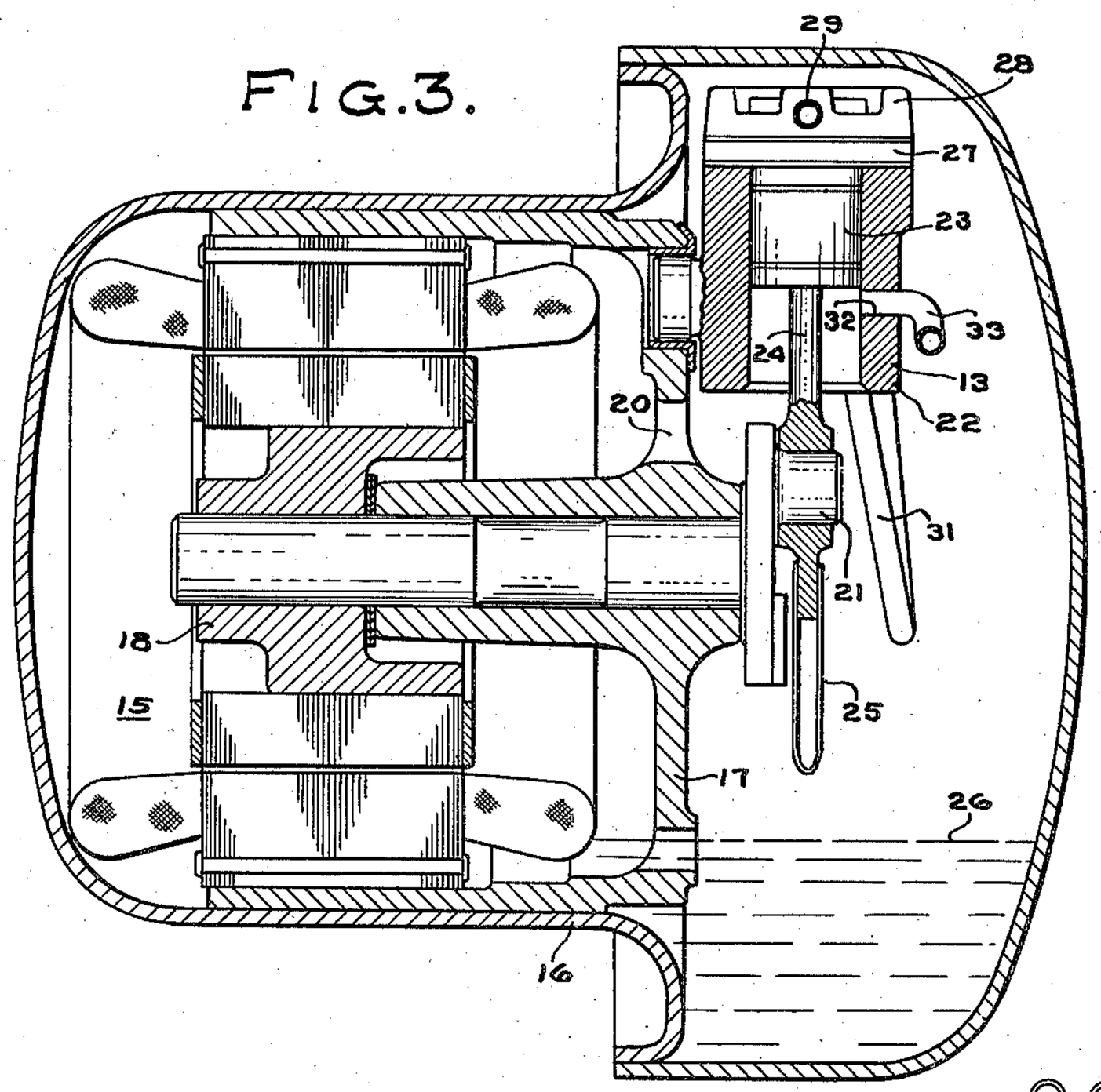
July 12, 1938. L. B. M. BUCHANAN 2,123,498

REFRIGERATING APPARATUS

Filed Nov. 11, 1936

FIG. 3.



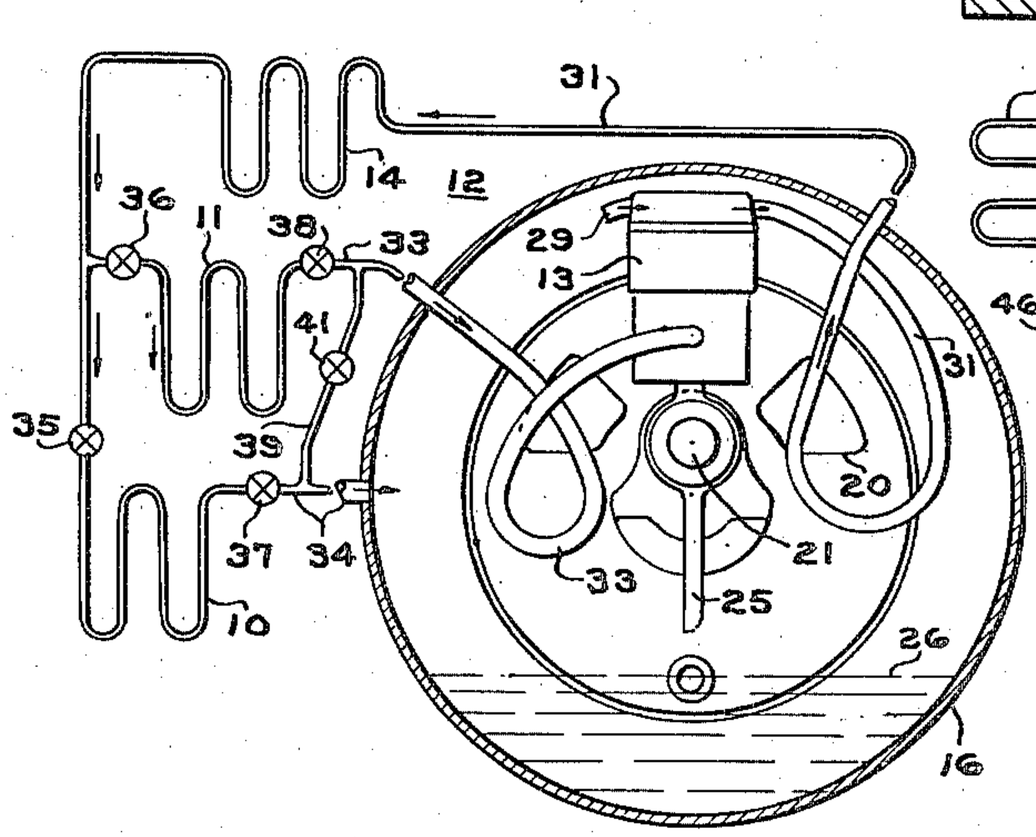


FIG. 1.

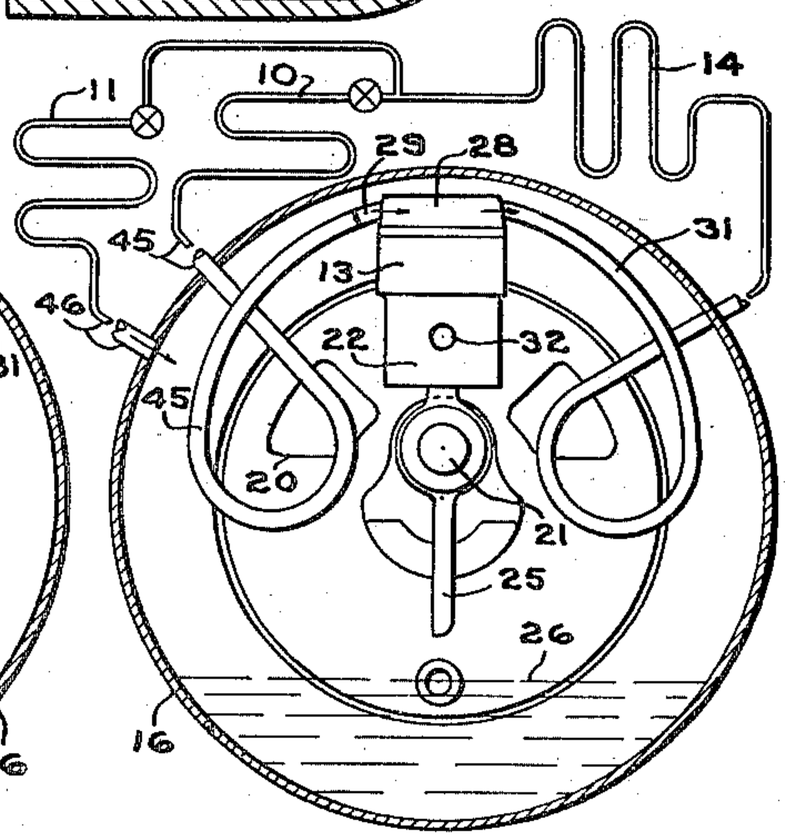


FIG. 2.

WITNESSES:

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UNITED STATES PATENT OFFICE

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REFRIGERATING APPARATUS

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Application November 11, 1936, Serial No. 110,204

5 Claims. (Cl. 62—115)

My invention relates to two temperature refrigerating apparatus employing a hermetically sealed compressor mechanism and has for an object to provide improved apparatus of this kind.

A further object of my invention is to provide improved means for conducting refrigerant vaporized in high and low temperature evaporators to the inlets of a hermetically sealed compressor.

A further object of my invention is to provide a refrigerating system having a plurality of evaporators and a hermetically sealed compressor of the so-called ported cylinder type wherein improved means are employed for conducting the vaporized refrigerant to the compressor.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a diagrammatic view showing a two temperature refrigerating system having a hermetically sealed compressor and arranged in accordance with my invention;

Fig. 2 is a view similar to Fig. 1 showing a second embodiment of the invention; and

Fig. 3 is a longitudinal section of the hermetically sealed compressor element shown in Fig. 1 and which may be used with the system shown in Fig. 2 with slight revisions referred to hereinafter.

Reference will now be had to Figs. 1 and 3 of the drawing, wherein relatively low and high temperature evaporators 10 and 11 are shown connected to a refrigerant condensing unit 12 having a hermetically sealed compressor 13 and a condenser shown at 14. The compressor 13 is preferably driven by an electric motor 15, both of which are enclosed by a casing 16.

A frame 17 is carried by the casing 16 in any suitable manner and defines the support for the motor 15 and compressor 13. Openings 20 are preferably provided in the frame 17 for permitting circulation of vaporous refrigerant through the motor 15 for cooling the same. The motor 15 includes a rotor element 18 carried by a shaft 19 that is journaled in the frame 17 and which carries a crank 21 for actuating the compressor. The compressor 13 includes a cylinder 22 having a piston 23 therein, the latter being reciprocated by the crank 21 through the medium of a connecting rod 24. An oil thrower 25 may be employed for distributing lubricant, shown at 26, over the moving elements of the motor and compressor.

The cylinder 22 includes a valve structure, shown generally at 27 and disposed between the cylinder 22 and a head 28. The valve structure 27 may be of any suitable type for controlling the passage of refrigerant between the head 28 and the cylinder 22. The head 28 has an inlet for vaporous refrigerant shown at 29 and a conduit 31 for compressed refrigerant extends from the head 28 through the casing 16 to the condenser 14. A second inlet or port 32 for refrigerant vapor is formed in the wall of the cylinder 22 and a conduit 33 provides communication between the inlet or port 32 and the higher temperature evaporator 11, said conduit 33 passing through the casing 16 as shown. The inlet 29 of the compressor 13 is in communication with the interior of the casing 16 which receives vaporous refrigerant from the low temperature evaporator 10 through a conduit 34.

Liquid refrigerant in the condenser 14 is supplied to the evaporators 10 and 11 through suitable expansion devices shown at 35 and 36. The flow of refrigerant from the evaporators 10 and 11 to the conduits 34 and 33, respectively, is controlled by suitable valves 37 and 38. Accordingly, refrigeration of both evaporators may be effected by opening the valves 37 and 38 and operating the compressor 13 or the evaporators 10 and 11 may be selectively operated by opening the valve associated with the evaporator to be operated.

A conduit 39 is connected between the conduits 33 and 34 and includes a valve 41, the purpose of which is referred to hereinafter.

Operation

The compressor mechanism described in the foregoing is of the so-called ported cylinder type. During operation, low pressure refrigerant is drawn into the cylinder 22 as the piston 23 descends, through the inlet 29 and valve structure 27. The relatively high pressure refrigerant vapor enters the cylinder 22 through the port 32 when the latter is uncovered by the piston 23 near the end of its stroke. The low pressure vapor in the cylinder 22 is compressed by the higher pressure vapor so that, during the compression stroke, the piston compresses a mixture of the vapors having a density substantially equal to the density of the higher pressure vapor. This operation is effected during periods when both evaporators 10 and 11 are operated and their respective suction line valves 37 and 38 are open.

When the valve 37 is open and the valve 38 is closed, the lower temperature evaporator only is operated. Accordingly, vaporous refrigerant is admitted to the cylinder 22 through the inlet

opening 29 only. The uncovering of the port 32 at this time is of no importance and the only result thereof is a reduction in pressure in the conduit 33 as far as the valve 38, to substantially the pressure value in the cylinder 22 at the time the port opens.

During periods when the higher temperature evaporator is operated, the valves 37 and 38 are closed and open, respectively. At this time, the valve 41 is opened to permit the higher pressure vapor from the evaporator 11 to enter the casing 16 through the conduits 39 and 34, and, therefore, to effect admission of the vapor to the cylinder 22 through the inlet 29. This operation prevents the compressor from pulling a high vacuum in the cylinder 22 prior to the time that the port 32 is uncovered, which condition would prevail if the higher pressure vapor were admitted to the cylinder 22 through the conduit 33 and the port 32, only.

From the foregoing, it will be apparent that vapor from either the low or high temperature evaporators circulates through the casing 16 at all times that the compressor operates and, therefore, cooling of the motor and compressor and the lubricant is effected at all times by the vapor.

In my copending application, Serial No. 110,203, filed November 11, 1936 and assigned to the Westinghouse Electric & Manufacturing Company, I have disclosed and broadly claimed the system of controlling the flow of vapor from a plurality of evaporators to a multiple inlet compressor mechanism. The present application is directed to the application of such system to a hermetically sealed mechanism so that the cold gas from one or the other of the evaporators is employed for cooling the mechanism in the casing at all times that the mechanism is operated.

In Fig. 2, I have shown a two temperature system wherein the evaporators are operated together at all times that the system is active.

The low and high temperature evaporators are shown at 10 and 11, respectively, and may be supplied with condensed refrigerant from the condenser 14 in the same manner as shown in Fig. 1. Elements which are common to both embodiments are represented by similar numerals in both Figs. 1 and 2. The evaporators 10 and 11 may be connected to the interior of the casing and the inlet port 32 in this embodiment in the same manner as shown in Fig. 1, but I prefer to show in Fig. 2 a second method of connecting the evaporators to the hermetically sealed mechanism.

The low temperature evaporator 10 is provided with a suction conduit 45 that extends through the casing 16 and communicates directly with the inlet 29 in the cylinder head 28. The high temperature evaporator 11 is connected to a suction conduit 46 that communicates with the interior of the casing 16. The cylinder inlet or port 32 is in direct communication with the interior of the casing 16. Accordingly, low pressure vapor from the evaporator 10 is conducted directly to the cylinder inlet 29 and the higher pressure vapor from the evaporator 11 passes through the conduit 46 to the interior of the casing 16 and thence through the port 32 to the cylinder 22 as the compressor 13 is operated. The compressing of the low pressure gas in the cylinder 22 by the higher pressure gas entering through the port 32 and the subsequent compression of the mixture of gases is accomplished in the same manner as described heretofore.

In the present embodiment, the interior of the casing 16 is subjected to the higher pressure vapor entering through the conduit 46 at all times. As both evaporators 10 and 11 are operated together, flow of vapor through the casing 16 is effected for cooling at all times that the compressor 13 is actuated.

From the foregoing, it will be apparent that I have provided an improved two temperature refrigerating system employing a hermetically sealed compressor mechanism having a plurality of vapor inlets wherein cooling of the elements and the lubricant within the hermetic casing is effected at all times that the compressor operates. As the interior of the casing is subjected to cool vapor at relatively low pressure, less contamination of the lubricant with refrigerant is obtained than with systems wherein the relatively high pressure compressed vapor prevails in the casing. A concomitant of this operation is the passage of less lubricant to the condenser with the high pressure gas, as is well understood.

While I have shown a hermetically sealed compressor of the ported cylinder type, it will be understood that my invention is not so limited and that other types of multiple inlet compressors may be employed without departing from the spirit of the invention.

While I have shown my invention in two forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. In a refrigerating system having first and second refrigerant evaporators, the combination of a compressor mechanism including a cylinder and a piston movable therein, a casing for hermetically enclosing said compressor mechanism, said cylinder having a first inlet port for refrigerant vaporized in the first evaporator and a second inlet port communicating with the space within the hermetic casing for refrigerant vaporized in the second evaporator, a conduit for conveying refrigerant vaporized in the first evaporator to said first inlet port of the compressor, said conduit extending through the hermetic casing and a second conduit for conveying refrigerant vaporized in the second evaporator to the interior of said hermetic casing.

2. In refrigerating apparatus, the combination of relatively high and low temperature evaporators, a compressor mechanism including a cylinder and a piston movable therein, a casing for hermetically enclosing the compressor mechanism, said cylinder having a first inlet port for refrigerant vaporized in the low temperature evaporator and a second inlet port communicating with the interior of the casing for refrigerant vaporized in the higher temperature evaporator, a conduit extending through the hermetic casing and connecting the low temperature evaporator and said first inlet port of the compressor, and a second conduit providing communication between the higher temperature evaporator and the interior of the casing.

3. In refrigerating apparatus, the combination of relatively high and low temperature evaporators, a compressor mechanism including a cylinder and a piston movable therein, a casing for hermetically enclosing the compressor mechanism, said cylinder having a first inlet port for

refrigerant vaporized in the higher temperature evaporator and a second inlet port communicating with the interior of the casing for refrigerant vaporized in the lower temperature evaporator, a conduit extending through the hermetic casing and connecting the higher temperature evaporator and the first inlet port of the compressor and a second conduit providing communication between the low temperature evaporator and the interior of the casing.

4. In refrigerating apparatus, the combination of relatively high and low temperature evaporators, a casing, a compressor mechanism disposed within the casing and having first and second inlets for refrigerant vaporized in the evaporators, one of said inlets being in communication with the interior of the casing, means for conveying refrigerant vaporized in the high temperature evaporator to the second of said inlets, means for conveying refrigerant vaporized in the lower temperature evaporator to the interior of the casing, and means effective during periods when the higher temperature evaporator only is refrigerated for conveying a portion of the refrigerant vaporized therein to the interior of the casing.

5. In refrigerating apparatus, the combination of relatively high and low temperature evaporators, a casing, a compressor mechanism disposed within the casing and having first and second inlets for refrigerant vaporized in the evaporators, one of said inlets being in communication with the interior of the casing, a first conduit providing communication between the low temperature evaporator and the interior of the casing, a second conduit extending through the casing for conveying refrigerant vaporized in the higher temperature evaporator to the second of said compressor inlets, a connecting conduit providing communication between said first and second-mentioned conduits and a plurality of valves for controlling the flow of refrigerant through said conduits and effective during periods when the higher temperature evaporator only is operated to terminate flow of the lower temperature refrigerant to said first conduit and to pass a portion of the higher temperature refrigerant from the second conduit through said connecting conduit to the interior of the casing.

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