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THERMOSTATIC CONTROL DEVICES

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FIG. 1

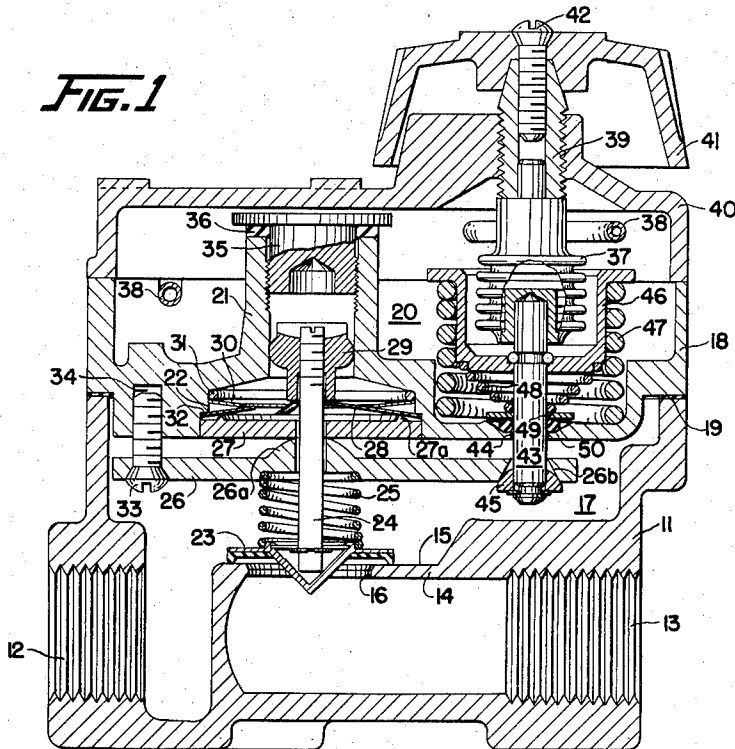


FIG. 2

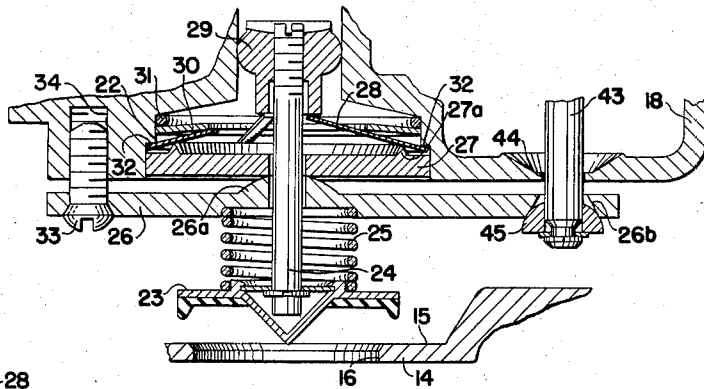
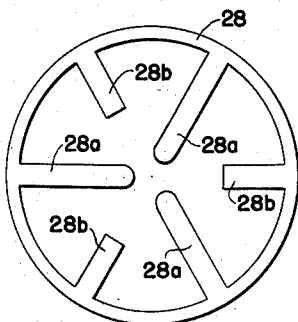


FIG. 3



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THERMOSTATIC CONTROL DEVICES

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5 Claims. (Cl. 236—48)

This invention relates to thermostatic control devices, and, more particularly, to a thermostatic snap-acting mechanism for a gas valve.

The overall structural details of the valve embodying this invention are quite similar to, but an improvement over, the thermostatic valve portion of the combination valve disclosed in the copending application of Courtland B. Currie and Roger S. Loveland, filed June 6, 1955 under Serial No. 513,188.

One of the difficulties in making a snap acting valve of very small size, lies in the mechanism for giving a substantial amount of movement to the valve head by a conventional snap disc.

One of the objects of this invention is to provide a very compact and inexpensive valve construction wherein the valve may be moved a substantial amount when a conventional snap disc is used as part of the snap acting mechanism for the valve.

Another object of the invention is to provide a very simple yet sturdy and reliable motion amplifying means usable with a conventional washer-shaped snap disc to move a control member such as a valve or switch.

A further object of the invention is to provide a motion amplifying means which will be self-compensating for the movement necessary to load the snap acting means so as to cause no movement of the member to be actuated thereby until the means snaps the member to its operating position.

Still other objects of the invention will become apparent upon reading the following description in conjunction with the accompanying drawing wherein:

Figure 1 is a vertical sectional view to the preferred embodiment of the invention;

Figure 2 is an enlarged view of the snap acting portion of the valve, showing the valve in its open position; and

Figure 3 is a plan view of the motion amplifying actuator for the valve.

While the invention is applicable to a switch or possibly some other type of control, the detailed description of the invention will be of the preferred modification, namely, an automatic gas valve.

The valve body consists of a lower casting 11 having an inlet 12, an outlet 13, and a dividing wall 14, which is finished off on the inlet side thereof to provide a flat valve seat portion 15 around an opening 16 through the wall. The casting 11 has a chamber 17, on the inlet side of the partition wall 14, that is open at its top, as viewed in Figure 1 of the drawing.

An intermediate casting 18 is sealingly secured to the casting 11 with a gasket 19 therebetween by means of bolts (not shown) passing through the casting 18 and screw threaded into threaded bores (not shown) in the casting 11.

The casting 18 has a recessed chamber 20 in the top thereof encircling an upwardly extending boss or sleeve portion 21. The lower end of the sleeve terminates

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in an enlarged bore portion 22 extending upwardly from the bottom surface of the casting 18.

A valve head 23 is positioned over the opening 16 and is adapted to sealingly engage the valve seat 15. It has a valve stem 24 that extends upwardly through a coiled compression spring 25, an opening through an actuating lever 26, an annular fulcrum member 27, a motion amplifying actuator 28, and is adjustably threaded into an abutment and guide member 29 at the upper end of the stem. The member 29 is positioned within the sleeve portion 21 in which it is vertically slidable.

A concave-convex, washer-shaped snap disc 30 is pivoted at its outer periphery on a ring pivot 31 at the inner end of the stepped bore 22 and bears at its inner edge against the motion amplifying member 28 intermediate the ends of a plurality of inwardly extending arms 28a and 28b on the member 28 (see Figure 3). The outer edge of the motion amplifying actuator 28 bears against a shoulder 32 of the stepped bore 22 while the inner ends of the arms 28a, which are preferably three in number, bear against the lower end of the abutment member 29 on the valve stem. An annular knife-edged pivot rib 27a on the movable annular fulcrum 27 engages the arms 28a and 28b between their outer ends and the point at which the snap disc engages them. The lever 26 is pivoted at its left-hand end on an adjustable screw pivot 33 that is threaded into a bore 34 in the casting 18. The lever has an upwardly extending arcuate portion 26a that serves as a movable fulcrum for actuating the fulcrum disc 27 in response to movement of the other end of the lever 26.

As thus far described, the valve 23 is held in its closed position by means of the compression spring 25 positioned between the lever 26 and the valve head 23, the snap disc 30 being sufficiently strong, if free to do so, as to overcome the bias of the spring 25 and to hold the actuator arms 28a down sufficiently far as to free the valve 23 to move to its closed position. The arms 28a may even be out of engagement with the lower end of the abutment member 29 on occasions, depending upon the adjustment of the abutment member 29 on the stem 24 and the extent of movement of the lever 26.

The position of the abutment member 29 on the stem 24 may be varied by the use of a spanner wrench type of tool to hold the abutment 29 while the stem 24 is adjusted by a conventional screwdriver relative to the abutment member. A threaded plug 35 seals the open end of the tube 21 by clamping a washer 36 between the head of the plug and the end of the sleeve portion 21.

The valve is adapted to be moved to its open position by means of a bellows 37 connected through a capillary tube 38 to a bulb (not shown) that senses the temperature of a space the temperature of which is to be controlled by the burning of gas that passes through the valve being described. The upper end of the bellows has a swivel connection with an adjustable sleeve abutment member 39 that is screw threaded through the cover casting 40. The cover is bolted to the valve casting 18 by means of bolts passing through the cover 40 and screw threaded into threaded bores (not shown) in the casting 18. The handle 41 is adjustably clamped to the abutment member 39 by means of a bolt 42. The lower end of the bellows 37 has a socket therein which receives an actuating pin 43 that extends through an aperture 44 in the bottom of the casting 18 and through an aperture 26b of the lever 26. A semispherical head portion 45 is secured to the lower end of the pin 43 to provide a pivot between the pin and the lever 26. A cup-shaped abutment member surrounds the pin 43 intermediate its end and is anchored to the pin 43 by means of an O-ring positioned in an annular groove in the pin 43. A coiled spring 47 extends between the upper end of the member 46 and the inner

surface of the casting 18 to cause the pin and the lever 26 to follow the movement of the bellows 37. A lighter helical spring 48 extends between the lower end of the abutment member 46 and a washer 49 that holds a sealing ring 50 against the stem 43 and the casting 18 around the opening 44, to prevent the leakage of gas along the pin 43 through the opening 44.

Operation

The elements of the invention are shown in Figure 1 as being in the positions they would assume when the bulb connected to the bellows 37 is at or above the temperature desired.

Upon a drop in temperature the spring 47 causes upward movement of the lower end of the bellows 37 to pivot the lever 26 about the fixed pivot 33 and thus cause lifting of the movable fulcrum member 27. As the member 27 starts to move upwardly, the motion amplifying member 28 will be pivoted about the fixed pivot shoulder 32, which will tend to raise the inner edge of the snap disc or washer 30. However, due to the fact that the arms 28a and 28b are resilient, the portion of the arms between the inner edge of the snap washer and the shoulder 32 will bend so that the amount that the inner ends of the arms 28a would move, were it not for the snap washer, will be compensated for by the arms 28b tending to pivot about the inner edge of the snap washer causing the inner ends of the arms to move downwardly as much as it would have moved upwardly in the absence of a snap disc. It is thus seen that upward movement of the member 27 in response to contraction of the bellows will not cause the valve to be opened until the snap washer moves over center with a snap motion and thus relieves a portion of the loading on the arms 28a and 28b to permit the inner ends of the arms 28a to force the abutment member 29 and the valve head upwardly with a snap action. The valve is shown in its open position in Figure 2 of the drawing. The short arms 28b help to distribute the loading of the snap disc around its periphery to improve its operation and to reduce the stress that would otherwise fall on the arms 28a.

It will be noted that the distance that the valve moves is approximately three times as much as the amount of movement of the inner edge of the snap washer, which provides full flow capacity for the valve and still permits the use of a relatively small snap disc or washer. It is thus seen that this arrangement of parts provides a snap acting movement of the valve that heretofore has required a much larger and a much more expensive arrangement of mechanical parts.

Upon the room or the space surrounding the bulb reaching a satisfied condition, the bellows will be expanded causing the stem 43 to move downwardly and to tend to move the head 45 away from the right-hand end of the lever 26. However, as the snap washer 30 is of the type that returns to its initial position once the loading has been removed therefrom, the arms 28 will be lowered by the snap disc as the fulcrum member 27 moves downwardly, following the movement of the lever 26 under the bias of the snap disc, until the point is reached where the snap washer will snap over center and assume the position that it had just prior to snapping open. This causes the valve to move only a slight distance towards its closed position before it will be snapped completely closed by the snap disc. The amount of movement of the member 27 after the valve has snapped closed, depends upon how much the bulb and bellows temperature responsive unit is heated above the control point, due to the heat stored up in the heating plant in which the gas is burned. It is immaterial, however, how much additional movement is imparted to the arms 28 by the bellows inasmuch as the closing of the valve has already been accomplished

by the coil spring 25 causing the valve to close once the loading of the snap disc has been removed.

The calibration of the valve may be varied by varying the position of the abutment member 29 on the stem 24 while the temperature setting or control point at which the valve opens and closes may be varied by rotating the handle 41 to vary the position of the fixed end of the bellows.

While I have described the preferred embodiment of the invention above, it is to be understood that various mechanical changes may be made therein without departing from the spirit thereof. Therefore, the scope of the invention is to be determined solely from the appended claims.

I claim:

1. A control device comprising a control member having an actuating stem thereon, an annular abutment on said stem, a washer-shaped actuator for said control member being pivoted at its outer edge on a fixed pivot and having a plurality of radially and inwardly extending tines with their inner ends positioned adjacent to said abutment for engagement therewith, a washer-shaped snap-disc positioned coaxially of and adjacent to said actuator, the inner edge of said snap disc engaging said tines intermediate their ends and the outer edge thereof being pivoted on a fixed pivot, and condition responsive means engaging said actuator between its outer edge and the inner edge of said snap-disc for snapping said control member between its different control positions.

2. A control device comprising a control member, an abutment on said member, a washer-shaped actuator for said control member being pivoted at its outer edge on a fixed pivot and having a radially and inwardly extending tine positioned adjacent to said abutment for actuating the same, a snap-disc positioned adjacent to said actuator, an inner edge of said snap disc engaging said tine intermediate its ends and the outer edge thereof being pivoted on a fixed pivot, and condition responsive means engaging said actuator between its outer edge and the inner edge of said snap-disc for snapping said control member between its different control positions.

3. A valve comprising a valve body having a valve seat therein, a valve head normally biased into engagement with said seat, a ring-shaped actuator for said valve having a plurality of radially extending arms thereon, the ring portion being pivoted on a fixed pivot and the free ends of the arms being positioned to engage said valve head to actuate it, a washer-shaped snap-disc having one of its edges pivoted on a fixed pivot and the other of its edges being positioned to engage said actuator arms intermediate their ends, and a condition responsive means having a movable fulcrum arranged to engage said arms between the other edge of said snap-disc and the fixed fulcrum for said actuator.

4. A valve comprising a valve body having a valve seat therein, a valve head normally biased into engagement with said seat, a ring-shaped actuator for said valve having a plurality of radially extending and alternately unequal length arms thereon, the ring portion being pivoted on a fixed pivot and the free ends of the longer arms being positioned to engage said valve head to actuate it, a washer-shaped snap-disc having one of its edges pivoted on a fixed pivot and the other of its edges being positioned to engage said actuator arms intermediate their ends, and a condition responsive means having a movable fulcrum arranged to engage said arms between said other edge of said snap-disc and the fixed fulcrum for said actuator.

5. A valve comprising a valve body having a valve seat therein, a valve head normally biased into engagement with said seat, a ring-shaped actuator for said valve having a radially extending arm thereon, the ring portion being pivoted on a fixed pivot and the free end of the arm being positioned to engage said valve head to

actuate it, a washer-shaped snap-disc having one of its edges pivoted on a fixed pivot and the other of its edges being positioned to engage said actuator arm intermediate its ends, and a condition responsive means having a movable fulcrum arranged to engage said arm between the other edge of said snap-disc and the fixed fulcrum for said actuator.

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