

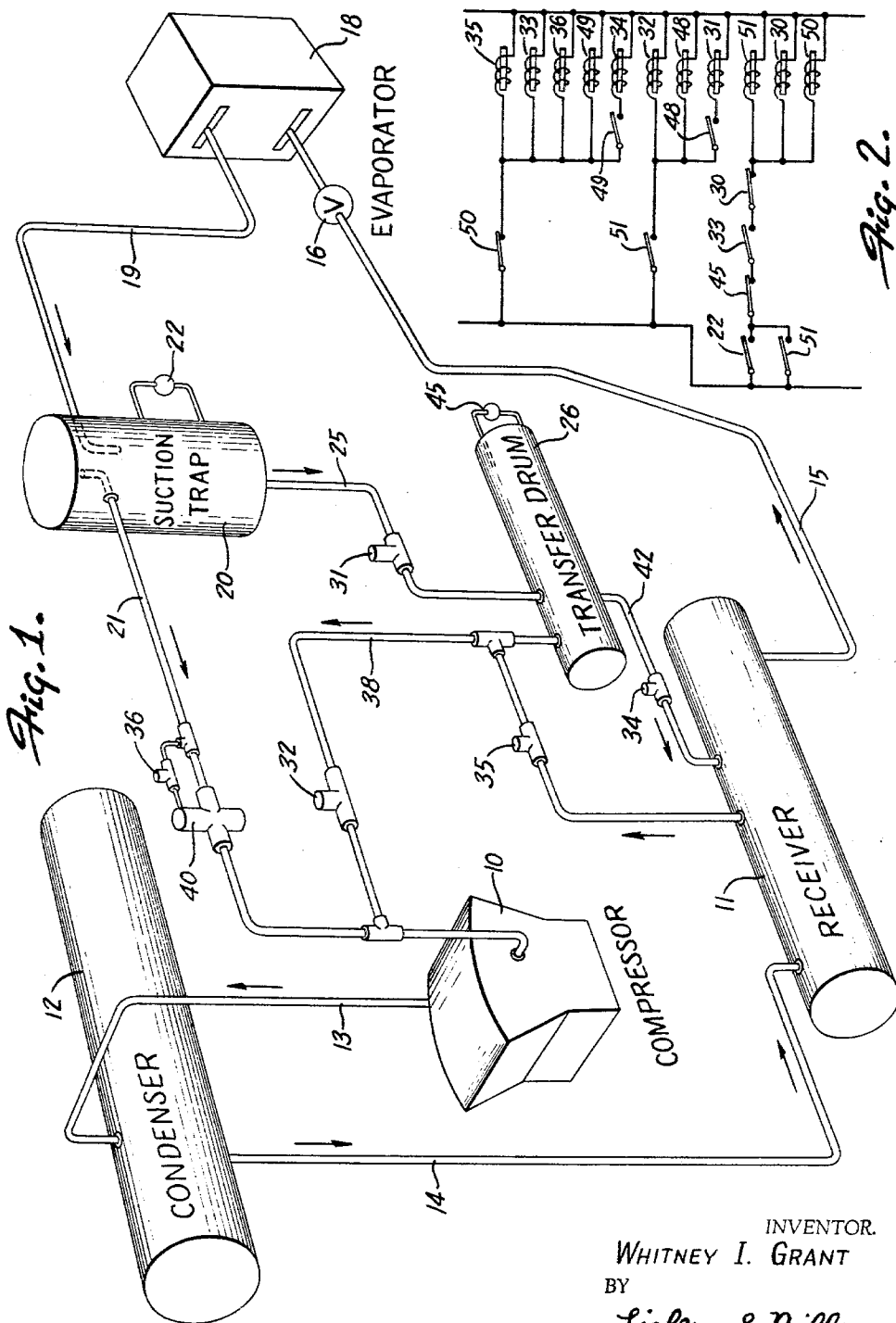
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LIQUID TRANSFER SYSTEM

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LIQUID TRANSFER SYSTEM

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This invention relates to refrigerating systems and more particularly to improved liquid transfer in such systems wherein the force of gravity is relied on as the motivating force to transfer liquid from one vessel to another in the refrigerating system.

Present liquid transfer systems of the gravity type are not generally satisfactory when the vertical distance between a receiver and a suction trap is relatively short, or when the receiver is located above the suction trap. In other words, the available liquid head after consideration is given to line friction, pressure loss in valving and the like, results in a low flow and capacity in the transfer system.

To overcome this problem, U.S. Patent No. 2,589,859 augmented the gravity transfer by pressure existing in the refrigerating system. However, this patent relates to a two stage system for pumping light pressure refrigerant gas and for returning liquid refrigerant accumulating in the suction line to the high pressure side of the system. The teaching of this patent is directed toward a refrigeration system embodying a first and second liquid trap or similar containers together with a connection from the second trap or container to the high pressure refrigerant line.

The instant invention provides a pressure difference to force liquid out of a trap or the like into a transfer drum that is mounted above the receiver a sufficient distance to provide a gravity drain of liquid from the transfer drum to a receiver.

The invention also provides for transfer of liquid refrigerant when the transfer drum is above the suction trap or the like within predetermined pressure differentials established by the system.

Further, the invention relates to a lowering of pressure in the transfer drum by means of an auxiliary connection to a source of lower pressure. Thus, the lowered pressure allows a faster transfer rate from the suction trap.

It is therefore an object of this invention to provide an improved liquid transfer system wherein transfer rate is augmented by pressure differential.

It is another object of this invention to provide an improved liquid transfer system wherein the transfer of liquid is augmented by pressure differential and the force of gravity.

It is a further object of this invention to provide an improved method for transferring liquid at low pressure to a receiver at higher pressure.

It is another object of this invention to provide an improved transfer rate control system for the transfer of liquid in a system having multiple compressors.

It is a further object of this invention to provide an improved control system for improving the transfer of liquids from one pressure zone to another regardless of relative vertical spacing between pressure zones.

These and other objects and advantages of the invention will become apparent from the following detailed description.

A clear conception of the several features constituting the present invention of the transfer of liquids in a refrigerating system embodying the improvements may be had by referring to the drawings accompanying and forming a part of this specification, wherein like reference characters designate the same or similar parts in various views.

FIGURE 1 is a schematic diagram of a refrigerating liquid transfer system of the invention; and

FIG. 2 is a schematic electric circuit diagram of the system of FIG. 1.

While the improvements and method has been illustrated and described as being especially advantageously embodied in a refrigerating system, it is not intended to thereby unnecessarily limit or restrict the invention to refrigeration system, but may be applicable to other systems requiring improved liquid transfer. It is also contemplated that certain descriptive terminology used herein shall be given the broadest possible interpretation consistent with the disclosure.

Referring now to the liquid transfer system of FIG. 1 which discloses a refrigerant compressor 10 for compressing refrigerant gas for discharge through a conduit 13 to a condenser 12 wherein the refrigerant gas at high pressure is condensed to liquid at high pressure: The high pressure liquid refrigerant drains from condenser 12 through conduit 14 to a receiver 11. The liquid refrigerant is communicated through pressure reducing control valve 16 and evaporator 18 by a conduit 15, wherein the liquid in evaporator 18 is at a lower pressure for evaporation. The resulting gas is communicated by conduit 19 to a suction trap 20. In suction trap 20, any entrained liquid in the gas settles out, and the gas flows out of trap 20 through conduit 21. The gas is thus returned to compressor 10 by conduit 21, and the liquid-gas cycle is repeated.

In the preferred embodiment, liquid at low pressure in the suction trap 20 is transferred to the receiver 11, which is at a higher pressure than the suction trap. Such a transfer from a low pressure zone of the suction trap to a higher pressure zone at the receiver is accomplished by initially transferring the liquid from the trap 20 via conduit 25 to a transfer drum 26. This transfer cycle is initiated by a control device 22 that is responsive to the liquid level in the suction trap 20. Such response to liquid level may be either direct or indirect, and such liquid level responsive devices are well known in the art, and the device per se is not part of the present invention.

Reference is also made to the electrical circuit diagram of FIG. 2 wherein control device 22 in response to liquid level in trap 20 actuates fill timer to open solenoid valves 31 and 32. The control device 22, through timer 33, also disconnects solenoid valves 34, 35, and closes back pressure valve pilot 36.

A pilot operated back pressure valve 40 which is known in the art, and, in the preferred embodiment is a Type A4CB valve manufactured by Refrigerating Specialties Company, partially closes to provide a lower pressure between valve 40 and the compressor 10, which also provides a lower pressure in the transfer drum 26 via conduit 38 communicating drum 26 to compressor 10 through solenoid valve 32. The lower pressure thus established in drum 26 is lower than the pressure in suction trap 20, and liquid from the trap is thereby forced into transfer drum 26. The timer 30 is set for a predetermined time to allow the transfer drum 26 to be filled. Should the timer 30 be incorrectly set, a safety level switch 45 on the drum 26 can close solenoid valve 32 or recycle timers 30 and 33 to initiate a drain cycle and end the fill cycle. In either case, adequate protection is offered by safety level switch 45 to prevent a return of liquid from the transfer drum 26 to the compressor 10. The action of timers 30, 33 during this portion of the cycle is to energize solenoid valves 34, 35 to open and to close solenoid valves 31, 32 to restore normal suction pressure in conduit 21 to provide normal system performance.

The liquid in transfer drum 26 drains by gravity through conduit 42 and solenoid drain valve 34 to the

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receiver 11 for a predetermined period of time as established by timer 33.

At the end of the drain cycle, the timers 48, 49 recycle and the transfer of liquid also recycles. The recycling of liquid continues until the level in the suction trap 20 lowers sufficiently to a point where level control device 22 is no longer operative and the pressure in the transfer drum 26 is equalized with the pressure in receiver 11 with the back pressure valve 40 in normally open position. This prevents any prolonged operation of the system at a suction pressure beyond that of the predetermined normal system suction pressure.

If, for example, it is desired to utilize the invention in multiple compressor systems, it is only necessary to provide a pilot operated back pressure valve 40 in a conduit to one compressor, providing that the selected compressor is always in operation, and, further, that a gas equalizing conduit 38 between the transfer drum 26 and the compressor 10 is always connected to the selected compressor.

When multiple gas equalizing conduits 38 and multiple back pressure valves 40 are used, it is only necessary to establish the hereinabove described system control to operate the hereinabove described valves in accordance with the compressor that is being operated.

Thus, a liquid transfer system has been described wherein a liquid is transferred from a zone of low pressure to a zone of higher pressure by the invention embodied and described hereinabove. While the improvements have been illustrated and described as being especially advantageously embodied in a refrigerating system it is not intended to thereby unnecessarily limit or restrict the invention.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention:

I claim:

1. In a refrigerating system having a compressor, a condenser communicating with the high pressure side of said compressor, a receiver communicating with said condenser, an evaporator communicating with said receiver, and a suction trap communicating with said evaporator and having a conduit communicating with the low

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pressure side of the compressor for returning gaseous refrigerant thereto; a transfer drum interposed between and communicating with said suction trap and receiver for transferring liquid refrigerant from said suction trap to said receiver, means responsive to the liquid level in said suction trap for controlling flow of liquid refrigerant to said transfer drum, a pressure regulator in the conduit between said suction trap and the low pressure side of said compressor to control flow of gaseous refrigerant from said suction trap to said compressor, and conduit means connecting said transfer drum to the low pressure side of said compressor between said pressure regulator and said compressor.

2. A refrigerating system according to claim 1, wherein a flow control valve is interposed in the conduit connecting the transfer drum to the conduit connection between the pressure regulator and the compressor.

3. A refrigerating system according to claim 1, wherein conduit means is also provided for connecting the receiver to the low pressure side of the compressor between the pressure regulator and the compressor.

4. A refrigerating system according to claim 3, wherein the conduit means connecting the receiver to the low pressure side of the compressor includes the conduit connecting the transfer drum to the compressor.

5. A refrigerating system according to claim 4, wherein valve means are provided for separately controlling flow through the conduit connection between the transfer drum and the compressor and the conduit connection between the receiver and the compressor.

References Cited by the Examiner

UNITED STATES PATENTS

2,590,741	3/52	Watkins	62—503 X
2,655,008	10/53	Sloan et al.	62—509 X
2,871,673	2/59	Richards et al.	62—509 X
2,986,898	1/61	Wood	62—509 X

FOREIGN PATENTS

598,372	5/60	Canada.
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