

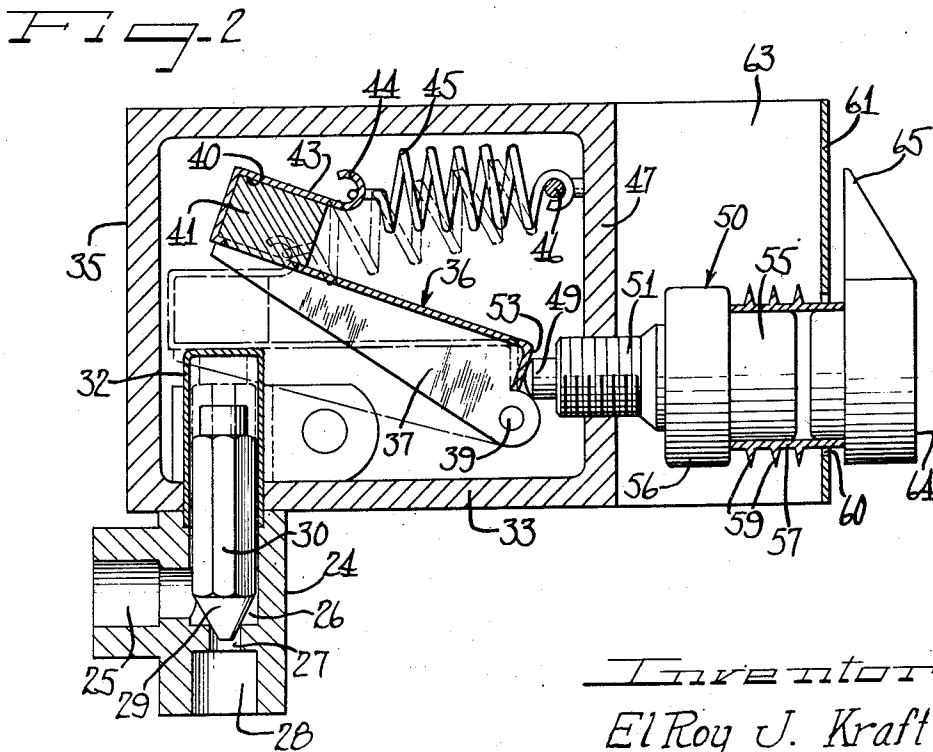
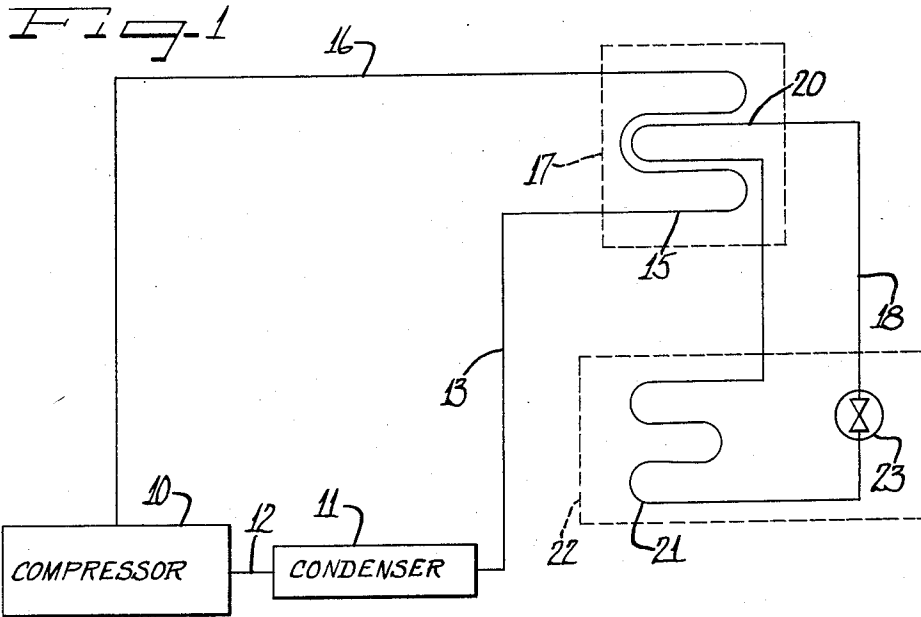
Feb. 19, 1957

EL ROY J. KRAFT

2,781,979

THERMO-MAGNETIC REFRIGERANT VALVE

Filed July 13, 1955



Inventor
El Roy J. Kraft

By Hill, Sherman, Morris, Chas. S. Hitt

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THERMO-MAGNETIC REFRIGERANT VALVE

El Roy J. Kraft, Des Plaines, Ill., assignor to The Dole Valve Company, Chicago, Ill., a corporation of Illinois

Application July 13, 1955, Serial No. 521,749

6 Claims. (Cl. 236—48)

This invention relates to improvements in refrigerant valves particularly adapted to control the temperature of the high temperature compartment of a dual refrigerating system.

A principal object of the invention is to provide a simple and efficient thermostatic valve controlling the flow of refrigerant in the secondary refrigerant line of a dual temperature refrigerating system in accordance with the temperature of the high temperature refrigerating compartment.

Another object of the invention is to provide a new and improved form of thermo-magnetic valve particularly adapted to control the temperature of the high temperature compartment of a dual temperature refrigerating system.

A further object of the invention is to provide a refrigerant control valve in which a thermal element is located in a position subject to the temperature of a compartment being cooled and controls the flow of refrigerant through the compartment in accordance with the temperature thereof.

A further object of the invention is to provide a valve for controlling the flow of refrigerant through the evaporator of a refrigerant line to effect a uniform temperature in the compartment being refrigerated, and operated by a power type of thermal element having an extensible piston moving a magnetic field in position to envelope the valve and effect opening thereof.

Another and more detailed object of the invention is to provide a refrigerant control valve for the secondary refrigerant loop of a dual temperature refrigerating system in which the valve is in the form of an armature actuated to an open position by a magnet biased in a direction to permit closing of the valve, and moved in a direction to envelope the valve with its magnetic field by the extensible plunger of a power type thermal element adapted to be positioned in the flow of air through the secondary refrigerating compartment of the refrigerating system.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawing wherein:

Figure 1 is a circuit diagram of a dual temperature refrigerating system diagrammatically showing a thermostatically operated control valve in the secondary refrigerant line for the high temperature refrigerating compartment; and

Figure 2 is a longitudinal sectional view taken through a thermo-magnetic refrigerant valve constructed in accordance with my invention.

In Figure 1 of the drawing, I have shown a typical dual temperature refrigerating system of the thermal syphon type in which a motor driven compressor 10 serves to compress a suitable refrigerant, such as Freon or a like gas and supply the same to a condenser 11 through a pressure line 12. From the condenser, the refrigerant condensed to a liquid may pass through a

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capillary tube 13 to and through an evaporator or cooling coil 15 where heat is absorbed. The refrigerant then passes through a return line 16 back to the compressor, as is usual in closed circuit refrigerating system used for domestic purposes.

The evaporator 15 is in association with a low temperature refrigerating compartment 17, for maintaining said compartment at a desired low temperature, as for example, 10° below zero F.

A secondary refrigerant loop 20 is shown as being in heat exchange relation with respect to the evaporator 15 and has an evaporator 21 associated therewith which may be located in a secondary refrigerating compartment 22 of the refrigerator for maintaining said compartment at a higher temperature than the temperature of the compartment 17, as for example 40° F.

Located in the secondary refrigerating compartment 22 and connected in a refrigerant line 18 leading to the evaporator 21 is a control valve 23 for controlling the flow of refrigerant through the secondary refrigerant loop in accordance with the need for refrigeration in the secondary refrigerating compartment 22.

The control valve 23 as shown in Figure 2 includes a valve body 24 having an inlet 25 leading into a chamber 26 in said valve body and having a reduced diameter port 27 leading to an outlet 28. The port 27 is shown as being engaged by a valve 29 on the lower end of an armature 30, and formed integrally therewith.

The armature 30 is shown as being slidably guided in the valve chamber 26 and in a guide and closure member 32, seated in the valve body 24 and extending upwardly through a wall 33 of a housing 35 for a magnetic actuator 36.

As herein shown, the armature 30 and valve 29 drop by gravity to close the port 27 and block the flow of refrigerant through the secondary refrigerant loop 20, and move out of engagement with the port 27 upon the envelopment of the armature 30 with the magnetic field of the magnetic actuator 36.

The magnetic actuator 36 is shown as comprising a lever arm 37 pivoted within the housing 35 on a transverse pivot pin 39, which may be mounted in the walls of said housing. The lever arm 37 is shown as extending over the guide and closure member 32 and as having a rectangular recess or receptacle 40 at its free end, carrying a magnet 41.

The magnet 41 is herein shown as being a bar, rectangular in cross-section and may be made from Alnico, Permalloy or a steel having high remanence and coercive force and containing high percentages of tungsten or cobalt.

The arm 37 has a portion 43, the inner margin of which defines the outer margin of the recess 40, which extends inwardly beyond the magnet 41 and has an upwardly and inturned end 44, forming a hook, and shown as having a tension spring 45 hooked thereto. The opposite end of the tension spring 45 from the hook 44 is shown as being hooked to a U-bolt 46 secured to and extending inwardly from a wall 47 of the casing 35. The spring 45 thus biases the lever 37 and magnet 41 in the upright position shown in Figure 2 with the magnetic field of the magnet out of enveloping relation with the armature 30.

The magnet 41 is moved against the bias of the spring 45 into enveloping relation with respect to the armature 30 by means of a piston 49 of a thermal element 50. The thermal element 50 is shown as having a cylinder 51 threaded within the wall 47 and positioning the piston 49 to engage a shoulder 53 of the lever 37, for pivoting said lever against the bias of the spring 45 toward the guide and closure member 32.

The thermal element 50 may be a so-called power type

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of thermal element, such as is shown and described in the Vernet Patent No. 2,368,181, dated January 30, 1945, and frequently referred to as a "Vernay" thermal element. In such types of thermal elements, a fusible material (not shown) is carried in the casing 55 of the thermal element and acts against a membrane or a deformable member (not shown), to extend the piston 49 from the cylinder 51 upon a sufficient rise in temperature to effect fusion of the fusible material. The fusible material is selected for its temperature of fusion and may be of various forms and materials. The casing 55 is encircled by a metal ring 56, which may be suitably secured thereto and forms a heat conductor for said casing.

A sleeve 57 is shown as encircling the casing 55 and as being secured thereto for turning the same upon turning movement of said sleeve. The sleeve 57 is shown as having spaced radiating fins 59 extending thereabout, and as extending through an opening 60 formed in a wall 61 spaced outwardly from the wall 47 and secured to the wall 47 as by a side wall 63. A knob 64 is shown as being secured to the sleeve 57 for turning the same. The knob 64 has an indicator or pointer 65 extending therefrom which may cooperate with indicia (not shown), which may be on the outer face of the wall 61, to indicate the temperature setting of the thermal element.

The temperature at which the thermal element 50 moves the lever arm 37 and magnet 41 in position to effect opening of the valve 29 may be varied by varying the travel of the piston 49 necessary to move the lever 37 and magnet 41 from the upwardly extending position shown in Figure 2 to the downwardly extended broken line position shown in this figure. This is attained by turning of the entire thermal element with respect to the wall 47 and varying the position of the cylinder with respect to the shoulder 53.

The housing 35 may be located in the secondary refrigerating compartment in such a position as to place the thermal element 50 in the path of cold air circulated through the high temperature chamber, commonly called the 40° chamber. When the temperature of the secondary refrigerating compartment is above the temperature setting of the thermal element 50, the piston 49 will move outwardly along the cylinder 51, pivoting the lever arm 36 downwardly toward the cap 32 and moving the magnet 41 against the top of said cap. The armature 30 will then be enveloped in the magnetic field of the magnet and will rise to the top of the guide and closure member 32, opening the valve 29 and permitting the circulation of refrigerant from the inlet 25 out through the outlet 28 and through the secondary refrigerant loop.

As the temperature in the secondary refrigerating compartment becomes colder, the piston 49 will be retractably moved within the cylinder 51 by the spring 45. The spring 45 will also move the magnet 41 away from the armature 30 until the magnetic field becomes so weak that the armature 30 will drop to engage the valve 29 with the port 27 and block the flow of refrigerant through the secondary refrigerant loop.

While I have herein shown and described one form in which my invention may be embodied, it should be understood that I do not wish to be limited to the specific form shown, but that various modifications and variations of the invention may be effected without departing from the spirit and scope of the novel concepts thereof.

I claim as my invention:

1. In a refrigerant shut-off valve particularly adapted to shut-off the flow of refrigerant in a secondary refrigerant loop of a dual temperature refrigerator, a valve body having a central valve chamber, an inlet leading into said chamber and an outlet leading therefrom, a metallic valve biased by gravity to block the passage of refrigerant from said inlet to said outlet, a housing extending from said valve body and having said valve movable therein, an arm pivotally mounted in said casing for movement toward and from said valve, at least an outer portion of which is magnetic, a thermal element having a cylinder extend-

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ing within said housing, a casing on the outside of said housing and a piston extensible from said cylinder into engagement with said arm upon predetermined rises in temperature, for moving said arm toward said valve to envelope said valve with the magnetic field of said arm and effect opening thereof, and a spring having connection with said arm for biasing said magnet away from said valve to accommodate said valve to close by gravity, and for retractibly moving said piston within said cylinder.

2. In a valve particularly adapted to control the flow of refrigerant in a secondary refrigerant loop of a dual temperature refrigerator, a valve body having a chamber therein, an inlet leading into said chamber and an outlet leading therefrom, a housing associated with said valve body, an armature guided for movement along said valve body and having a valve on the lower end thereof for blocking the flow of fluid from said inlet through said outlet, an arm pivoted within said housing for movement toward and from said valve, a permanent magnet on the free end of said arm and moved thereby to envelope said armature with its magnetic field, a thermal element having a cylinder threaded within a wall of said housing and a piston extensible from said cylinder and having engagement with said arm for pivoting the same toward said armature upon extensible movement thereof with respect to said cylinder, and a spring biasing said arm and magnet away from said armature to weaken the magnetic field around said armature sufficiently to accommodate said valve to close by gravity and retractibly moving said piston within said cylinder.

3. In a valve particularly adapted to control the flow of refrigerant in a secondary refrigerant loop of a dual temperature refrigerator, a valve body having a chamber therein, an inlet leading into said chamber and an outlet leading therefrom, a housing in association with said valve body, an armature guided for movement along said valve body within said housing and having a valve on the lower end thereof for blocking the flow of fluid from said inlet through said outlet, an arm pivoted within said housing from movement toward and from said valve, a permanent magnet on the free end of said arm and moved thereby to envelope said armature with its magnetic field to effect opening of said valve, a thermal element having a cylinder threaded within a wall of said housing, a piston extensible from said cylinder upon predetermined increases in temperature and having engagement with said arm for pivoting the same toward said armature upon extensible movement thereof with respect to said cylinder, a spring biasing said arm and magnet away from said armature to weaken the magnetic field sufficiently to accommodate said valve to close by gravity and also retractibly moving said piston within said cylinder upon predetermined reductions in temperature, and a knob having operative connection with said thermal element for turning the same to vary the position of said piston with respect to said arm and the temperature of operation of said thermal element to move said arm and magnet in position to envelope said armature with its magnetic field.

4. In a thermally operated refrigerant shut off valve, a valve body having an inlet and an outlet and a central valve chamber, a port between said inlet and outlet, an armature slidably guided within said valve chamber and having a valve on the end thereof engageable with said port, an arm pivoted for movement toward and from said armature, a permanent magnet on the free end of said arm, a spring biasing said magnet away from said armature, and a thermal element having a casing on the outside of said valve body and having a piston extensible with respect to said casing upon predetermined increases in temperature, and a shoulder on said arm engaged by said piston upon extensible movement thereof with respect to said cylinder.

5. A shut-off valve comprising a valve body having

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an inlet and an outlet and a central valve chamber, a housing associated with said valve body, an armature guided within said valve chamber and having a valve on the end thereof, a guide and a closure for said armature, extending within said housing and sealing said valve chamber therefrom, an arm pivoted within said housing for movement toward and from said guide and closure member, a permanent magnet on the free end of said arm, a spring biasing said arm and magnet away from said guide and closure member, and a thermal element having a casing on the outside of said housing, a cylinder extending within said housing and a piston extensible from said cylinder upon predetermined increases in temperature, and a shoulder on said arm facing said piston and engaged thereby upon extensible movement thereof with respect to said cylinder.

6. A shut-off valve comprising a valve body having an inlet and an outlet and a central valve chamber, a housing associated with said valve body, an armature guided within said valve chamber and having a valve on the end thereof, a guide and closure for said armature extending within said housing and sealing said valve

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chamber therefrom, an arm pivoted within said housing for movement toward and from said guide and closure, a permanent magnet on the free end of said arm, a spring biasing said arm and magnet away from said guide and closure, a thermal element having a casing on the outside of said housing, a cylinder extending within said housing and a piston extensible from said casing upon predetermined increases in temperature, said arm having a shoulder facing said piston and engaged thereby upon extensible movement thereof with respect to said cylinder, and means for adjustably moving said cylinder with respect to said shoulder to vary the temperature necessary to operate said arm to bring said permanent magnet into position to effect opening of said valve.

References Cited in the file of this patent

UNITED STATES PATENTS

1,837,871	Kindermann	Dec. 22, 1931
2,044,609	Hedlund	June 16, 1936
2,368,181	Vernet	Jan. 30, 1945
2,405,127	Beach	Aug. 6, 1946
2,657,861	Dillman	Nov. 3, 1953