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REFRIGERANT FLOW CONTROL MECHANISM

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FIG. 1

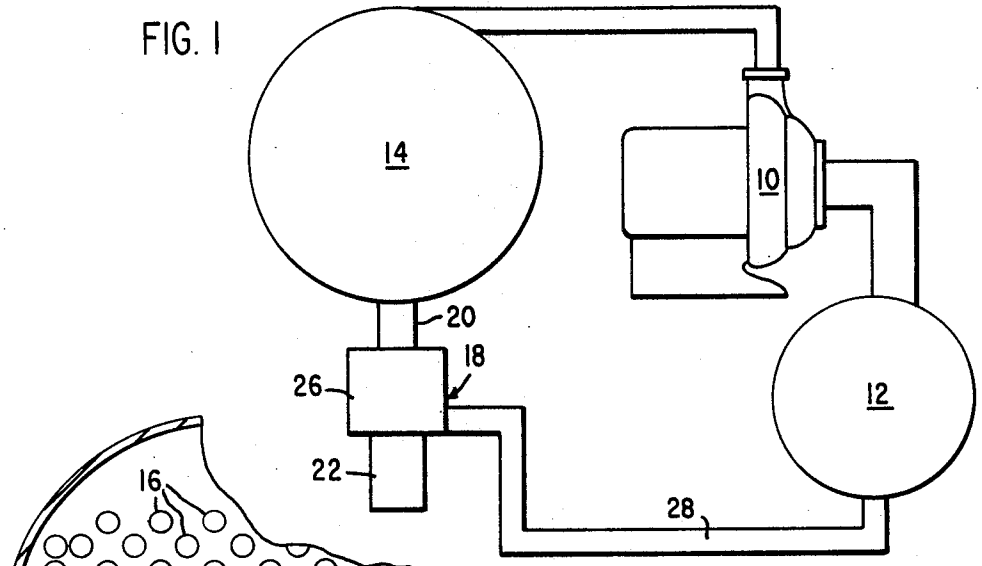
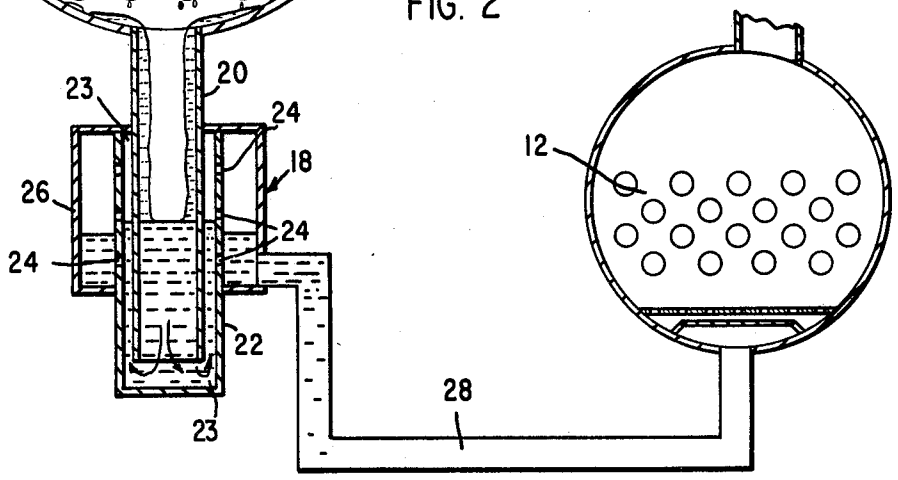


FIG. 2



INVENTOR.
WILLIAM T. OSBORNE.
BY Raymond Curtis
ATTORNEY.

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REFRIGERANT FLOW CONTROL MECHANISM

William T. Osborne, East Syracuse, N.Y., assignor to Carrier Corporation, Syracuse, N.Y., a corporation of Delaware

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ABSTRACT OF THE DISCLOSURE

A refrigerant flow control device for regulating passage of refrigerant from the condenser of a refrigeration machine to the evaporator of the machine characterized in that the device serves as a fixed restriction and is effective to pass refrigerant under circumstances where the condenser and evaporator are subject to movement whereby the machine may assume any one of a number of positions during its operation.

BACKGROUND OF THE INVENTION

In refrigeration machines employing refrigerant gas compression means, a condenser and an evaporator, it is necessary to provide in the refrigerant flow circuit, between the condenser and evaporator, refrigerant metering means to establish the desired difference in pressure between the high pressure side of the machine and the low pressure side of the machine.

In relatively large size refrigeration machines employing centrifugal gas compressors, the refrigerant flow metering means may consist of a float controlled valve regulating an opening in a float box located in the circuit between the condenser and evaporator.

Under circumstances where the refrigeration machine may be installed in an environment subject to movement such as aboard ship, float controlled valves of the type described are often subject to erratic operation especially when the body or charge of liquid refrigerant present in the float box drains to a section of the box remote from the valve opening.

It is the object of this invention to provide refrigerant flow control means capable of operation under circumstances where the machine is subject to a tilting action.

SUMMARY OF THE INVENTION

Briefly this invention involves the provision of a refrigerant flow control device including an elongated conduit extending from a condenser so as to receive liquid refrigerant formed in the condenser and a chamber disposed about the lower open end of the conduit so that refrigerant flowing from the open end of the conduit may collect and rise upwardly in the chamber. The chamber in turn is provided with a plurality of openings through which refrigerant in either the liquid or vapor form may flow to a manifold having communication with a conduit leading to the evaporator.

The openings formed in the side wall of the chamber impose a pressure drop on the refrigerant passing from the high side of the refrigeration side (interior of the chamber) to the low pressure side of the refrigerant side (exterior of the chamber).

Under operating conditions, a certain number of the openings will pass refrigerant in the liquid form while the remainder will pass vaporous refrigerant to the low pressure side of the system.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a schematic view of a refrigeration machine of the type employing the refrigerant flow control device serving as the subject of this invention; and

FIGURE 2 is a schematic view of a refrigerant flow control device formed in accordance with the invention for passing refrigerant from the high pressure side of the system to the low pressure side of the system.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A refrigeration machine of the kind under consideration is illustrated schematically in FIGURE 1. A compressor **10** extracts gaseous refrigerant from the evaporator **12** and forwards it at elevated pressure to the condenser **14**. In the condenser **14** the gaseous refrigerant is converted to liquid refrigerant with the resulting heat of condensation being rejected to a condenser cooling coil **16**. The liquid refrigerant formed in condenser **14** passes through refrigerant flow control device **18** serving as the subject of this invention to the evaporator **12** to complete the refrigerant flow circuit. In the evaporator **12** the liquid refrigerant is converted to gaseous refrigerant as the refrigerant extracts heat from a heat transfer fluid such as chilled water employed in an air conditioning system.

Referring more particularly to FIGURE 2, the liquid refrigerant formed in condenser **14** passes from the condenser through an elongated conduit **20** designed to depend vertically from the condenser. The lower open end of conduit **20** is surrounded by a cylindrical wall **22** forming an enclosure or chamber **23** for receiving the liquid refrigerant introduced therein through the conduit **20**.

The wall **22** includes a plurality of openings **24** arranged throughout its height. The openings **24** communicate with a manifold **26** to which a conduit **28** is connected. The conduit **28** serves as a passage for refrigerant collecting in the manifold to the evaporator.

Considering the operation of the refrigerant flow control device illustrated, it will be appreciated that the refrigeration machine described is designed to be effective within a prescribed range of operation. When the machine is operating at a point within this range, liquid refrigereant flows continuously from the condenser and attains a particular level within the conduit **20**. The liquid refrigerant collecting within the chamber **23** also attains a predetermined level at or near the level of liquid in conduit **20**.

With the construction shown, it will be obvious that the refrigerant disposed within chamber **23** is subject to high side pressure. The openings **24** below the level of collected refrigerant in the chamber pass liquid refrigerant, a portion of which flashes as it passes through the openings in accordance with the particular evaporator or low side pressure encountered. The openings **24** in the chamber above the level communicate with the low pressure side of the system such that portions of the top layer of liquid refrigerant within chamber **23** flash and attempt to flow from the chamber through the openings **24** located above the level of liquid refrigerant in the chamber. These openings, however, inhibit passage of gaseous refrigerant causing the pressure above the liquid level in the refrigerant to rise and eventually reach an equilibrium condition, or balance of pressures, as effected by the static head differences in conduit **20** and chamber **23**, the lower vapor pressure at the surface of the refrigerant in chamber **23** due to the flashing of sufficient refrigerant gas to choke the openings **24** above the liquid surface, and the high side pressure. A variation in any of the operating parameters of the machine, as for example a change in condensing water temperature, a change in chilled water temperature, a change in refrigerant flow rate or a combination of same will cause a variation in the level of liquid present in the conduit **20**. The corresponding change in the level of the liquid in the chamber **23** will also occur

as will the phenomena described above as a new equilibrium condition is attained.

U.S. Patent 3,286,482 discloses a refrigerant flow control device in which a number of openings are provided for simultaneously passing liquid and gaseous refrigerant. Such an arrangement, however, may continuously pass condenser gas through the openings so as to operate in effect as a hot gas bypass. The arrangement proposed here is a more effective refrigerant flow control device in that the amount of gaseous refrigerant passing from the high side of the system to the low side of the system is limited to that generated by the flashing of liquid refrigerant on the upper surface of the liquid refrigerant present in the chamber. In other words, the device here described may be considered as incorporating a liquid seal not present in the device described in the patent. Accordingly, the arrangement proposed here is more effective and more sensitive to a variation in the operating conditions encountered by the machine.

The arrangement shown is effective when the parts are subject to tilt or inclination such as may be encountered aboard ship. It will be appreciated that within certain limits conduit **20** may tilt without disturbing the flow of refrigerant from the high side to the low side for the reason that the relationship between the number of openings **24** feeding liquid refrigerant and the number of openings **24** feeding gaseous refrigerant remains the same.

An additional feature of this invention, independently of the feature enabling use under conditions where tilt is encountered, is the provision of a refrigerant flow control device devoid of moving parts. Such an arrangement, it will be appreciated, possesses a high reliability particularly when subject to vibrating forces.

While I have described a preferred embodiment of the invention, it is to be understood the invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

I claim:

1. In a refrigeration machine including an evaporator, a condenser and a compressor for extracting refrigerant from the evaporator and forwarding it to the condenser, refrigerant flow control means interposed between the condenser and evaporator for regulating passage of refrigerant from the condenser to the evaporator, said refrigerant flow control means comprising:

(a) a first conduit extending vertically downwardly from said condenser through which refrigerant formed in the condenser may drain;

(b) means surrounding the conduit to form a chamber to which refrigerant from the conduit enters in the lower region thereof and, by flow upwardly around the conduit, accumulates within the chamber, said means including a plurality of vertically spaced apertures for passing refrigerant from said chamber; and

(c) means communicating with the low pressure side of the machine for receiving refrigerant flowing through said chamber apertures for passage to said evaporator, the parts being constructed so that gaseous refrigerant, created as portions of the liquid refrigerant in the chamber exposed to the low pressure side of the machine flash, is confined to the region above the lower region of the chamber.

2. The method of regulating the flow of refrigerant from the high pressure side of a refrigeration machine to the low pressure side of the refrigeration machine which consists in the steps of:

collecting liquid refrigerant formed in the condenser in a chamber having restricted communication with the low pressure side of the refrigeration machine by supplying the liquid refrigerant to the lower region of the chamber so that the liquid refrigerant may thereafter rise in the chamber and form a liquid seal between the high pressure side and the low pressure side of the refrigeration machine, and

providing passages in the chamber so that liquid refrigerant or gaseous refrigerant may pass to the low pressure side of the machine, the passages above the liquid level in the chamber providing restriction to gaseous refrigerant flow so as to develop an equilibrium condition in the chamber space above the level of liquid.

3. The method of regulating the flow of refrigerant from the high pressure side of a refrigeration machine to the low pressure side of the refrigeration machine which consists in the steps of:

providing a chamber having a plurality of openings in communication with the condenser for receiving refrigerant formed in the condenser, and

collecting refrigerant in the chamber so that the body of collected refrigerant presents a first surface subject to high side pressure and a second surface remote from said first surface subject to low side pressure through at least one of said openings.

References Cited

UNITED STATES PATENTS

2,196,858	4/1940	Gleason	62—525
2,220,595	4/1940	Andersen	62—525
2,237,239	4/1941	Smith	62—525 XR

MEYER PERLIN, Primary Examiner

U.S. Cl. X.R.

62—511, 504