United States Patent [19]

Kaiser

[11] **3,742,727**

[45] **July 3, 1973**

[54] **ABSORPTION REFRIGERATION SYSTEM**

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[22] Filed: **June 2, 1971**

[21] Appl. No.: **149,285**

[52] **U.S. Cl.** **62/476**, 62/DIG. 2, 137/207, 138/30, 165/107, 417/543

[51] **Int. Cl.** **F25b 15/04**

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

[56] **References Cited**

UNITED STATES PATENTS

2,315,179	3/1943	Allender	417/543 X
2,138,654	11/1938	Doran	417/543 X
2,212,281	8/1940	Ullstrand	62/333 X
3,491,553	1/1970	Briggs	62/476 X

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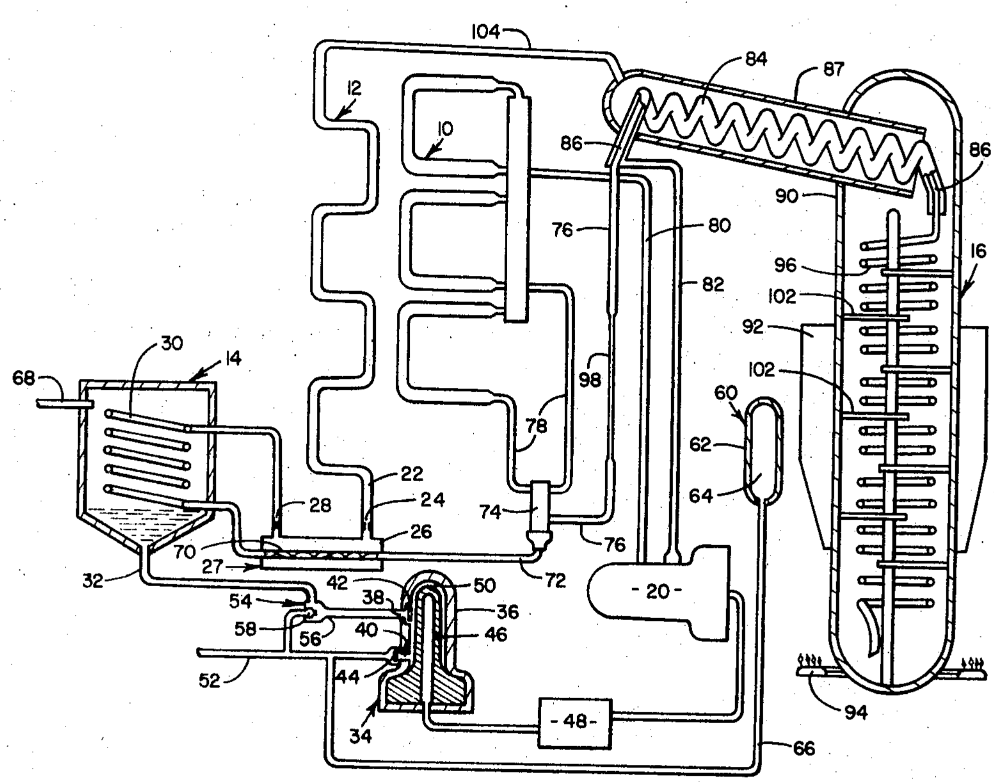
[57] **ABSTRACT**

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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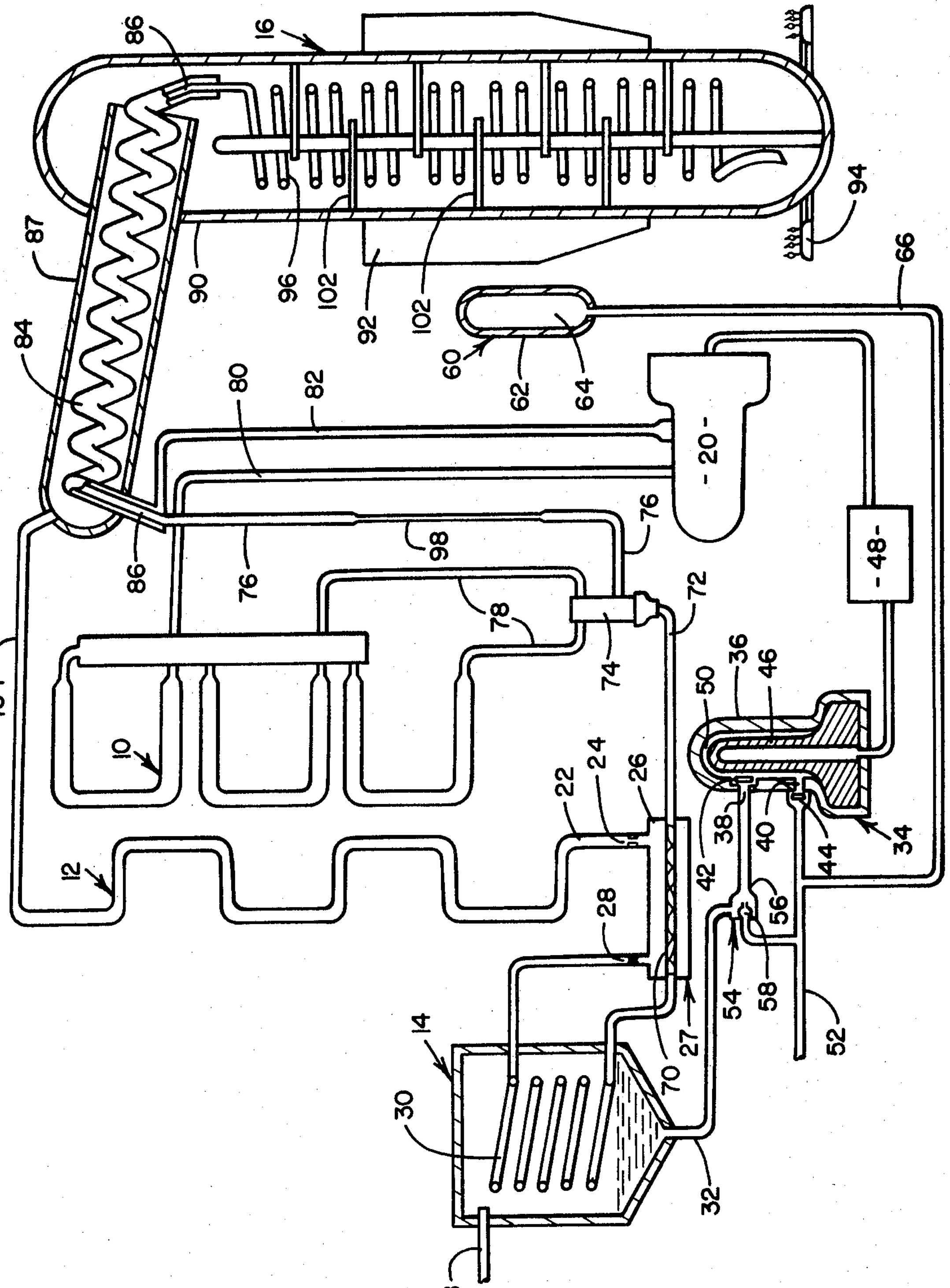

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ABSORPTION REFRIGERATION SYSTEM

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 refirgeration 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, dichlorodifluoromethane, 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 efficieny 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 solution 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 refigerant 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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