Nov. 3, 1931. W. FOURNESS 1,830,022

EXPANSION VALVE CONTROL

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FIG. 1.

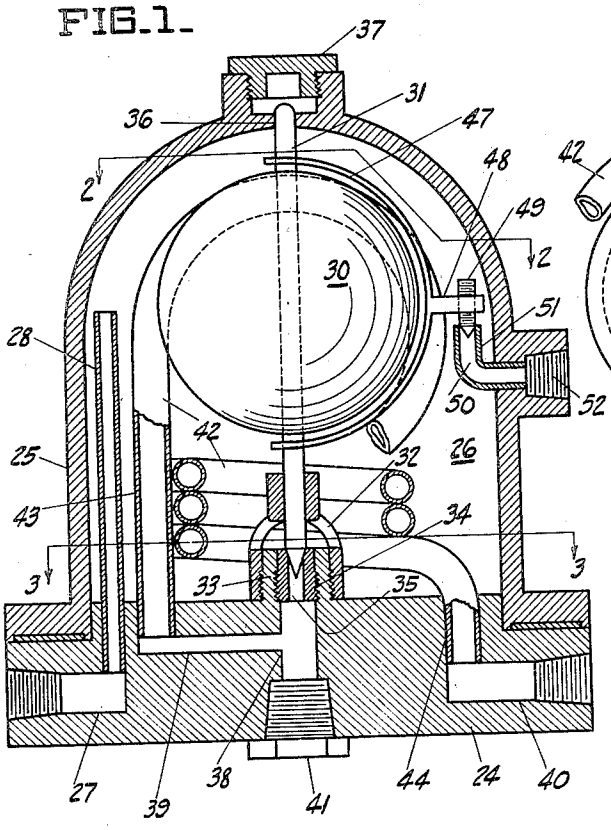


FIG. 2.

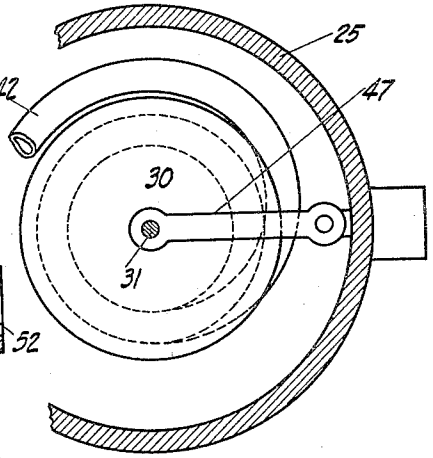


FIG. 3.

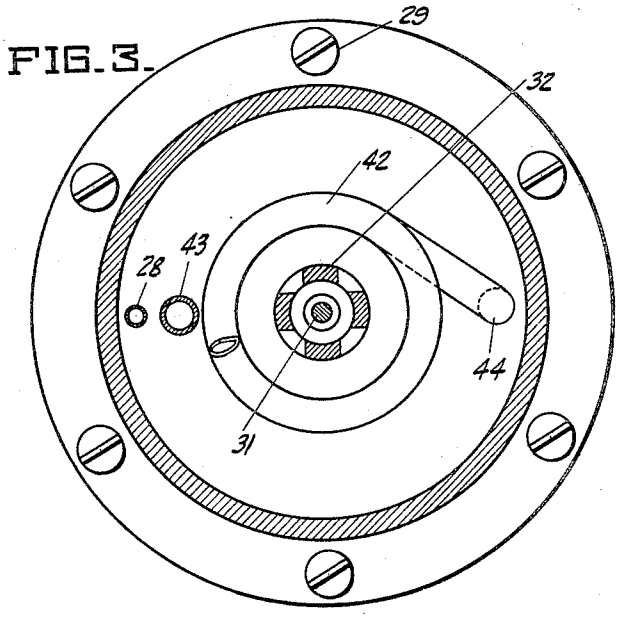


FIG. 4.

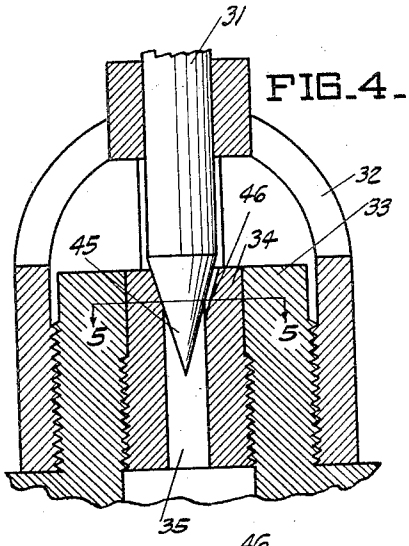
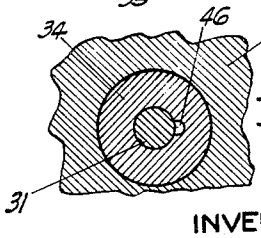


FIG. 5.



INVENTOR

Wilfred Fourness

BY John F. Lam

HIS ATTORNEY

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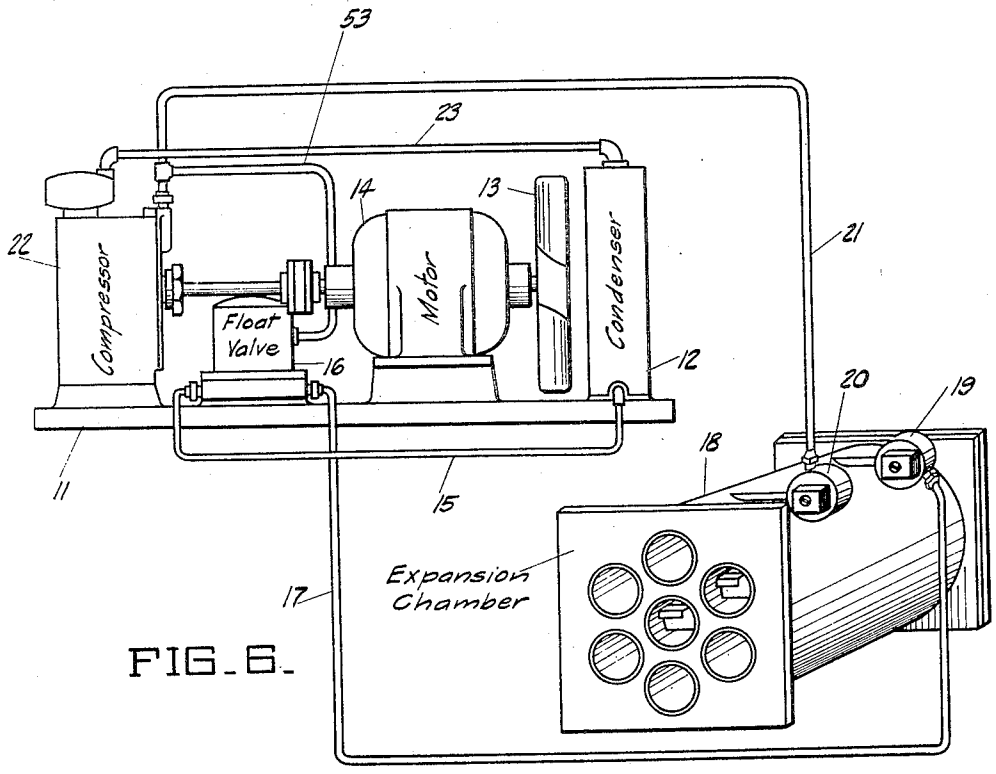


FIG. 6.

INVENTOR
Wilfred Fourness
BY John Flam
HIS ATTORNEY

Patented Nov. 3, 1931

1,830,022

UNITED STATES PATENT OFFICE

WILFRED FOURNESS, OF OAKLAND, CALIFORNIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE FOURNESS DEVELOPMENT CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

EXPANSION VALVE CONTROL

Application filed November 1, 1926. Serial No. 145,635.

This application is a continuation in part of my application, Serial No. 92,199, filed March 4, 1926, and entitled "Float operated expansion valve".

This invention relates to refrigeration, and particularly to a controlling device for feeding refrigerant to a space where it is permitted to expand.

In the usual type of mechanical refrigeration, use is made of a fluid refrigerant, which absorbs heat as it is allowed to expand in a space specially provided for this purpose. Mechanical work can then be performed on the fluid after it is fully expanded and removed from the space, to compress it and thereby to abstract some of its heat content. It can then be recondensed, and passed again to the expansion chamber to complete the cycle.

It is thus evident that such systems have the following important elements operating upon the fluid: a compressor, a condenser, and an expansion chamber. Several different kinds of fluids can be utilized for the refrigerant; in my system I have used sulphur dioxide. The expansion chamber can be in the form of a coil, or of a drum.

In order to control the flow of liquid refrigerant to the expansion chamber, use is made of a valve, which operates at times to pass the refrigerant to the chamber. In order to operate this valve automatically so as to keep the chamber always supplied with an adequate amount of refrigerant, the valve can be arranged for example to respond to variations in pressure, so that when the pressure in the chamber is low, more refrigerant is allowed to enter therein. Another form of valve control is obtained by the aid of a float in a valve chamber, into which chamber the condenser discharges. When the level rises in the chamber, the float is lifted and the valve is opened.

In the latter form of control especially, it is desirable to ensure that the condenser will pass all of the accumulated refrigerant to the float chamber, so as to be sure that all of the refrigerant is kept in circulation. It is one of the objects of my invention to ensure the emptying of the condenser chamber into the float chamber.

In order to accomplish this result, I provide for a slight refrigerating effect in the float chamber, thereby making it cooler than the condenser chamber. I accomplish this by means of a coil in the float chamber through which the refrigerant first passes. Due to the further expansion of the refrigerant in the coil, the temperature therein is considerably lower beyond that in the condenser. The pressure being directly dependent on the temperature, is likewise lowered and as a result the greater pressure in the condenser forces a refrigerant into the coil, thus ensuring the complete evacuation of the refrigerant from the condenser chamber. Therefore it is still another object of my invention to provide such as refrigerative effect in a float valve.

There is always a tendency for oil or scum to be intermingled with the refrigerant, and this is usually hard to separate. It is another object of my invention to provide for the separation of this foreign matter by the aid of the float valve.

My invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of one embodiment of my invention. For this purpose I have shown a form in the drawings accompanying and forming part of the present specification. I shall now proceed to describe this form in detail, which illustrates the general principles of my invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of my invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a vertical sectional view of a float valve incorporating my invention;

Fig. 2 is a fragmentary horizontal section, taken along plane 2—2 of Fig. 1;

Fig. 3 is a horizontal section, taken along plane 3—3 of Fig. 1;

Fig. 4 is an enlarged section of the valve itself;

Fig. 5 is a sectional view, taken along plane 5—5 of Fig. 4; and

Fig. 6 is a diagrammatic view of a complete refrigerating system embodying my invention.

In Fig. 6, the elements of the system are diagrammatically disclosed. Most of the apparatus is mounted on a base 11, which can rest for example, on top of an ordinary ice box. A complete circulatory system is disclosed for a refrigerant that is cyclically permitted to expand, and is then compressed and condensed. Thus a condenser chamber 12 is shown on base 11; this condenser can be of the air cooled type, made up of a network of conduits, somewhat like automobile radiators. A fan 13, driven by motor 14, can be used to assist the movement of cool air over the condenser 12, in the bottom of which the condensed refrigerant settles.

By the aid of pipe or conduit 15, the condensed refrigerant is conducted to a float valve 16, which opens the connection between conduit 15 and conduit 17, whenever a definite amount of refrigerant accumulates in the float valve chamber.

The refrigerant thence passes to an expansion chamber 18. In this chamber, it vaporizes and rapidly absorbs heat. The conduit 17 connects to the inlet valve 19 of the chamber 18; and an outlet valve 20 is provided through which the vaporized refrigerant can pass into a conduit 21. The valves 19 and 20 are arranged to be manually controlled, whereby it is possible to close them and to disconnect the chamber 18 for inspection, repairs or replacement. The chamber 18 is described in detail and claimed in my copending application, Serial No. 109,306, filed May 15, 1926, and entitled "Refrigerating system."

The vaporized refrigerant passes into the intake side of a compressor 22, which is directly connected in this instance to the motor 14, and rests upon base 11. The compressor can be of any desired type. The compressor compresses the refrigerant which in its compressed state leaves the outlet side through pipe 23 and enters condenser 12. Here it is liquefied and starts the cycle all over again, of expansion with attendant absorption of heat, compression and condensation.

The system of refrigeration just described is quite general, and its principles are well understood, obviating any necessity for further detailed description. The float valve 16 is so arranged as to draw the refrigerant substantially completely from the condenser 12, so as to keep it substantially always empty; and further, to skim the foreign matter from the refrigerant. The manner in which this is accomplished can be explained by reference to Figs. 1 to 5.

It is of course understood that the supply of refrigerant in the closed system is set at a predetermined amount, and that the size of the float chamber in which some of it collects is also such that the resultant passage of refrigerant to the chamber 18 is of such quantity as to keep the system operating efficiently.

In Fig. 1, the float chamber 26 is shown as formed by the aid of a base 24, over which is fastened a body 25, as by screws 29 (Fig. 3). The supply of refrigerant to the chamber 26 is effected through an aperture 27 in the base, into which conduit 15 is fastened, and an upright lead-in pipe 28, connecting with aperture 27 and fastened into the base 24. The float 30 is shown in this instance as spherical, and as fastened to a spindle 31. The movement of the float is guided by bearing 36 in the top of body 25, and in yoke 32 in the bottom of the chamber 26.

Yoke 32 is screw threaded onto a boss 33 in the bottom of the chamber 26; and this boss also serves to accommodate a valve seat 34, with which the tapered lower extremity of spindle 31 cooperates, the tapered portion acting as a valve. The aperture 35 in seat 34 is thus uncovered whenever float 30 rises. Over the upper end of rod 31, a cap 37 is provided, in order to maintain the chamber 30 air tight.

The aperture 35 when open, permits refrigerant to pass from the chamber 26, through passage 38, out of the float chamber 26, through various devices to be later described, to the pipe 17 by way of apertures 40, into which said pipe is threaded. A plug 41 covers the bottom of passageway 38, which must be drilled or cored from the bottom of base 24.

In order to provide a slight refrigerating effect in chamber 26, and thereby to secure complete emptying of condenser 12, I provide one or more turns of tubing 42 in chamber 26, in which turns refrigerant is allowed to expand. This tubing is arranged so that the refrigerant must pass therethrough to the expansion chamber 18. For this purpose, one end 43 of this tubing passes downwardly into the base 24, to connect with a passageway 39 that extends into the opening 38, controlled by the tapered valve extremity of spindle 31. The first convolution of turns 42 is vertical, and extends considerably above the highest level of the liquid in chamber 26, so that its cooling effect is considerable. The remaining turns are placed substantially horizontal, and adjacent the bottom of chamber 26. The other end of coil 42 has a downwardly turned extremity 44 that extends into the base 24 and connects with outlet bore 40.

It is thus evident that all refrigerant passing through the float valve must also pass through coil 42. In this way, chamber 26 is always cooler than condenser 12. The complete path for the refrigerant, when valve 34 is open, is as follows: from inlet 27, to tube 28, chamber 26, passage 35, passageways 38 and 39, coil 42, to outlet 40.

In order to maintain the cooling effect in chamber 26 even when the valve 34 is closed, and the liquid is collecting in chamber 26, I provide a leakage path past the tapered valve closure 45. This path 46 is shown most clearly in Figs. 4 and 5, and consists of a small groove cut in the wall of the valve opening 35. In this way, a continuous stream of refrigerant is insured for coil 42, in which it expands and produces the cooling effect.

Foreign matter, such as oil or the like, is apt to collect at the top of the refrigerant in chamber 26. In order to withdraw this in a simple manner, I provide a valve arrangement also controlled by float 30. Thus float structure carries a yoke 47, to which is attached an extension 48 carrying a needle valve 49. This valve is adjustable, as by screw threads, in extension 48, and controls a passage 50 in a tube 51 that is fastened into the side of body 25, and communicates with the aperture 52 leading to the outside of the chamber 26, and through which the skimmed material is removed when valve 49 is lifted by the float 30. The skimmed material can be returned to the suction line of compressor 22, as by pipe 53 (Fig. 6).

I claim:

1. In combination, a container in which liquid refrigerant is arranged to be collected, means forming a valved chamber into which said container discharges, a valve controlling an outlet from said chamber, means forming an expansion space to which the refrigerant is passed through said valve, and means for producing a cooling effect in the valved chamber to ensure that the liquid in the container will be emptied therein.

2. In a float valve for liquid refrigerant used in refrigerating systems, a casing forming a chamber, a float in the chamber, a valve controlled by the float, said valve when opened being arranged to discharge liquid from the casing, and means forming an expansion space for liquid refrigerant located within the chamber and connected therewith, to produce a cooling effect.

3. The combination as set forth in claim 2, in which the means forming an expansion space is connected in such manner that the refrigerant must pass therethrough on its way out of the casing.

4. In combination, a container in which liquid refrigerant is arranged to be collected, means forming a valved chamber into which said container discharges, a valve controlling an outlet from said chamber, means forming an expansion chamber to which refrigerant is passed through said valve, and a coil within the valved chamber and interposed between an inlet to said valved chamber and the valve, said valve being provided with a restricted by-pass to pass refrigerant at a slow rate to the coil for cooling said valved chamber.

5. In combination, a container in which liquid refrigerant is arranged to be collected, a casing forming a chamber having an inlet to which said container is connected, a float in said chamber, a valve arranged to be lifted by the float and cooperating with an opening in connection with the interior of the casing, means forming a refrigerating expansion space, said means being located within the chamber, and connected to be supplied with refrigerant through the valve opening and to pass the refrigerant to an outlet from the casing, and means exterior of the casing forming an expansion chamber and connected to said outlet.

6. The combination as set forth in claim 5, with means forming a restricted by-pass around the valve to supply limited refrigerant to the expansion space within the casing even when the valve is closed.

7. A float operated valve including a casing with chamber therein with inlet and outlet openings, a coiled pipe within said chamber one end of which is connected to said outlet opening and the other end of which is connected to a valve-controlled inlet thereto from said chamber, and a float controlled valve for said inlet to said coil.

8. A float operated valve including a casing with a chamber therein with inlet and outlet openings, a coiled pipe within said chamber one end of which is connected to said outlet opening and the other end of which is connected to a valve-controlled inlet thereto from said chamber, a float-controlled valve for said inlet to said coil, and a second outlet from said chamber with a valve connected to be opened by said float, whereby to drain matter from the fluid level, substantially as described.

9. A float operated extension valve including a base with inlet and outlet openings, a body forming a chamber over said base, a vertical inlet pipe within said body connected to said base at the inlet opening therein, a central valve controlled opening into said base, a coiled pipe having one end connected with said central valve controlled opening and its other end connected with the outlet opening in said base, a float with valve for controlling said central opening, whereby when said float is lifted by fluid in said chamber, said valve is opened to permit fluid to pass into and through said coiled pipe and to said outlet opening in said base.

10. A float operated valve of the character referred to including a body with chamber therein, means for connecting an inlet pipe thereto, means for connecting an outlet pipe thereto, a coiled pipe within said chamber having one end connected with said outlet and its other end connected to communicate with said chamber, a valve and float controlling the inlet to said coiled pipe, whereby the lifting of said float opens said valve, and means

providing for leakage from said chamber to said coiled pipe when said valve is closed.

11. In combination a body with chamber therein, an inlet pipe vertically positioned within said chamber, a coiled pipe within said chamber having one end connected to the outlet from said chamber, a float controlled valve controlling the inlet from said chamber to the other end of said coiled pipe, means permitting leakage from said chamber to said coiled pipe when said valve is closed, and a second float controlled valve outlet at fluid level from said chamber.

In testimony whereof I have hereunto set my hand.

WILFRED FOURNESS.