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Refrigerant recovering system.

For use in recovering an original refrigerant from a refrigeration circuit, a refrigerant recovering system comprises a suction unit (13 to 30) for sucking the original refrigerant and a producing unit (11) coupled to the refrigeration circuit. Responsive to inner pressure of the refrigerant circuit, the producing unit produces a pressure signal. Coupled to the refrigeration circuit and the suction unit and responsive to the pressure signal, a supplying unit (10 and 12) supplies the original refrigerant from the refrigeration circuit to the suction unit. The producing unit may comprise a judgement unit (11) coupled to the refrigerant circuit for judging whether or not the inner pressure is negative in comparison with atmospheric pressure to produce an internal signal when the inner pressure is negative. Coupled to the judgement unit, a sending unit (11a) sends the internal signal as the pressure signal to the supplying unit. The supplying unit may comprise conducting unit (12) for conducting the original refrigerant to the suction unit and an inhibit unit (10) for inhibiting passage of the original refrigerant directed to the suction unit.

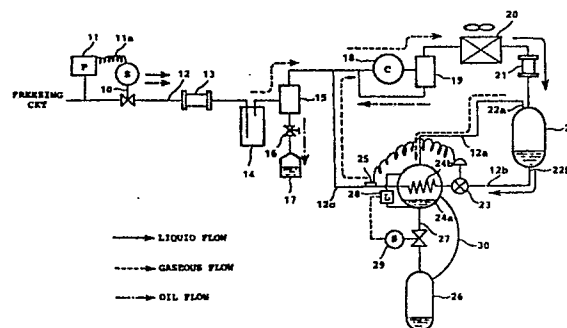


FIG. 1

REFRIGERANT RECOVERING SYSTEM

Background of the Invention:

This invention relates to a refrigerant recovering system.

A refrigerant, such as a fluorocarbon refrigerant, is commonly employed in an air conditioner of an automobile or a refrigerator.

A refrigeration system will operate most efficiently when the refrigerant is made pure and relatively free of pollutants, for example, oil, air and water. But, a used refrigerant becomes impure by pollutants.

Therefore, it is necessary to periodically remove and recharge the refrigerant within the refrigerant system.

Various refrigerant processing and charging system are already known. In the Miyata et al article, a citation is made as regards refrigerant charging system of the type disclosed in Japanese Patent Prepublication (Kokai) No. 251767 of 1988.

Such a refrigerant recovering system comprises a liquefying unit which sucks an original refrigerant from an external freezing circuit or refrigeration circuit which is employed in, for example, an air conditioning system.

When the original refrigerant is sucked from the external freezing circuit by a suction unit, amounts of the original refrigerant in the external freezing circuit gradually decreases.

According to decreasing the amounts of the original refrigerant, inner temperature of the external freezing circuit gradually decreases by an evaporation of the original refrigerant in the external circuit.

As a result, inner pressure of the external freezing circuit becomes negative pressure in comparison with atmospheric pressure. This negative pressure causes the external freezing circuit to be invaded by atmosphere, therein.

Summary of the Invention:

It is therefore an object of the present invention to provide a refrigerant recovering system for recovering an original refrigerant from an external freezing circuit et al without invasion of atmosphere into the external freezing circuit.

It is another object of this invention to provide a system of the type described, which can prevent from decrease of inner pressure of the external freezing circuit while charging the original refrigerant.

Other objects of this invention will become clear as the description proceeds.

In accordance with this invention, there is provided a refrigerant recovering system for use in recovering an original refrigerant from a refrigeration circuit. The refrigerant recovering system comprises a suction unit for sucking the original refrigerant, a producing unit coupled to the refrigeration circuit and responsive to inner pressure of the original refrigerant for producing a pressure signal, a supplying unit coupled to the refrigeration circuit and the suction unit and responsive to the pressure signal for supplying the original refrigerant from the refrigeration circuit to said suction unit.

Brief Description of the Drawing:

Fig. 1 is a block diagram of a refrigerant recovering system according to an embodiment of this invention.

Description of the Preferred Embodiment:

A refrigerant recovering unit according to an embodiment of this invention is connected to an air conditioning system of an automobile.

The air conditioning system uses a fluorocarbon refrigerant as an original refrigerant in a freezing circuit (not shown).

Referring to Fig. 1, the refrigerant recovering unit comprises an inlet electromagnetic valve 10 on a conducting pipe 12 which is coupled to the external freezing circuit. The original refrigerant flows as a liquid phase flow and gaseous flow through the conducting pipe 12.

For controlling inner pressure of the external freezing circuit, a pressure sensor 11 is connected to the external freezing circuit. The pressure sensor 11 is for judging whether or not the inner pressure is negative in comparison with atmospheric pressure to produce an internal signal when the inner pressure is negative. The internal signal is sent to the electromagnetic valve 10 through a wire 11a. Responsive to the internal signal, the electromagnetic valve 10 is automatically driven to inhibit passage of the original refrigerant in the conducting pipe 12.

When the inlet electromagnetic valve 10 is opened for introducing the original refrigerant from the freezing circuit, the original refrigerant is sucked to a first filter dryer 13 by virtue of a compressor 18 which will later be described. The inlet electromagnetic valve 11 can be disconnected from the freezing circuit. The first filter dryer 13 is for removing an impurity, moisture, and acid content from the original refrigerant in the manner known in the art.

An accumulator 14 is connected to the first filter dryer 13 for accumulating the original refrigerant. The liquid phase flow is accumulated in a bottom part of the accumulator 14, and the gaseous phase flow thereon is supplied to a first oil interceptor 15. The first oil interceptor 15 is to intercept an oil element of the original refrigerant. The intercepted oil element is accumulated in an oil tank 17 through an oil valve 16.

The original refrigerant is supplied to the compressor 18 from the first oil interceptor 15. In this event, the original refrigerant is of gaseous phase.

The gaseous original refrigerant is compressed in the compressor 18 and is supplied as a compressed refrigerant to a condenser 20 through a second oil interceptor 19. The intercepted oil element is accumulated in another oil tank (not shown). In the condenser 20, the compressed refrigerant is cooled to thereby be condensed as a condensed refrigerant. The condensed refrigerant is supplied to a second filter dryer 21 which is for removing an impurity, moisture, and acid content from the condensed refrigerant.

After that, the condensed refrigerant is supplied to a separation vessel 22 and is separated into a gaseous phase refrigerant component and a liquid phase refrigerant component in the separation vessel 22.

The separation vessel 22 comprises an upper part and a bottom part defining an upper space and a bottom space, respectively. The upper space and the bottom space is contiguous each other to form a hollow space in the separation vessel 22. As well known in the art, the gaseous phase refrigerant component has superior purity in comparison with the liquid phase refrigerant component.

A combination of the compressor 18, the second oil interceptor 19, the condenser 20, the second filter dryer 21 and, the separation vessel 22 is referred to as a separating arrangement. A pipe 12 is for connecting between the inlet electromagnetic valve 11 and the separation vessel 22.

The separation vessel 22 has a first outlet port 22a at an upper portion thereof and a second outlet port 22b at a bottom portion thereof. The first outlet port 22a is connected to a liquefaction vessel 24a through a first supplying pipe 12a to communicate with a thermal space which is defined by the liquefaction vessel 24a. Therefore, the gaseous phase refrigerant component is sent as an object refrigerant from the separation vessel 22 to the liquefaction vessel 24b. On the other hand, the second outlet port 22b is connected to an evaporator 24b through an automatic expansion valve 23 and a second supplying pipe 12b. Therefore, the liquid phase refrigerant component is sent as a liquid refrigerant from the separation vessel 22 to the evaporator 24b and is evaporated in the evap-

orator 24b to carry out cooling of a surrounding area of the evaporator 24b in the manner known in the art.

The evaporator 24b is thermally coupled to the thermal space of the liquefaction vessel 24a. In this embodiment, the evaporator 24b is contained in the liquefaction vessel 24a. As a result, the gaseous phase refrigerant component is cooled in the liquefaction vessel 24a by evaporation of the liquid refrigerant, namely, the liquid phase refrigerant component in the evaporator 24b. In other words, heat exchange is carried out between the gaseous and the liquid phase refrigerant components. Therefore, the evaporator 24b may be referred to as a liquefying arrangement.

After being evaporated in the evaporator 24b, the liquid refrigerant is returned to the compressor 18 through a returning pipe 12c.

A temperature detecting unit 25 is thermally coupled to the returning pipe 12c. The temperature detecting unit 25 is for detecting temperature of the liquid refrigerant at vicinity of the liquefaction vessel 24a to produce a temperature signal which is representative of the temperature signal which is representative of the temperature. Responsive to the temperature signal, the automatic expansion valve 23 is automatically driven to adjust flow amount of the liquid phase refrigerant component.

The liquefied object refrigerant is collected at a lower portion of the thermal space of the liquefaction vessel 24a. A storage container 26 is placed under the liquefaction vessel 24a and is connected to the thermal space through a sending pipe 27. Therefore, the liquefied object refrigerant drips from the liquefaction vessel 24a towards the storage container 26 through the sending pipe 27 by gravitational force thereof. As a result, the liquefied object refrigerant is charged in the storage container 26. It is a matter of course that the modified refrigerant has a relatively higher purity in the storage container 26.

When the thermal space is not enough of quantity of the liquefied object refrigerant, the liquefied object refrigerant is prevented from charging thereof towards the storage container 26.

For controlling quantity of liquid of the thermal space, a liquid level sensor 28 is connected to the liquefaction vessel 24a. The liquid level sensor 28 is for detecting a predetermined liquid level to produce a condition signal. The condition signal is sent to an electromagnetic valve 29. The electromagnetic valve 29 is coupled to the sending pipe 27. Responsive to the condition signal, the electromagnetic valve 29 is automatically driven to adjust the movement of the liquefied object refrigerant through the sending pipe 27. A combination of the sending pipe 27, the liquid level sensor 28, and the electromagnetic valve 29 is referred to as a

control arrangement. In this event, it is preferable that the condition signal responsive to the predetermined liquid level is produced until the evaporator 24b is made thoroughly wet by the liquefied object refrigerant in the liquefaction vessel 24b because of an effectiveness of the heat exchange. When the detected liquid level is lowered than the predetermined liquid level, the electromagnetic valve 29 is driven in response to the condition signal to stop the dripping of the liquefied object refrigerant to the storage container 26.

When the detected liquid level is higher than the predetermined level, the electromagnetic valve 29 is driven in response to the condition signal to open the sending pipe 27. So that, the liquefied object refrigerant flows into the storage container 26. Preferably, a breathing pipe 30 is disposed between the liquefaction vessel 24a and the storage container 26 for breathing a residual gas of the refrigerant in the storage container 26 because of smooth flow of the liquefied object refrigerant. Therefore, the effectiveness of the heat exchange is increased in the liquefying arrangement.

The object refrigerant can be smoothly charged into the storage container 26 by a repeat of operation which is described before.

While the present invention has thus far been described in connection with the embodiment thereof, it will readily be possible for those skilled in the art to put this invention into practice in various other manners.

Claims

1. A refrigerant recovering system for use in recovering an original refrigerant from a refrigeration circuit, comprising suction means for sucking said original refrigerant, wherein the improvement comprising:

producing means coupled to said refrigeration circuit and responsive to inner pressure of said refrigerant circuit for producing a pressure signal;
supplying means coupled to said refrigeration circuit and said suction means and responsive to said pressure signal for supplying said original refrigerant from said refrigeration circuit to said suction means.

2. A refrigerant recovering system as claimed in Claim 1, wherein said producing means comprises:

judgement means coupled to said refrigerant circuit for judging whether or not said inner pressure is negative in comparison with atmospheric pressure to produce an internal signal when said inner pressure is negative;
sending means coupled to said judgement means for sending said internal signal as said pressure

signal to said supplying means.

3. A refrigerant recovering system as claimed in Claim 2, wherein said supplying means comprises:

conducting means coupled to said refrigerant circuit and said suction means for conducting said original refrigerant into said suction means;
inhibit means coupled to said conducting means responsive to said pressure signal for inhibiting passage of said original refrigerant into said suction means.

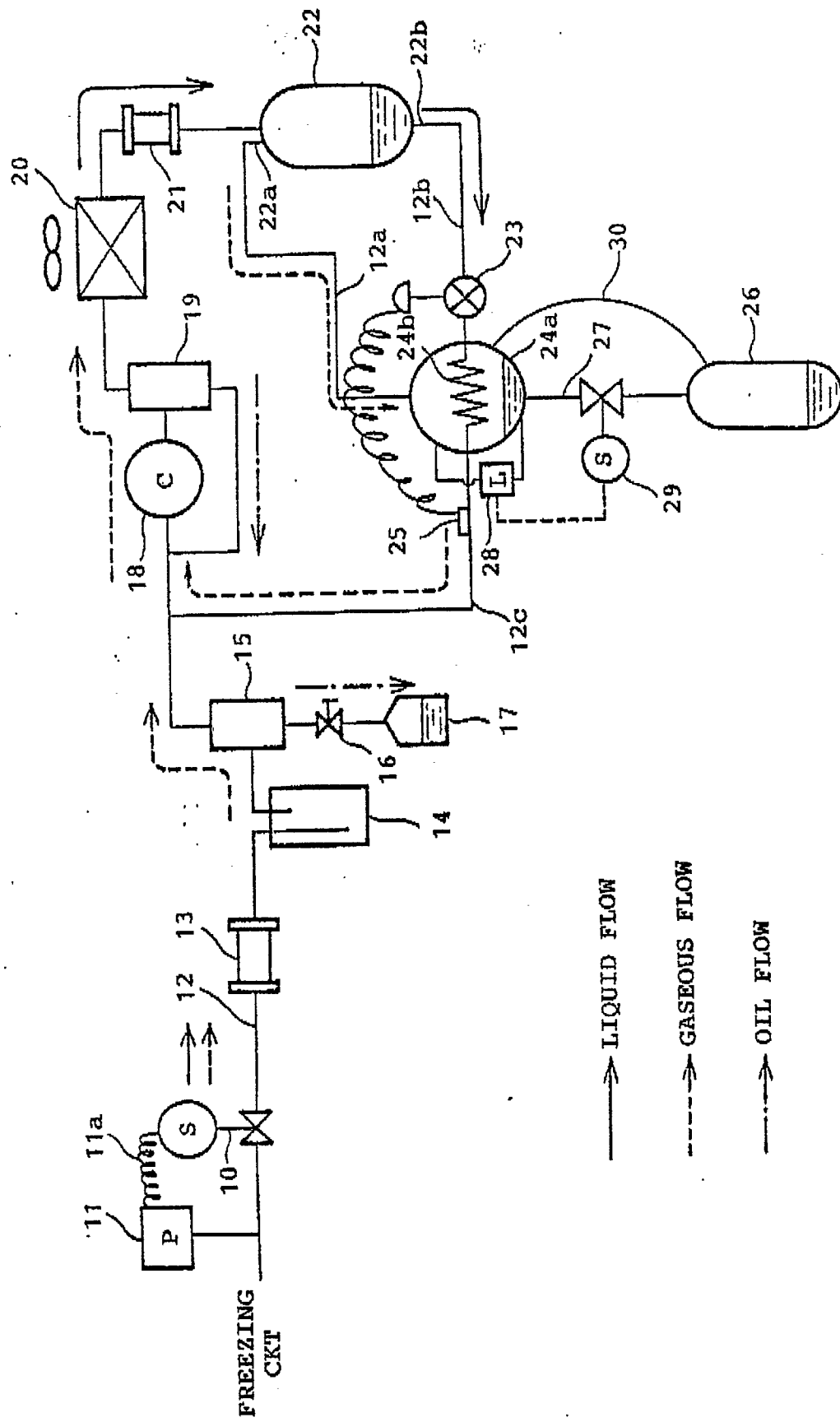


FIG. 1