My invention relates generally to thermostatically controlled valves, and particularly to a thermostatically controlled valve especially adapted for use on individual units in refrigeration systems containing several units to be refrigerated to different temperatures, and more particularly to a snap-action two temperature valve of this character, enabling independent control of the individual units according to their particular requirements.

Another important object of my invention is to provide a two-temperature thermostatic snap action valve of the character indicated above which has broad range and differential action whereby the same is efficiently usable with SO₂, with methyl or freon gases without changing the adjustment thereof except when extreme temperatures are utilized, and then only in the case of employment of SO₂ gas, change of adjustment being usually not required when methyl or freon gas is employed.

Other important objects of my invention will be apparent from a reading of the following description taken in connection with the drawings, wherein for purposes of illustration I have shown a preferred embodiment of my invention.

In the drawings:

Figure 1 is a general longitudinal vertical sectional view taken through an embodiment of my invention.

Figure 2 is a horizontal sectional view taken through Figure 1 approximately on the line 2—2 and looking downwardly in the direction of the arrows.

Figure 3 is a horizontal sectional view taken through Figure 1 approximately on the line 3—3 and looking upwardly in the direction of the arrows.

Ordinarily where two or more individual refrigerating units such as a storage box, a display case, a florist's box, and an ice cream cabinet are utilized in one store or other place, it is necessary to provide a separate compressor for each of these units because the temperature range of each unit is much different from that of the others. The trouble and expense incident to such an arrangement are obvious.

The present invention makes it convenient and practical to operate a plurality of the units mentioned by a single compressor, by providing an individual valve in accordance with the present invention for each unit which operates at a temperature higher than any low temperature for which the system or any part thereof has been set.

Referring in detail to the drawings, the numeral 5 generally designates the closed generally rectangular casing which is to be located outside of each region or individual unit to be refrigerated and whose temperature is to be controlled, and from the top of the casing 5 leads the capillary tube 6 which terminates in the bulb 7 which is to be located within the refrigerated area.

The opposite end of the capillary tube 6 enters the top of the casing 5 and terminates in the upper end of the bellows 8 which has attached to its bottom theslide shaft 9 which works through a bearing 10 in the bottom of a protective housing 11 which is fastened as indicated by the numeral 12 to the underside of the top of the casing 5. The bellows 8 is responsive to changes of temperature in the liquid contents of the thermostatic bulb 7 in the usual manner.

A transverse shaft 13 is mounted in respective bearings 14 and 15 in the opposite side walls of the casing 5 and this shaft forms the pivot for the lever 16 which has the short arm 17 and the long arm 18, the long arm 18 having an opening 19 near the pivotal point 13 in which the lower end of the slide shaft 9 is pivoted as indicated by the numeral 20 for connection with the lever 16. The outer end of the short arm 17 is connected as indicated by the numeral 21 to the upper end of an inverted U-shaped standard 22 which is made up of two legs clamped together by a bolt 23. The legs have on their inner side at their lower ends knobs 24.

A second shaft 24 and a third shaft 25 extend between the sides of the casing 5 and are mounted in respective bearings 26, 27 and 28 as shown in Figure 2, and these shafts are in approximately the same horizontal plane. Pivoted mounted on the shaft 24 between spacers 30 and 31 on the shaft 24 are the legs of the U-shaped lever 32, and the extremities of these have holes therein pivotally receiving the knobs 45 of the standard 22. Pivoted on the shaft 25 between spacers 33 and 34 is the narrower U-shaped lever 35 which is pivoted near its bight on the shaft 25 and has slotted cross-heads 36 whose slots are slidable engaged with the shaft 24 between the legs of the U-shaped lever 32. A spring guiding rod 37 is slidable through an opening 38 in the bight of the lever 32 and has its opposite end pivoted as indicated by the numeral 40 to and between lugs on the middle of the heads 36 of the lever 35, and a helical spring 41 is interposed between the bifurcation 39 and the bight of the lever 32 and acts as an expanding spring to snap the lever 35 to either side of center position.
The needle valve 43 has a point 44 adapted to seat in the needle valve seat 45 to close fluid passage through the seat, and the upper end of the needle valve 43 is pivoted as indicated by the numeral 48 on a pin 47 which is carried by and between the arms of the narrow lever 38. A pipe 49 leads to the valve from the cooling coil of the system and is connected to the nipple 50 which leads to the valve seat 45. A second pipe 51 is connected to the nipple 52 which opens into the interior of the bottom of the casing 5, the pipe 51 being connected to the suction side of the compressor.

For adjusting the action of the lever 16 in response to the thermostatically controlled bellows 8 there are provided the adjusting spring assemblies which are respectively designated 53 and 54. Each consists of a respective rod 54, 55 on which is circumposed a respective spring 56, 57 which operates in an expanding manner between the upper and lower sides of the long arm 18 of the lever 16 and the respective heads 58 and 59 of the adjustable sleeves 60 and 61 which are threaded in the nipples 62, 63 which project from the top and bottom, respectively, of the casing 5 and are respectively closed by caps 64 and 65. The lower spring 57 is adjusted to a higher tension than the upper spring 56 because the lower spring has the work of collapsing the bellows 8.

In this connection it is pointed out that the thermostatically operated bellows 8 acts more quickly under a rise in temperature than it does under a drop in temperature, and for this reason requires the extra tension in the lower spring 57 which is also provided to increase the speed and snap of the valve mechanism on the closing action thereof. The sleeves 60 and 61 are adjustable to an extent which permits adjustment of the springs 56 and 57 to provide for a broad range and differential.

When a higher than desired temperature affects the bulb 7 the thermostatic bellows 8 expands and pushes the long arm 18 of the lever 16 downwardly so as to cause the short arm 17 of the lever to pull upwardly until the inner ends of the levers 32 and 35 reach approximate longitudinal extension of each other or get past center of pins 24 and 25 whereupon the snapping spring 41 will over-balance in an upward direction by help of spring 56 and the needle 43 will be snapped into open position with respect to the seat 45. When the temperature within the refrigerated space drops to the desired level the bellows 8 will contract and by the help of spring 57 pull the long arm 18 of the lever 16 upwardly and thereby push the short arm downwardly because 57 is stronger than 56 to a point where the snapping spring 41 will snap to the opposite side of the position above described and snap the needle 43 into seat and thereby close the valve. The spring adjusting means 53 and 54 are to be adjusted for the temperatures desired.

Although I have shown and described herein a preferred embodiment of my invention, it is to be definitely understood that I do not desire to limit the application of the invention thereto, and any change or changes may be made in the materials, and in the structure, of the parts, within the spirit of the invention and the scope of the subjoined claims.

What is claimed is:

1. In combination, a lever swingably supported between its ends, means for actuating said lever, said means being connected to one arm of said lever whereby said lever may be moved in either of two directions on its pivotal point, a valve operatively connected to the remaining arm of said lever on the opposite side of said pivotal point, and oppositely acting individually adjustable spring means engaged with the said remaining arm of the lever for predetermining the force required to be exerted by said actuating means.

2. In combination, a lever swingably supported between its ends, means for actuating said lever, said means being connected to one arm of said lever whereby said lever may be moved in either of two directions on its pivotal point, a valve operatively connected to the remaining arm of said lever on the opposite side of said pivotal point, and oppositely acting individually adjustable spring means engaged with the said remaining arm of the lever for predetermining the force required to be exerted by said actuating means, snap-action means operatively connecting said remaining arm of the lever and said valve.

3. In combination, a lever swingably supported between its ends, means for actuating said lever, said means being connected to one arm of said lever whereby said lever may be moved in either of two directions on its pivotal point, a valve operatively connected to the remaining arm of said lever on the opposite side of said pivotal point, and oppositely acting individually adjustable spring means engaged with the said remaining arm of the lever for predetermining the force required to be exerted by said actuating means, said individually adjustable spring means comprising rods supported to project from points on opposite sides of said one arm of the lever and pass through accommodating openings formed in the lever, adjustable stops on the laterally outward ends of said rods, and helical springs circumposed on the rods and expanding between the lever and the adjustable stops.