

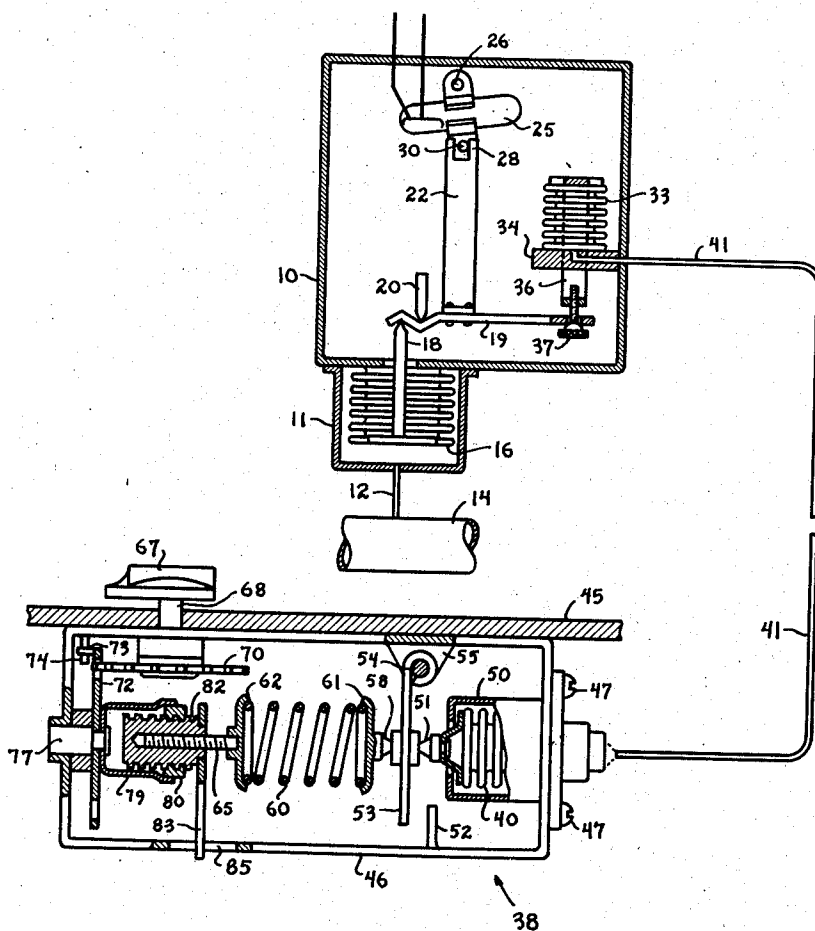
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REMOTELY ADJUSTABLE CONTROL

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REMOTELY ADJUSTABLE CONTROL

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The present invention relates to control devices and particularly to a remote adjusting arrangement for such a device. While the usual temperature, pressure, or humidity control devices are adjustable as to control point and are suitable for the requirements of most installations, it is often desirable to locate the control device in an inaccessible position. Under such circumstances it is desirable to provide a remote adjustment of the control point of the device. For example, modern air conditioning units, particularly room type units, are provided with a decorative housing enclosing the control devices as well as the air conditioning apparatus. Here it is especially desirable to provide a remote adjustment on the exterior of the housing for adjusting the control devices located in the interior of the housing.

Accordingly, the prime object of this invention is to provide a condition responsive control device the control point of which may be adjusted from a point remotely located with respect to the control device proper.

More specifically, the object of this invention is to provide a condition responsive control device having an adjusting spring remotely located from the control device and connected thereto in a manner which permits the adjusting spring to be located at any remote point with respect to the controller. This may be accomplished by connecting the remotely located adjusting spring to the control device through the medium of a hydraulic transmission utilizing a flexible tube for transmitting the force of the adjusting spring to the control device.

Further objects will be apparent from the specification, claims, and from the single figure of the drawing which shows a remotely adjustable pressure responsive control device partly in section.

For purposes of illustration the invention is shown as incorporated in a pressure responsive control device which may be controlling the compressor motor of a compression refrigeration system in response to suction pressure. A casing 10 has a cup 11 hermetically sealed to its lower edge. A tube 12 connects the cup 11 with the suction pipe 14, the pressure within which is to be utilized to actuate the control. Within cup 11 a flexible metallic bellows 16 is disposed. Bellows 16 is also hermetically sealed to the bottom of casing 10. It will be seen that variations in pressure in the pipe 14 will be transmitted through tube 12 to act on bellows 16 and raise or lower the lower portion of the bellows due to flexing of the bellows.

A vertically extending rod 18 transmits movement of bellows 16 to the left hand end of lever 19 to rotate said lever about a knife edge 20 which is suitably secured in casing 10. A verti-

cally extending arm 22 is fixedly attached to lever 19 to operate a mercury switch 25. Mercury switch 25 is frictionally pivoted in casing 10 on a pin 26 so that it will remain in any position it has been moved to by arm 22. Bifurcated end 28 of the arm 22 is adapted to actuate mercury switch 25 through a pin 30. It will be noted that the distance between the bifurcated portions 28 is greater than the diameter of pin 30 in order to provide a differential between the pressures which will open and close the circuit through the mercury switch 25.

A flexible metallic bellows 33 is supported at its lower end in the casing 10 on a block 34 which is rigidly attached to the casing 10. The upper end of the bellows 33 is operatively connected to the right hand end of the lever 19 by means of a yoke 36 and an adjusting screw 37. The remote adjusting device 38 has a flexible metallic bellows 40 located at the right hand end thereof which is connected to the bellows 33 by means of a flexible tube 41.

Bellows 33, bellows 40, and tube 41 are completely filled with any suitable non-compressible liquid such as oil so that a decrease in the volume of either bellows will result in a like increase in volume of the other. The elements associated with casing 10 and the pipe 14 may be located adjacent the refrigeration mechanism while the parts of the remote adjusting device 38 may be located at any convenient point such as on a control panel or on the surface of the decorative housing of a unit air conditioner where it will be readily accessible. Such a panel 45 has secured thereto a frame 46 to the right hand end of which the bellows 40 is suitably attached by means of screws 47. It should be pointed out here that any movement of the upper end of the bellows 33 as determined by lever 19 will result in a transfer of liquid through tube 41 and into bellows 40. A cup shaped member 50 surrounding the bellows 40 serves as a protection to the bellows 40 and limits its expansion.

A cone 51 is secured to the left hand end of bellows 40 to transmit movements of bellows 40 to a lever 53 which is pivoted at 54 on two ears 55 which may be formed as part of the frame 46. A stop 52 formed as part of the frame 46 cooperates with the lower end of lever 53 to prevent excessive compression of the bellows 40. Directly opposite the cone 51 with respect to lever 53 is a similar cone 58 which also bears upon lever 53 and transmits the force exerted by a spring 60 through lever 53 to the bellows 40. The spring 60 is held in place by a spring retainer 61 which carries the cone 58 and by a spring retainer 62 which is attached to the right hand end of an adjusting screw 65, the purpose of which is to be set forth hereinafter. A manual adjusting knob 67 is mounted on a shaft 68 which extends

through the panel 45. To the lower end of the shaft 68 is secured a gear wheel 70 which is adapted to cooperate with another gear wheel 72. Gear 72 consists of a plate having radial slots therein suitably spaced to cooperate with the teeth on the gear 70. A stop 73 on gear 72 cooperates with a stop 74 on the frame 46 to limit the movement of gear 72 and consequently the available range of adjustment. Gear 72 is pivoted in the frame 46 on a pin 77 and has rigidly attached thereto a cup shaped member 79 which also carries at its right hand end a nut 80. A screw 82 is carried in the nut 80 but is prevented from rotating with nut 80 by an arm 83 which extends through a slot 85 in the frame 46. The screw 65 which carries the spring retainer 62 is carried by the screw 82 and may be adjusted therein for the purpose of changing the tension on spring 60 to calibrate the device.

It will be seen from the arrangement of the parts that by turning the adjusting knob 67, gear 72 is correspondingly turned by gear 70 to angularly position the nut 80. The screw 82 is thereby moved to the right or left to position the left hand end of the spring 60.

In operation it will be seen that an increased pressure in the pipe 14 will be transmitted through the tube 12 to compress the bellows 16 and rotate the lever 19 about the knife edge 20 in a clockwise direction. The right hand end of the lever 19 will be lowered to compress the bellows 33 through the yoke 36 and force liquid out of the bellows into tube 41. From the tube 41 the liquid will be forced into the bellows 40 and result in an expansion thereof to move cone 51 to the left. The lever 53 will be rotated slightly in a clockwise direction and the spring 60 will be compressed. Thus spring 60 resists movement of the lever 19 so that the position of lever 19 will be determined by the force of spring 60 in combination with the pressure acting on the bellows 16. The pressure at which the mercury switch 25 will be actuated therefore depends on the adjustment of spring 60. Hence for each setting of the manual control knob 67 which determines the tension of the spring 60 there will be a corresponding pressure acting on bellows 16 which will actuate the mercury switch 25.

In order that the range of adjustment of the manual control knob 67 will be suitable to cover the range of adjustment desired, the adjusting screw 65 associated with the spring retainer 62 is provided. Thus if suitable indications are placed adjacent the knob 67, the knob may be set to indicate a certain temperature and screw 65 adjusted until the device actually controls at that temperature. Another adjusting screw 37 is provided between the lever 19 and the yoke 36, as previously mentioned. By means of this adjustment it is possible to adjust the relation between bellows 33, bellows 40, and the lever 19 so that the available range of movement of the bellows will cover the range of adjustment desired.

From the foregoing description it will be seen that a remote adjusting arrangement has been provided for a condition responsive device which may be located at any desired point with respect to the switch or other control means utilized. It will be understood that a temperature responsive element could be substituted for the pressure responsive bellows 16. Likewise, a humidity responsive element could serve as the condition responsive means. I am not to be limited by the

particular device described but only by the appended claims.

I claim as my invention:

1. In a condition responsive device, in combination, a first expansible envelope the pressure in which depends on the value of a variable condition, a pivoted lever a first portion of which is operatively connected to said envelope, control means adapted to be actuated by said lever on rotation thereof, a second expansible envelope the volume of which is changed by movements of said lever, said second expansible envelope being operatively connected to a second portion of said lever, a third expansible envelope, a tube connecting said second and third envelopes and a substantially noncompressible liquid filling said second and third envelopes and said tube, a spring tending to reduce the volume of said third envelope and manually operable means for adjusting the tension of said spring for adjusting the control point of the device.

2. In a remotely adjustable condition responsive controller, in combination, a condition responsive element, control means adapted to be actuated by said element, a first expansible envelope, a spring remotely located from said element and tending at all values of the condition to reduce the volume of said first envelope, a second expansible envelope adapted to control the effect of said condition responsive element on said control means, a flexible tube connecting said first and second envelopes, a first screw threaded means rotation of which adjusts the tension of said spring, and a second screw threaded means for varying the relationship between said first screw threaded means and said spring, thereby calibrating the setting of said first screw threaded means.

3. In a remotely adjustable condition responsive controller, in combination, a condition responsive element, control means adapted to be actuated by said element, a first expansible envelope, a spring remotely located from said element and tending at all values of the condition to reduce the volume of said first envelope, a second expansible envelope adapted to control the effect of said condition responsive element on said control means, a flexible tube connecting said first and second envelopes, an abutment for said spring having a screw threaded portion, a first nut cooperating with said screw threaded portion, means preventing rotation of said nut, and a second nut cooperating with external threads on said first nut, said second nut being manually rotatable to effect a longitudinal positioning of said first nut for varying the tension of said spring.

4. In a remotely adjustable condition responsive controller, in combination, a condition responsive element, control means adapted to be actuated by said element, a first expansible envelope, a spring remotely located from said element and tending at all values of the condition to reduce the volume of said first envelope, a pivoted lever extending between said first expansible envelope and said spring, said lever acting as a guiding abutment for both said first expansible envelope and said spring, a second expansible envelope adapted to control the effect of said condition responsive element on said control means, a flexible tube connecting said first and second envelopes, and manual means for adjusting the tension of said spring.

ALWIN B. NEWTON.