

[54] **ABSORPTION REFRIGERATION SYSTEM**
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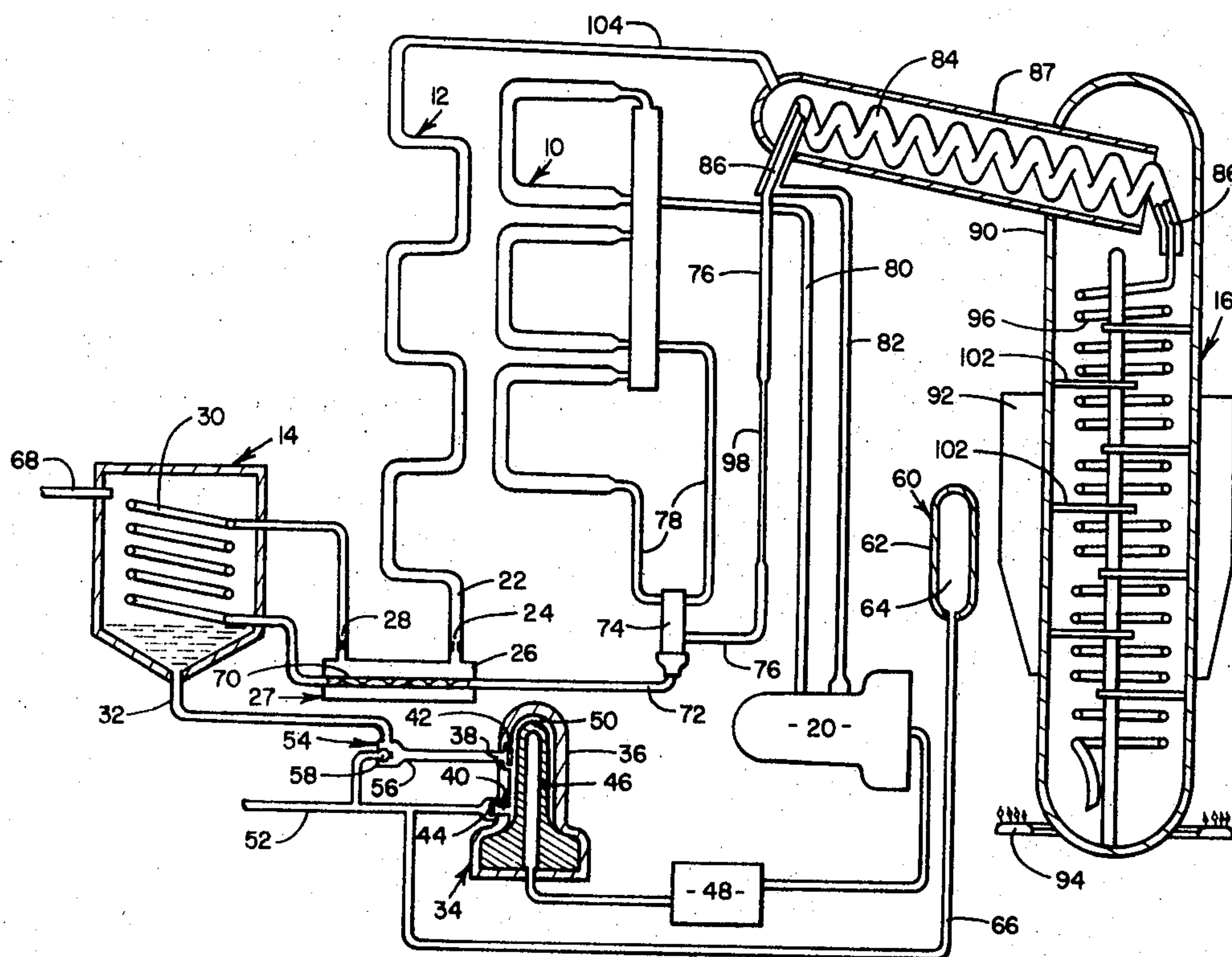
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[58] Field of Search **62/487, 488, 476, 62/DIG. 2, 333; 137/207, 568; 138/30; 165/107; 417/543**

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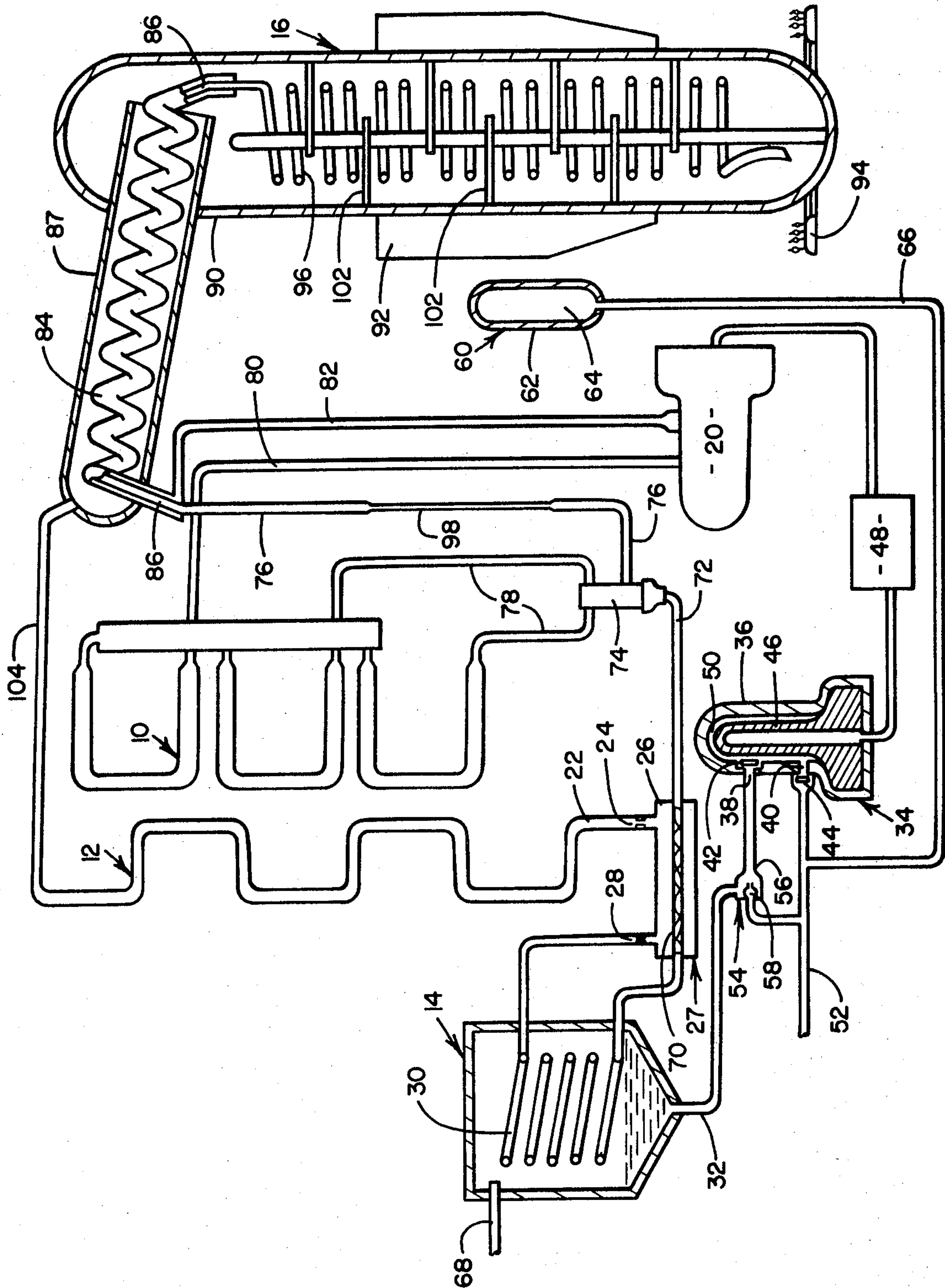
[57] **ABSTRACT**
An absorption refrigeration system employing a secondary refrigerant to transfer heat from a suitable heat exchanger to the absorption cycle evaporator, a pulser type pump being provided to circulate the secondary refrigerant. A pulsation dampener employing vaporized refrigerant as a compressible cushion is provided to minimize the pulsations produced by the pump.

1 Claim, 1 Drawing Figure



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ABSORPTION REFRIGERATION SYSTEM

BACKGROUND OF THE INVENTION

In many applications, for example air conditioning systems, an absorption refrigeration system is provided with a chilled water circuit. The water chilled by the absorption refrigeration machine is circulated to a heat exchanger within the conditioned space, warm air from the space being circulated over the heat exchanger to cool the air for distribution throughout the conditioned space. The warm water from the heat exchanger is returned to the absorption refrigeration machine for transferring the heat therein to the evaporator or chiller of the refrigeration machine.

In a number of installations, it may be desirable to utilize a halogenated hydrocarbon refrigerant such as dichlorodifluoromethane. To minimize refrigerant loss and produce sufficient system pressure for adequate refrigerant circulation, a hermetic, pulser type pump may be utilized. However, the pulses produced by a pulser type pump may produce cyclical stresses in the elements constituting the secondary refrigerant system. Further, objectional noise may be generated due to the cyclical pulses produced by the pump.

SUMMARY OF THE INVENTION

This invention relates to an apparatus for transferring heat through an intermediate heat transfer fluid including a first heat exchanger for transferring heat to the heat transfer fluid and a second heat exchanger for transferring heat from the heat transfer fluid. Cyclical pump means are provided for circulating the heat transfer fluid through the first and second heat exchangers. Means forming a chamber communicating with the discharge side of the pump means are provided, the chamber being maintained at a temperature sufficient to vaporize at least a portion of the heat transfer fluid therein to provide a vapor cushion for dissipating the pulse energy imparted to the heat transfer fluid by the cyclical pump means.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is a schematic diagram of an absorption refrigeration system employing a secondary refrigerant circuit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing there is shown a refrigeration system comprising an absorber 10, a condenser 12, a chiller 14 and a generator 16 connected to provide refrigeration. A pump 20 is employed to circulate weak absorbent solution from absorber 10 to generator 16.

As used herein the term "weak absorbent solution" refers to solution which is weak in absorbent power and the term "strong absorbent solution" refers to a solution which is strong in absorbent power. A suitable absorbent for use in the system described is water and a suitable refrigerant is ammonia.

Liquid refrigerant condensed in condenser 12 passes through refrigerant liquid passage 22 and refrigerant restrictor 24 to heat exchange tube 26 of liquid suction heat exchanger 27. The liquid refrigerant, which is cooled in tube 26, passes through refrigerant restriction 28 into heat exchange coil 30 of chiller 14.

A heat exchange medium such as a halogenated hydrocarbon refrigerant, for example, dichlorodi-

fluoromethane, is passed over the exterior of coil 30 where it is chilled by giving up heat to evaporate the refrigerant within heat exchange coil 30.

The chilled heat exchange medium is collected in the lower portion of chiller 14 for subsequent passage through line 32 to a pulser type pump 34. The pump 34 includes a housing 36 having an inlet opening 38 and a discharge opening 40. A suction valve 42 is disposed within inlet opening 38 and a discharge valve 44 is disposed within discharge opening 40. A flexible diaphragm 46 is mounted within housing 36. A pulsating flow of hydraulic fluid from a suitable hydraulic pump 48 is provided to the interior of diaphragm 46.

When hydraulic fluid under pressure is supplied to diaphragm 46, the diaphragm is expanded outwardly toward the housing walls. The heat exchange medium in space 50 between the diaphragm and housing is forced through discharge valve 44 into discharge line 52. When the hydraulic pressure within the diaphragm is released, the diaphragm contracts. This allows heat exchange medium to pass through suction valve 42 into space 50. Thus, the pulsing hydraulic pressure in diaphragm 46 causes heat exchange medium to be pumped from line 32 to line 52.

For optimum pump efficiency it is desirable to supply liquid heat exchange medium to the pump. However, the suction pressure at the pump inlet may be below the vapor pressure of the heat exchange medium which could result in flashing of a portion of the heat exchange medium. The resulting flash gas would reduce pump efficiency. To obviate this problem, an ejector 54 having a throat 56 is provided in line 32 to increase the pressure of the heat exchange medium at the pump inlet. A nozzle 58, disposed adjacent throat 56 is adapted to inject a portion of the heat exchange medium flowing through line 52 into throat 56 to provide a pressure downstream from the ejector sufficient to prevent flashing of the heat exchange medium.

Many types of pumps which could be utilized to circulate the heat exchange medium such as a piston pump or the disclosed diaphragm pump produce a "pulsed" output. The discharge pulsations may produce undesirable stresses and/or objectionable noise in the system. To minimize these problems, a pulsation damper 60 is provided. The damper comprises a cylindrical tank 62 forming a chamber 64. A line 66 provides communication between chamber 64 and pump discharge line 52. A vapor cushion is provided in chamber 64 by vaporizing a portion of the heat exchange medium supplied thereto. To maintain an adequate supply of vapor within the chamber, the pulsation damper is maintained at a temperature sufficient to vaporize the heat exchange medium. Preferably, this is accomplished by locating the pulsation damper in the flue gas passage of the absorption system generator. However, the damper could be heated by circulating hot absorbent solution through a suitable coil disposed therein or around the exterior of the tank 62. An electric resistance heater could also be provided to maintain the desired temperature within the chamber.

The compressible vaporized heat exchange medium within chamber 64, by dampening the pulsations produced in the heat transfer medium by the pump, minimizes the stresses produced by the cyclical pump output which in turn reduces the noise generated thereby.

The chilled heat exchange medium passes through line 52 to suitable remote heat exchangers (not shown)

after which it is returned to the chiller through line 68.

The refrigerant evaporated in heat exchange coil 30 passes through refrigerant vapor passage 70 of liquid suction heat exchanger 27 in heat exchange relation with liquid refrigerant passing through tube 26. Refrigerant vapor having a small proportion of absorbent liquid therewith passes from passage 70 through line 72 into vapor distributor 74. Strong solution which is supplied from the generator to the vapor distributor 74 through line 76 is discharged into the vapor distributor 74 to induce refrigerant vapor from distributor 74 into tubes 78. The strong solution with the refrigerant vapor therein is supplied to absorber 10 where a cooling medium, preferably ambient air is passed over the surface of the absorber in heat exchange relation with the solution therein for cooling the absorbent solution to promote the absorption of the refrigerant vapor by the solution. The same cooling medium may be supplied to condenser 12 in heat exchange relation with refrigerant vapor therein to condense the refrigerant.

Cold weak absorbent solution passes from absorber 10 through a line 80 into weak solution pump 20. Pump 20 may be of the same general design as pump 34, the hydraulic pump 48 being adapted to supply a pulsating flow of hydraulic fluid to pump 20 and pump 34. Liquid from pump 20 passes through pump discharge line 82 to a rectifier heat exchange coil 84. The weak solution passes through coil 84 in heat exchange relation with hot strong solution passing through heat exchange coil 86 disposed within coil 84 and with the hot refrigerant vapor flowing through rectifier shell 87 in contact with the outer surface of coil 84. The weak solution from coil 84 is discharged into the upper portion of generator 16 along with any vapor which is formed in coil 84 due to heat exchange with the hot vapor passing thereover and the hot solution flowing therethrough.

Generator 16 comprises a shell 90 having fins 92 suitably affixed thereto as by welding. The generator is heated by a gas burner 94 or other suitable heating means. The weak solution is boiled in generator 16 to concentrate the solution, thereby forming a strong solution and refrigerant vapor.

The hot strong absorbent solution passes upwardly through the analyzer section of generator 16 through analyzer coil 96 in heat exchange with weak solution passing downwardly over the coil. The warm strong so-

lution then passes through heat exchange coil 86 and line 76 into vapor distributor 74. A restrictor 98 is provided in line 76 so that the solution supplied to the vapor distributor is at the same pressure as the vapor in vapor distributor 74.

Refrigerant vapor formed in generator 16 passes upwardly through the analyzer section thereof where it is concentrated by mass heat transfer with weak solution passing downwardly over analyzer coil 96. Analyzer plates 102 in generator 16 provide a tortuous path for flow of solution and vapor, assuring intimate contact therebetween to improve the mass heat transfer. The vapor passes through rectifier 87 in heat exchange relation with the weak solution passing through coil 84. Absorbent condensed in rectifier 87 flows downwardly into the generator 16. The vapor formed in the generator is a mixture of refrigerant vapor and absorbent vapor. The analyzer plates and rectifier purify the refrigerant vapor by condensing the absorbent vapor from the mixture. The purified refrigerant vapor is passed from rectifier 87 through line 104 to condenser 12 to complete the refrigeration cycle.

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

I claim:

1. The combination comprising:

an absorption refrigeration system including a chiller with heat exchange coils for conducting refrigerant through said chiller, a condenser, a generator and an absorber;

means for circulating heat exchange medium through said chiller to evaporate refrigerant in said heat exchange coils, said circulating means including a pulser type pump, an outlet line from the discharge side of said pump, and a closed tank communicating with said discharge line for holding heat exchange medium; and

a common heat source for supplying heat to said absorption refrigeration system and to said tank, the heat supplied to said tank being sufficient to vaporize fluid in said tank to thereby create a vapor cushion for damping pulsations in the heat exchange medium.

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