

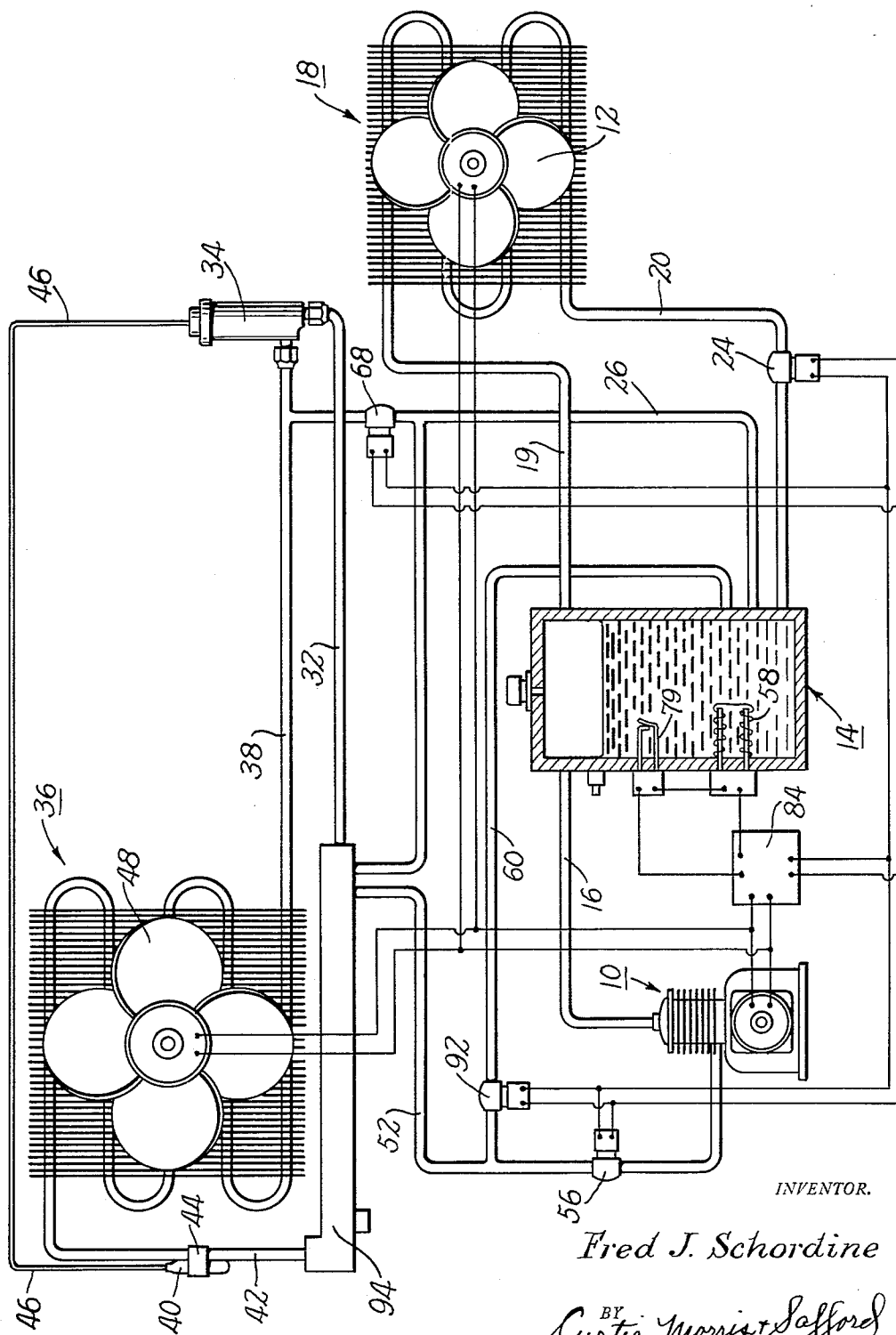
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LIQUID DEFROSTING SYSTEM AND THE LIKE

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LIQUID DEFROSTING SYSTEM AND THE LIKE

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4 Claims. (Cl. 62-4)

This invention relates to refrigeration and more in particular to a compressor type refrigeration system where one interchange unit acts as an evaporator during a cooling operation and may be heated by hot refrigerant.

It is an object of the present invention to provide a highly versatile and efficient type of refrigeration system which has an evaporator which may be heated rapidly and efficiently when desired. It is a further object to provide a refrigeration system where one unit acts as a receiver for a liquid refrigerant and may also act as a condenser or as a chamber within which the refrigerant is heated.

Other additional objects include that of providing an efficient and dependable defrosting arrangement for an evaporator, and that of providing an efficient and dependable heating and cooling system. These and other objects will be in part obvious and in part pointed out below.

In the drawing:

A single figure is a schematic representation of one embodiment of the invention adapted particularly for obtaining an efficient defrosting of the evaporator.

Referring to the drawing, the refrigeration system has a compressor 10, a receiver condenser tank 14, an auxiliary condenser 18, and an evaporator 36. The compressed refrigerant passes from the compressor through the pipe 16 to tank 14, the upper portion of which is normally occupied by refrigerant gas and the lower portion of which is normally occupied by a body of liquid refrigerant. The upper portion of tank 14 is connected to the top of condenser 18 by a pipe 19 and the bottom of the condenser is connected to the bottom of the tank by a pipe 20. Condenser 18 is cooled by a fan 12 which blows the air over the condenser so as to effect a cooling of the refrigerant. Thus the compressed gas from the compressor passes to tank 14 and it flows into the condenser as rapidly as the condensation takes place and the liquid refrigerant flows by gravity back to the bottom of the tank. The bottom of tank 14 is connected through a pipe 26 to an exchange unit (not shown) in a drip pan 94 and thence through a pipe 32 to an expansion valve 34. From the expansion valve the liquid refrigerant flows through a pipe 38 to the evaporator 36. The gas refrigerant passes from the evaporator through a pipe 42 to the heat exchange unit (not shown) referred to above in pan 94. The gas refrigerant then flows through pipe 52 back to the compressor 19. Evaporator 36 is provided with a fan 48. Expansion valve 34 is controlled by a bulb 40 connected through a tube 46 to the valve and held to pipe 42 by a clamp 44.

During operation the refrigerant is compressed and condensed, as pointed out above, so as to maintain a body of liquid in the bottom of tank 14. The liquid refrigerant flows to the evaporator through the extension valve so that a continuous refrigeration operation is carried on. However, this operation is such that frost accumulates on the evaporator and it is desirable to remove this frost periodically by a defrosting operation.

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Accordingly, pipe 26 is connected by a by-pass pipe to pipe 38, and this by-pass pipe has a normally closed solenoid valve 68 therein. Pipe 52 is connected to the lower portion of tank 14 by a pipe 60 having a normally closed solenoid valve 92 therein. A normally open solenoid valve 56 is in pipe 52 adjacent the compressor. Tank 14 is provided with a refrigerant heating coil 58 which is immersed in the liquid refrigerant.

When it is desirable to defrost the evaporator, the compressor is stopped and fans 12 and 14 are also stopped. Solenoid valves 68 and 92 are opened and valve 56 is closed. The heater coil 58 is then energized so as to heat the refrigerant. This raises the refrigerant temperature and pressure except that the frost or ice upon the evaporator and perhaps in the drip pan 94 tends to maintain cold zones. Hence liquid refrigerant tends to fill the entire evaporator and the pipes associated with the drip pan and forming the heat exchange unit referred to above. Further, the elevated temperature and pressure in tank 14 causes the refrigerant to tend to circulate with the aid of gravity so that hot refrigerant flows to the evaporator and the cold refrigerant flows back to tank 14. This effects a rapid and efficient defrosting of the evaporator. A thermostat 79 in tank 14 is in series with heater unit 58 and prevents over-heating.

A timer 84 controls the operation so as to effect the defrosting at predetermined periods. During the defrosting operation, a normally open valve 24 in pipe 20 is closed so as to prevent the flow of liquid refrigerant into the condenser. The operation is fully automatic, not only with respect to the timed opening and closing of the valves and the stopping and starting of the compressor and fan motors, but with respect to the circulation of the hot refrigerant for the purpose of defrosting. In the illustrative embodiment, the refrigerant is heated by a submerged electrical heating coil. Under some circumstances, it is preferable to mount this heating coil upon the outside surface of tank 14, and thermostat 78 may also be positioned upon this outside surface in close proximity to the heating coil. The heating may also be effected by the use of hot water supplied to a coil immersed in the liquid refrigerant in tank 14. This coil may also be supplied with cold water during the refrigeration operation for condensing the refrigerant. Under such circumstances, the condenser 18 may be dispensed with, and water cooling will then be relied upon for the entire condensing action. However, there are advantages in providing combined water and air cooling for condensing.

Where two evaporators are part of the same refrigeration system one may be defrosted by merely connecting it through to pipes to the bottom of the body of hot liquid refrigerant, and simultaneously disconnecting it from the compressor. The refrigeration then operates to cool the other evaporator and the defrosting of the first-mentioned evaporator is by heat of condensation in the hot refrigerant liquid.

When the defrosting operation has been completed, the normal operation referred to above is resumed. The motor of fan 48 has a time delay starting unit in series with it so that the temperature of the evaporator is reduced before the fan restarts.

It has been pointed out above that this type of system is admirably suited for performing a cooling and heating, or reverse cycle, operation. Under such circumstances water or air or a combination of both may be used to cool the condenser during the cooling operation and also to supply the heat during the heating operation. Furthermore, the compressor may be operated continuously so as to give the true reverse cycle heating, referred to above. With such systems, as well as with systems such as in the illustrative embodiment,

it may be desirable to provide check valves to prevent flow of refrigerant in a direction not in accordance with the present disclosure, and there may be safety features not specifically shown herein.

This application is a continuation-in-part of my co-pending application, Serial No. 81,673, filed March 16, 1949, now Patent No. 2,635,433, April 21, 1953.

I claim:

1. In a refrigeration system of the character described, the combination of, a compressor, a receiver tank connected to receive compressed refrigerant from said compressor and to provide storage for liquid refrigerant, condenser means connected solely with said tank to condense refrigerant, the liquid refrigerant flowing into and being accumulated in said tank, an evaporator, means including flow-restricting means connecting said evaporator to receive liquid refrigerant directly from said tank at a reduced pressure, heating means to heat the liquid refrigerant in said tank, and by-pass means which is opened to by-pass said flow-restricting means to connect said evaporator directly to said tank to deliver hot refrigerant to the evaporator to effect heating of the evaporator.

2. A system as described in claim 1 in which said by-pass means includes, solenoid valve means to by-pass portions of the refrigerant circuit during the evaporator heating cycle, and timer means to operate said solenoid valve means to carry on the evaporator heating operation.

3. A system as described in claim 1 wherein said condenser means comprises coil means, and a solenoid valve to control the flow through said coil means.

4. In a refrigeration system of the character described the combination of, a compressor, an evaporator, a condenser and receiver assembly comprising a receiver tank which is adapted to store condensed refrigerant and a coil which is connected solely to said tank and provides for heat transfer between the gaseous refrigerant and a cooling medium, means connecting said compressor to discharge compressed gas into said tank, means including restrictor means connecting the lower portion of said tank to said evaporator thereby to deliver liquid refrigerant from said tank at a reduced pressure to said evaporator, means connecting said evaporator with said compressor, means connected to said tank and including a normally closed valve which may be opened to connect the upper portion of said evaporator with said tank, by-pass means including a normally closed valve which may be opened to by-pass said restrictor means whereby hot refrigerant may flow directly from the lower portion of said tank to the lower portion of said evaporator, and control means to control the opening of said valves and to control the supplying of heat to refrigerant in said tank.

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