

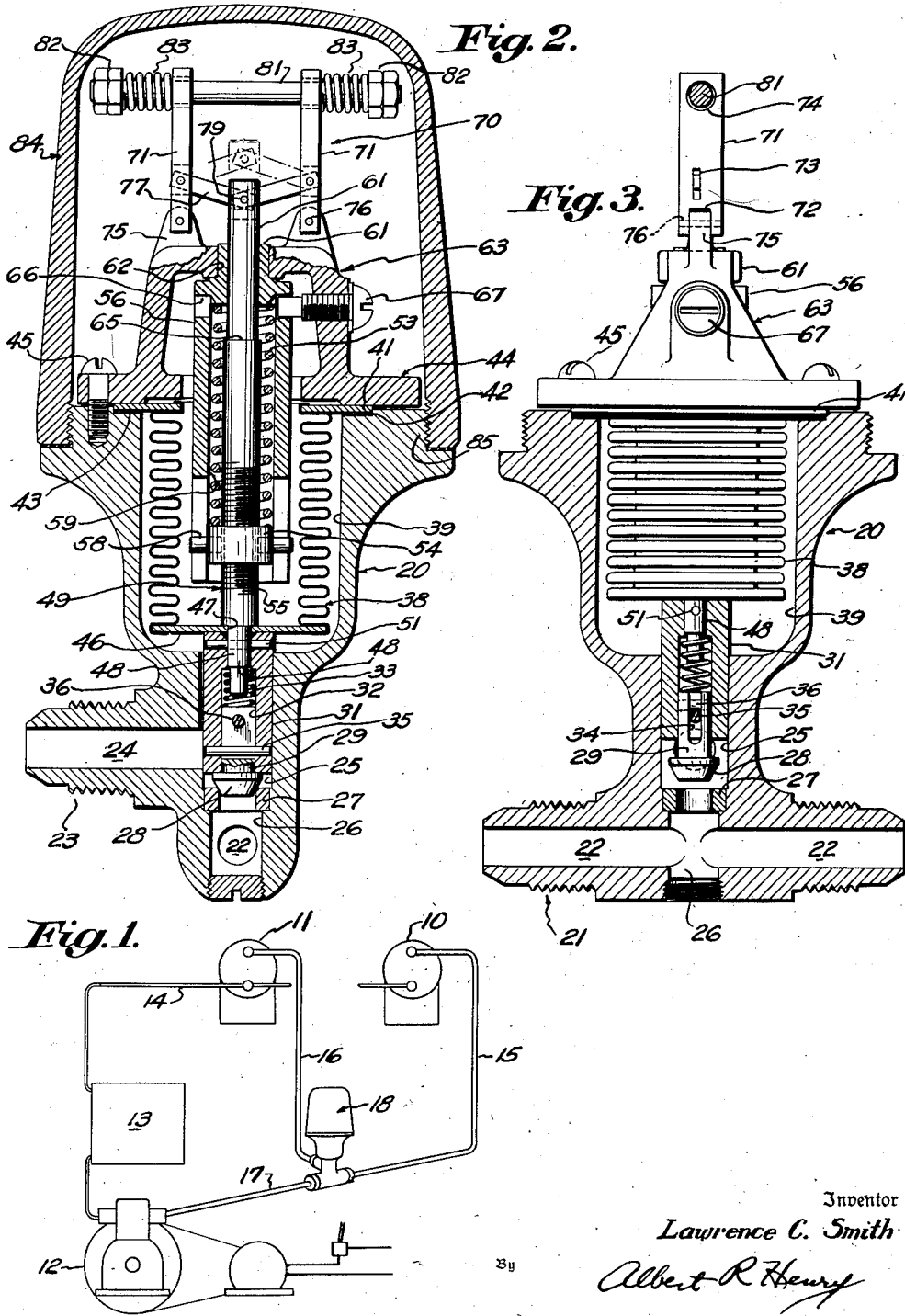
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SNAP ACTION VALVE

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SNAP ACTION VALVE

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This invention relates to pressure control devices for refrigeration systems, and it has particular reference to a valve for controlling the application of suction pressures to evaporators. The invention provides novel and effective adjustable means permitting maximum pressure adjustments over a wide range, and also a low pressure variable adjustment at any point in the high pressure range of adjustment. The structural features of the invention are more specifically set forth in the appended description and drawing wherein:

Fig. 1 discloses a diagrammatic refrigeration circuit of the multiple type wherein is included the valve of the present invention;

Fig. 2 is a vertical section of the valve with the valve in closed position;

Fig. 3 is a side elevation of the valve shown in Fig. 2, with the body shown in section and the housing removed.

The valve is primarily utilized to control the low or suction pressures in one or more evaporators in a refrigeration system. In Fig. 1, for example, evaporators 10 and 11 are connected in series in a refrigerant circuit and they receive refrigerant from a compressor 12 and condenser 13 through an input conduit 14. The expended refrigerant is removed through outlet or suction conduits 15 and 16, respectively, for return to the suction or input side of the compressor 12 through a common return conduit 17, with which the conduits 15 and 16 communicate.

In such circuits it is often desired to maintain the evaporators at different operating temperatures. For example, the evaporator 10 may be part of an ice maker with a maximum desired temperature of 14° F., while the evaporator 11 may be utilized in a domestic box with a maximum desired temperature of 45° F. The use of a compressor capable of providing the corresponding suction pressure for the evaporator 10 would permit direct coupling therebetween, while the evaporator 11 would require a suction pressure control to maintain the desired higher pressures therein. The present control valve 18, as exemplified in Fig. 1, provides, in its structure, fittings for obtaining a direct connection between the suction conduits 15 and 17, and a pressure control mechanism for controlling the communication between the conduits 16 and 17, to the end that the different temperatures may be obtained with one compressor.

The valve 18 is provided with a body 20 which is formed at its lower extremity with an integral T fitting 21 having a passage 22 therethrough,

and threaded at both extremities to afford connection with the conduits 16 and 17. A second fitting 23 also forms part of the body 20 and it is axially spaced from the fitting 21 and is formed with a radial passage 24 and a threaded extremity for connection with the conduit 15.

Fluid communication between the fittings is provided by an axial valve chamber 25 drilled in the body 20, and a communicating drilled hole 26. A valve seat 27 is pressed into the chamber 25 in a position interposed between the passages 22 and 24 and it is adapted to receive a valve 28 which is formed with a stem 29 of reduced diameter.

A valve guide 31 is mounted in the chamber 25 and it is formed with an axial hole 32 for receiving the valve stem 29 for limited axial movement. Referring to Fig. 2, it will be observed that the valve 28 in seated position is engaged by the lower face of the guide 31, while in unseated position the valve is axially moved from the guide 31 by a spring 33 mounted within the hole 32. A stop structure is provided to limit the relative movement between the guide and valve by slotting the valve stem 29 as indicated by the numeral 34, to straddle a pin 35 diametrically secured in the guide 31. A stop pin 36 is mounted across the slot 34 adjacent the extremity of the stem 29 and it is engageable with the pin 35 as shown in Fig. 3.

The movement of the valve guide 31, and thus the seating of the valve 28, is effected by the action of a bellows 38 which is responsive to pressure variations in the passage 24, and whose action is further modified by adjustable spring means hereinafter described. The bellows 38 is mounted within an open chamber 39, formed in the body 20, and it is provided with an annular flange 41 at its upper extremity which is mounted in a shouldered portion 42 of the body, and, together with a sealing gasket 43, it is clamped to the portion 42 by a clamping ring 44. The ring, in turn, is secured to the body 20 by screws 45. The lower end of the bellows 38 is closed by a head plate 46 which contains a central hole 47 for receiving the shouldered end 48 of an axially disposed rod 49. The rod end is soldered to the plate 46 and is received in the valve guide 31 and secured thereto by a pin 51.

A tension load is applied to the bellows 38 by a spring 53 which is disposed about the rod 49 and which engages a nut 54 mounted in a threaded portion 55 of the rod. The nut 54 is adjusted by a rotatable sleeve 56 which at its lower end is devised with a keyed connection with

the nut comprising opposed slots 57 cut therein for receiving pins 58 secured to the nut 54. The interior of the sleeve is formed with a chamber 59 which receives the spring 53 while its upper end is formed with a shouldered pilot 61 which is mounted in a bearing 62 of a bracket 63 forming part of the clamping ring 44. The pilot 61 is axially drilled to receive slidably the upper end 64 of the rod 49 which is slightly reduced in diameter to form a stop shoulder 65 thereon for engagement with the upper wall of the chamber 59. Radial holes 66 are drilled in the sleeve 56 to permit either adjustment by a suitable tool or the locking thereof by a screw 67 which is secured to the bracket 63.

A snap action mechanism 70 may, if desired, be added to the described structure to insure rapid opening movement of the valve 28. The device herein shown comprises a pair of upright arms 71 each formed with a notch 72 at its lower end, a slot 73 adjacent thereto, and a hole 74 near its upper extremity. The notch 72 forms part of a pivotal connection for the arm by straddling a bearing lug 75 formed on the bracket 63, such connection being completed by a pivot pin 76 which passes through the arm and lug 75. Each slot 73 receives one extremity of a fulcrum link 77 and a pin provides a pivotal connection therebetween. The opposite ends of the links 77 are received in a slot 78 formed in the upper extremity of the rod 49 and a pivotal connection is provided at this point by a pin 79.

The tensioning means for the snap action mechanism 70 consists of a rod 81 mounted loosely in the aligned holes 74 of the arms 71 and threaded at each extremity to receive adjusting nuts 82. Coil springs 83 are mounted on the rod 81 between each arm 71 and nuts 82, and the degree of compression of the springs may be adjusted through the nuts 82 to apply a definite maximum load on the links 77.

It will be observed that the valve and bellows and associated spring mechanisms are organized as a connected unit with the clamping ring 44, and such unit is removable from the body 20 after disengaging the screws 45. The exposed portions of the unit are enclosed by a removable housing 84 which is secured to the threaded flange 85 of the body 20.

In operation, assuming the pressures in the evaporator 11 were desired to be maintained between 15 and 27 pounds gage (using methyl chloride), then the springs 53 and 83 would be adjusted to permit contraction of the bellows 38 under the predetermined maximum of 27 pounds per square inch. During initial contraction of the bellows, the valve 28 is retained on its seat 27 through the lost motion connection with the valve guide 31 until such time as the links 77 of the snap action mechanism are in a dead center position. Subsequent to this, the further upward movement of the bellows 38 and accompanying rod 49 causes the reversal of direction of the load application of the springs 83, which then aid in lifting the valve to an open position. The valve is thereupon "snapped" open, and any shock or jar is absorbed by the shoulder 65 abutting the end of the chamber 59.

After the evaporator has been evacuated to the suction pressure of 15 pounds per square inch, the pressure on the bellows 38 is reduced sufficiently to permit the spring 53 to overcome the springs 83 and thus to seat the valve. During the seating operation the valve is first seated when the load of the springs is neutralized by the dead center positioning of the links 77. The subsequent rapid downward movement of the bellows assembly under the additional aid of the springs 83 will simply seat the valve more firmly, the load thereof being received on the shouldered connection between the valve 28 and the valve guide 31.

From the foregoing description, it will be observed that the auxiliary movement of the valve by its spring 33 fully protects the valve against violent closing movement and the attendant damage to valve and seat.

In adjusting the springs 83 and 53, the nuts 82 and the sleeve 56 are fully exposed for manipulation upon removal of the housing 84, and the valve may be adjusted to the proper degree of spring differential with the greatest facility.

I claim.

1. A pressure control device comprising a body, a valve seat therein, a valve thereon, a fluid inlet on one side of the seat, a fluid outlet on the remaining side of the seat, an open chamber in the body communicating with said inlet, a cylindrical bellows extending into the chamber and secured to the body to seal the chamber at the open end thereof, said bellows being connected to said valve, a rod extending into the bellows and secured thereto, said rod having a threaded portion within the bellows, a nut on the threaded portion, a sleeve encompassing said rod and slidably keyed to the nut at one extremity and formed with a pilot bearing at its opposite extremity, a spring disposed about said rod and extending between said nut and said pilot bearing, and a bracket secured to the body and formed with a bearing for rotatably receiving the sleeve pilot, said bracket being formed with openings for exposing said sleeve for adjustment thereof.

2. A valve comprising a body formed with inlet and outlet openings, a valve seat between said openings, a valve for said seat, said valve being formed with an upwardly extending stem, said body being formed with an upwardly extending portion providing a chamber around said stem, a bellows secured to said chamber and encircling the valve stem, a passage between said chamber and one of said openings whereby the bellows may be subjected to varying fluid pressures transmitted to said chamber, a bracket member disposed above the valve body and chamber, a sleeve within the bellows, said sleeve being rotatably mounted in said bracket, a nut on the valve stem having a keyed connection with the sleeve, a spring within the sleeve and bearing against said nut, means on the bracket for securing the sleeve in an adjusted position, and snap action mechanism mounted on the bracket and said stem for effecting rapid movement of said stem.

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