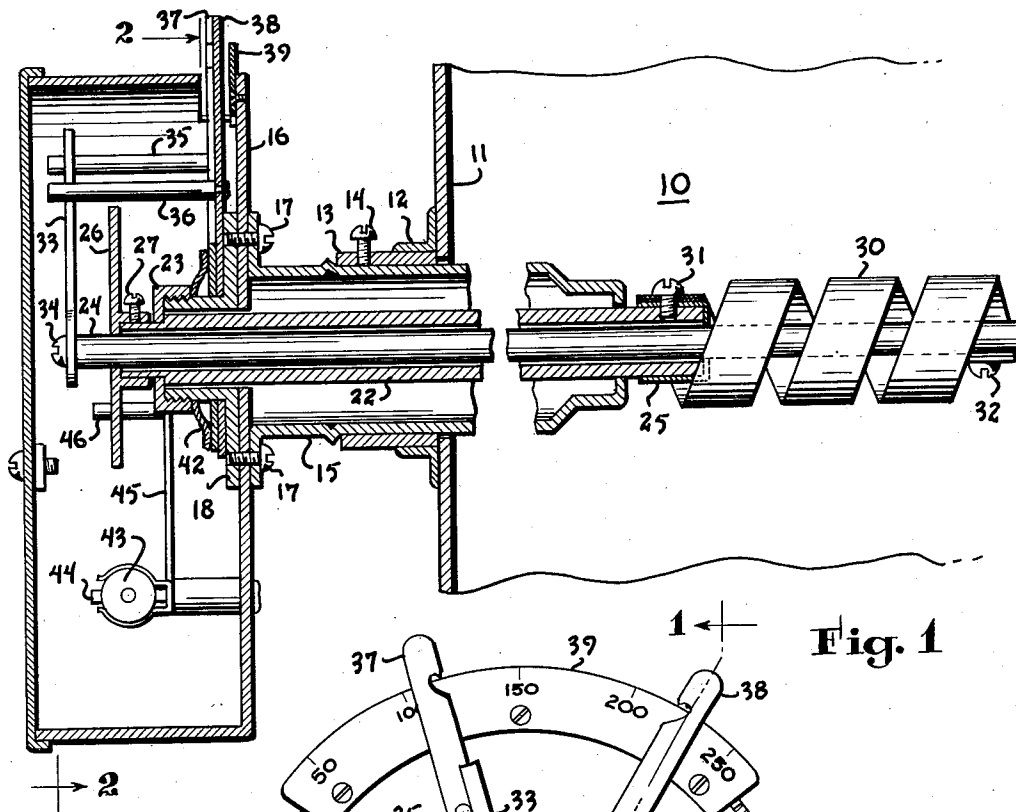
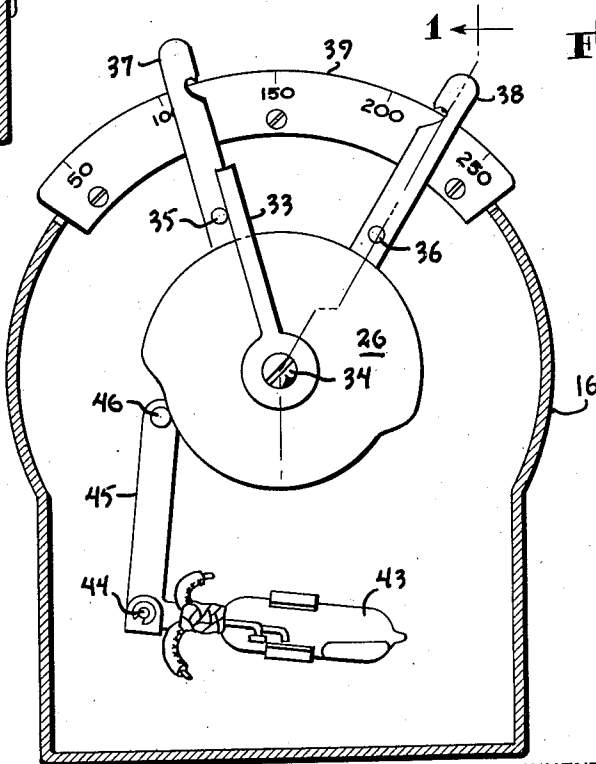


Fig. 1



INVENTOR
Frederick D. Joesting
BY George H. Fisher
ATTORNEY

UNITED STATES PATENT OFFICE

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CONTROL MECHANISM

Frederick D. Joesting, Minneapolis, Minn., assignor to Minneapolis-Honeywell Regulator Company, Minneapolis, Minn., a corporation of Delaware

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The present invention relates to control mechanisms and is particularly directed to means for selecting the desired operating range of such a device.

5 An object of the invention is to provide a control mechanism responsive to a condition such as temperature or humidity in which the cut-in and cut-out points at which the device operates are independently adjustable.

10 Another object is to provide a control mechanism responsive to a condition in which the cut-in and cut-out points at which the device operates are independently adjustable outside the casing in which the mechanism is enclosed.

15 Other objects will be apparent from the accompanying specification and from the drawing, in which:

Figure 1 is a vertical section taken substantially on line 1—1 of Figure 2, and

20 Figure 2 is a partial sectional view taken substantially along the line 2—2 of Figure 1.

While this invention could be applied to various control devices, it is here described as incorporated in a furnace fan control which is used to turn on the furnace fan after a desired temperature has been obtained in the bonnet of a warm air furnace and to shut down the fan when the temperature has dropped to another predetermined temperature.

25 The bonnet 10 of a warm air furnace has a wall 11 as shown in Figure 1. A mounting flange 12 for the control device is suitably attached to wall 11 as by screws (not shown) and has an outwardly extending cylindrical portion 13 in which the control device is held by a set screw 14. A cylindrical mounting member 15 extends into bonnet 10 through the mounting flange. A housing 16 for the outer control mechanism is supported on the cylindrical mounting member 15 by screws 17 which also extend through the housing to support a flanged tube 18 which is also concentric with mounting member 15.

30 A tube 22 is rotatable in the cylindrical mounting member 15, the inner end being journaled therein at a point inside bonnet 10. The outer end of tube 22 is journaled in a collar 23 which is screwed onto the flanged tube 18. Rod 24 is rotatable within tube 22 and is journaled in the inner end of tube 22 by a collar 25. The outer end of rod 24 is journaled in a cam member 26 which is secured to tube 22 by a set screw 27 and serves a purpose hereinafter to be set forth.

35 A bimetallic helix 30 is supported by the inner ends of tube 22 and rod 24 and is secured to tube 22 by screw 31 and to rod 24 by screw 32. Arm

33 rotates with rod 24 and is held thereto by screw 34. In the path of movement of arm 33 are stops 35 and 36 which are carried by adjusting arms 37 and 38. Arms 37 and 38 are pivoted on flanged tube 18 and extend through an opening 5 in housing 16. An indicia plate 39 is secured to the housing and is provided with appropriate figures representing temperature adjacent the two adjusting arms. A spring washer 42 placed over the flanged tube 18 presses against the two adjusting arms by reason of the tension applied thereto in tightening collar 23, thus preventing movement of arms 37 and 38 except when manually adjusted.

10 A mercury switch 43 is pivotally mounted in casing 16 on pin 44. The member which supports the mercury switch includes an arm 45 extending substantially vertically from pin 44. To the end of arm 45 is secured a pin 46 which due to the weight of the mercury switch tending to rotate 20 arm 45 in a clockwise direction rests against cam 26.

The operation of this device is as follows. Any change in temperature within bonnet 10 will result in relative rotation of the two ends of bimetallic helix 30. Since one end of the helix is attached to tube 22 and the other end is attached to rod 24, changes in temperature will result in relative rotation of tube 22 and rod 24. 25 Until arm 33 which is attached to rod 24 reaches one of the stops 35 or 36, the helix will move the arm 33 and rod 24 rather than move the cam 26. This is due to the manner in which the parts are arranged. Some friction must be overcome to move the tube 22 in the mounting while the rod 35 24 is free to rotate with respect to the mounting until arm 33 engages one of the stops 35 or 36. Whatever friction may exist between rod 24 and tube 22 only opposes movement of the helix due to temperature changes and has no effect on the sequence of operation of the device. Friction between the tube 22 and its support, however, will hold the tube stationary until the end of the helix not attached to the tube is held stationary. This will occur only when arm 33 has been moved into engagement with one of the stops 35 or 36 to hold rod 24 stationary.

Starting with the parts in the position shown in Figure 2, an increase in temperature in bonnet 10 will rotate rod 24 and arm 33 in a clockwise 50 direction. When arm 33 reaches stop 36, the rod can no longer turn, so further movement of the helix will result in rotation of tube 22 and cam 26 in a counter-clockwise direction. As the cam 26 is rotated counter-clockwise by the bi- 55

metal helix, the raised portion of the cam will encounter cam follower 46 and move it to the left, tilting the mercury switch 43 to close the furnace fan circuit at a bonnet temperature that is determined by the setting of adjusting arm 38. This will occur at approximately 220° F. with arm 38 at the position shown in the drawing, but may be varied to suit requirements.

When the temperature within bonnet 10 falls, arm 33 which has been against stop 36 will move counter-clockwise, the cam 26 remaining stationary and the circuit through the mercury switch remaining closed. When arm 33 reaches stop 35, cam 26 will be moved in a clockwise direction and will open switch 43 when the reduced portion of the cam permits follower 46 to move to the right. This would occur at approximately 120° F. with adjusting arm 37 in the position shown in Figure 2.

In the device described, control temperatures are visible on the indicia plate outside the casing. It is only necessary to set the two adjusting arms opposite the desired indicia to effect control at those points. Operating differential is then the difference between the two selected control temperatures. This arrangement provides a simpler adjustment than in the adjustable differential type of control where a differential adjustment is superimposed on the main adjustment.

If it is desired to use the furnace fan for circulating air in summer, the two adjusting arms 37 and 38 may be moved to the extreme left-hand position, in which case mercury switch 43 will be closed at temperatures above 50° F. and the fan could be controlled by a separate switch.

It is now apparent that a control device has been provided in which the cut-in and cut-out points are independently adjustable. While one embodiment of the invention has been described, it should be understood that the scope of the invention is to be limited only by the appended claims.

I claim as my invention:

1. A control device comprising, in combination, a condition responsive element, first and second members, said first member being operatively connected to one point on said condition responsive element, said second member being operatively connected to a second point on said condition responsive element, said two points being relatively movable on changes in the condition to which said element responds, a pair of stops to limit the movement of the first member, control means actuated by the second member, and means to prevent movement of the second member until the first member has moved into engagement with one of said stops on an increase in the value of the condition and has moved into engagement with the other of said stops on a decrease in the value of the condition.

2. A control device comprising, in combination, a mounting member, a first member movably supported by the mounting member, a second member movably supported by the first member, a condition responsive element operatively connected to said first and second members to cause relative movement of said members on changes in condition, a control element actuated by the first member and stops to limit movement of the second member, whereby the first member will be moved on changes in condition to actuate the control element after the second member has moved into engagement with one of said stops.

3. A control device comprising, in combination,

a mounting member, a first member rotatably supported by the mounting member, a second member rotatably supported by the first member, a thermostatic element operatively connected to said first and second members to cause relative rotation of said members on changes in temperature, a control element actuated by rotation of the first member, and stops to limit rotation of the second member, whereby the first member will be rotated on changes in temperature to actuate the control element after the second member has been rotated into engagement with one of said stops.

4. A control device comprising, in combination, a mounting member, a tube rotatably carried by the mounting member, a shaft rotatably carried by the tube, a bimetal strip one end of which is attached to the tube and the other end of which is attached to the shaft so that changes in temperature of the bimetal strip will result in relative rotation of the tube and shaft, means to limit rotation of the shaft with respect to the mounting member, and a control element actuated by rotation of the tube.

5. A control device comprising, in combination, a mounting member, a tube rotatably carried by the mounting member, a shaft rotatably carried by the tube, a bimetal strip one end of which is attached to the tube and the other end of which is attached to the shaft so that changes in temperature of the bimetal strip will result in relative rotation of the tube and shaft, stops to limit rotation of the shaft with respect to the mounting member, a control element, and a cam rotatable with the tube to actuate the control element.

6. A control device comprising, in combination, a mounting member, a tube rotatably carried by the mounting member, a shaft rotatably carried by the tube, a bimetal strip one end of which is attached to the tube and the other end of which is attached to the shaft so that changes in temperature of the bimetal strip will result in relative rotation of the tube and shaft, means to limit rotation of the shaft with respect to the mounting member, a control element actuated by rotation of the tube, and indicia to indicate the position of the limiting means, said indicia being calibrated in degrees of temperature so that the position of the limiting means will indicate the temperatures at which the control element will be actuated.

7. A control device comprising, in combination, a thermostatic element, first and second members, said first member being operatively connected to one point on said temperature responsive element, said second member being operatively connected to a second point on said temperature responsive element, said two points being relatively movable on changes in the temperature to which said element responds, a first adjustable stop to limit movement of the first member on temperature rise, a second adjustable stop to limit movement of the first member on temperature fall, control means actuated by the second member, means to prevent movement of the second member until the first member has moved into engagement with one of the stops, whereby the position of the first stop will determine the temperature at which the control element will be actuated on temperature rise and the position of the second stop will determine the temperature at which the control element will be actuated on temperature fall, and indicia calibrated in degrees of temperature to

indicate the temperatures at which the control element will be actuated at the various settings of the stops.

5 8. A control device comprising, in combination, a mounting member, a tube rotatably carried by the mounting member, a shaft rotatably carried by the tube, a bimetal strip one end of which is attached to the tube and the other end of which is attached to the shaft so that changes
10 in temperature of the bimetal strip will result in relative rotation of the tube and shaft, an actuating element rotatable with the tube, an arm rotatable with the shaft, a control element adapted to be actuated by the actuating element,
15 stops to limit rotation of the shaft relative to the mounting member, a housing for the arm, the actuating element and the control element, and means extending outside the housing whereby the stops may be manually positioned.

20 9. A control device comprising, in combination, a condition responsive element having first and second portions which are relatively moved on changes in the condition, means to limit movement of the first portion to a predetermined
25 range, control means actuated by the second portion, and means to prevent movement of the second portion until the first portion has moved to one limit of its range of movement on an increase in the value of the condition and has
30 moved to the other limit of its range of movement on a decrease in the value of the condition.

10. A control device comprising, in combination, a condition responsive element having first and second portions which are relatively moved on changes in said condition, means to limit movement of the first member to a predetermined range, means for varying at least one limit of the range, and means to prevent movement of said second portion on a change in said condition until the first portion has moved to one limit of its range of movement on an increase in the value of the condition and has moved to the other limit of its range of movement on a decrease in the value of the condition. 5 10

11. A control device comprising, in combination, a condition responsive element having first and second portions which are relatively moved on changes in the condition, a first adjustable stop to limit movement of the first portion on an increase in the value of the condition, a second adjustable stop to limit movement of the first portion on a decrease in the value of the condition, control means actuated by the second portion, and means to prevent movement of the second portion on an increase in the value of the condition until further movement of the first portion is prevented by the first stop and to prevent movement of the second portion on a decrease in the value of the condition until further movement of the first portion is prevented by the second stop. 15 20 25 30

FREDERICK D. JOESTING.