

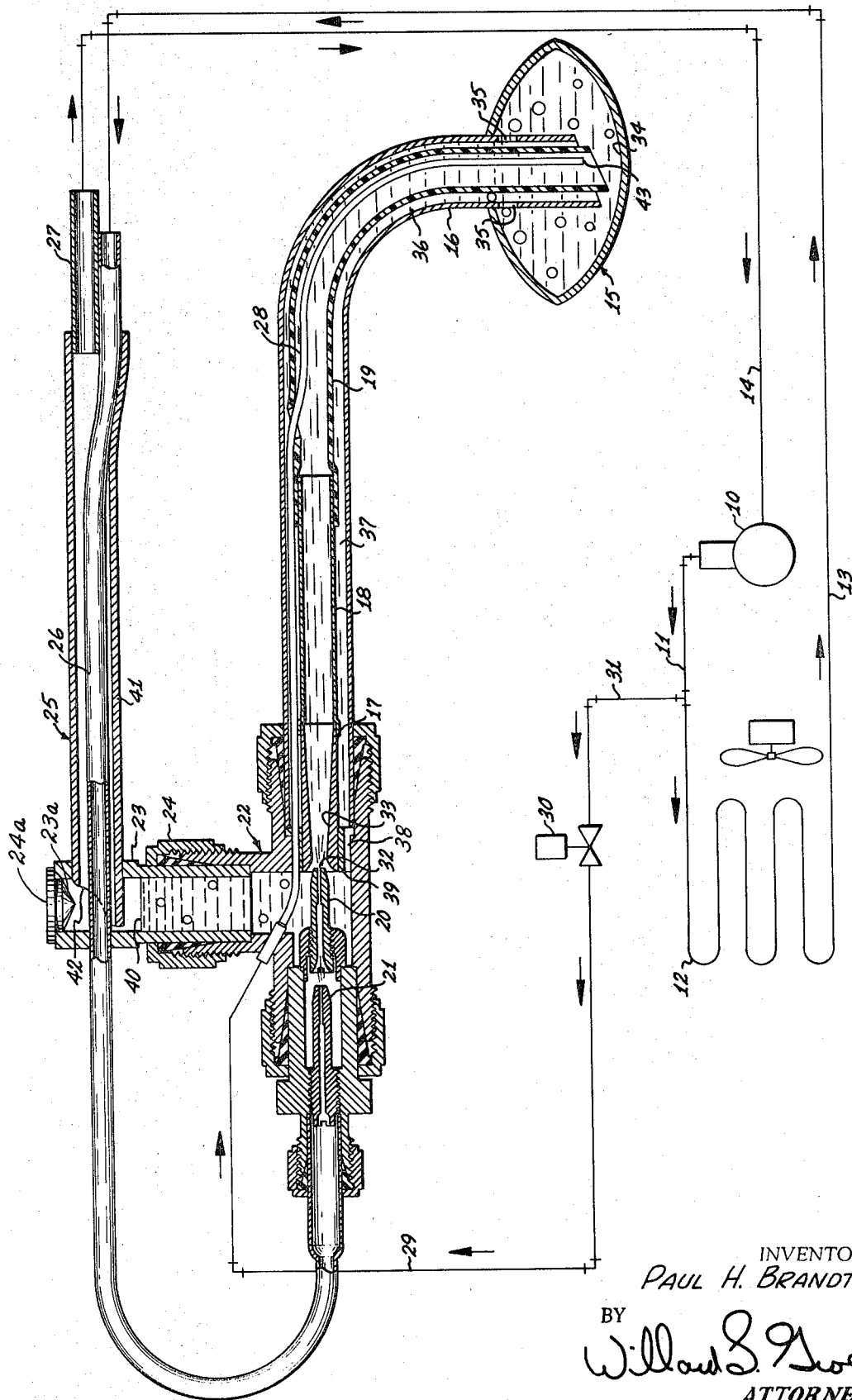
Jan. 26, 1971

P. H. BRANDT

3,557,570

REFRIGERANT METERING DEVICE

Filed March 10, 1969



INVENTOR.
PAUL H. BRANDT
BY
Willard S. Swenz
ATTORNEY

1

3,557,570

REFRIGERANT METERING DEVICE

Paul H. Brandt, 5202 E. Flower, Phoenix, Ariz. 85018

Filed Mar. 10, 1969, Ser. No. 805,720

Int. Cl. F25b 47/00

U.S. Cl. 62-278

3 Claims

ABSTRACT OF THE DISCLOSURE

An injector type refrigerant metering device for use in place of standard thermostatic or automatic expansion valves, high or low side floats, capillary tube metering devices or any other conventional method of metering liquid refrigerant from the high side to the low side of a compression type refrigeration system.

BACKGROUND OF THE INVENTION

This invention pertains to refrigeration systems and is particularly directed to an injector type refrigerant metering apparatus for such systems.

In systems formerly used in connection with, for example, a standard nitrogen cold trap with the standard type of refrigerant metering devices failure frequently resulted because of the low velocity in the evaporator cold trap because of poor oil return and low refrigerant velocities in the evaporator and the resulting evaporator inefficiencies.

SUMMARY OF THE INVENTION

One of the objects of this invention is to increase the refrigerant velocity in the refrigerant evaporator.

Another object of this invention as above is to provide a device which requires only one connection to the evaporator or the low side of the refrigeration system whereas a conventional type refrigerant metering device requires one inlet and one outlet connection.

Still another object is to increase the efficiency of the refrigerant evaporator by increasing the heat transfer of the evaporator.

It is a further object to assure complete oil return from the refrigerant evaporator to further increase the overall efficiency of the refrigeration system.

It is also an object to make use of a standard vacuum evaporator metalized cold trap designed for liquid nitrogen to be used successfully with mechanical refrigeration.

And a still further object is to reduce external heat gain to a refrigerant evaporator because of additional piping not being required as with its conventional method of metering devices.

BRIEF DESCRIPTION OF THE DRAWINGS

The figure is a system diagram, partly in section, showing a single connection injector metering system operating in conjunction with a conventional type compression refrigeration system.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As an example of one embodiment of this invention, there is shown a conventional compression type refrigeration system having the usual compressor 10, the pressure discharge line 11 connected to the input of the condenser 12 having the condenser discharge line 13, and the compressor return suction tube 14.

The refrigerant evaporator, in this particular example, comprises a conventional nitrogen cold trap 15 the top of which is connected to a large return tube 16 connected to the suction line 14 to the compressor 10, such as a high vacuum pump designed for liquid nitrogen.

The principal elements of this system comprise the

2

venturi tube 17; the extension tube 18; the flexible tube 19; the injection nozzle 20; and capacity control nozzle 21 all appropriately mounted in the main valve body 22. The injection head 23 suitably secured by compression nut 24 to the main valve body 22 includes the suction and oil scoop return and heat exchanger assembly 25 having the liquid heat exchanger line 26 connected to condenser discharge line 13 and the line 27 connected to the compressor return suction line 14. A cone-shaped ceiling 23a forms part of the cap 24a which closes the injection head 23 as shown.

A hot gas defrost tube 28 is connected through line 29, hot gas solenoid valve 30, and line 31 to the compressor pressure discharge line 11.

OPERATION

High pressure liquid refrigerant is fed from the condenser 12 through line 13 to the capacity control nozzle 21 and through the injection nozzle. High velocity refrigerant leaves the orifice 32 and enters the venturi tube bore 33 and is fed through tubes 18 and 19 to the bottom 34 of the refrigerant evaporator 15. Part of the refrigerant evaporated in the evaporator 15 and the mixture of evaporated refrigerant and liquid refrigerant returns to the injector head through openings 35 in the tube 16 within the evaporator 15, through annular space 36 and 37, and passageways 38 in the venturi tube support bushing 39 carried in the main valve body 22.

Evaporated refrigerant in vapor form rises to the top of the refrigerant liquid level 40 to be returned to the compressor 10 through suction line 41 having oil scoop 42 connected to the compressor return suction line. Liquid refrigerant which is not evaporated is driven back through the evaporator 15 by high velocity liquid refrigerant leaving injector nozzle 20 through venturi tube 17, through tube 18 and the flexible tube 19. Since three to four times more refrigerant is fed to the evaporator 15 than what is evaporated, a continual agitation is maintained in the evaporator.

It will be further noted that this agitation prevents oil separation from the refrigerant in the evaporator which returns the oil and refrigerant mixture to the injector head 23, this agitation not occurring with a conventional expansion valve system.

The passage of evaporated refrigerant through injection head 23 to suction of the oil scoop assembly 25 returns any excess oil back to the compressor by high velocity suction gas at the inlet 42 to the oil scoop assembly 25.

Fast defrosting and warm up of the system for servicing the evaporator 15 may be accomplished by energizing hot gas solenoid valve 30 which allows hot discharge gas to enter the evaporator through the end 43 of the small diameter tube 28 before being condensed in the condenser 12.

I claim:

1. An injection type refrigerant metering device comprising in combination:

- (A) a refrigerant evaporator,
- (B) a large return tube having its outer end connected to and discharging within the evaporator,
- (C) a main valve body having a valve chamber supporting the other end of the large return tube in communication with the valve chamber,
- (D) a venturi tube having its input opening in communication with the valve chamber mounted in the valve body within the other end of the large return tube,
- (E) an extension tube connected to the discharge end of the venturi tube of smaller outside diameter than and extending through the large return tube to discharge in the evaporator,

3

- (F) an injection nozzle in the main valve body chamber discharging into the input opening of the venturi,
- (G) an injection head on the main valve body,
- (H) an oil collector and return and heat exchanger including a suction line mounted on the injection head in communication with the valve body chamber above the venturi and the injection nozzle,
- (I) a liquid heat exchanger line within the suction line of the oil scoop return and heat exchanger,
- (J) and a line connecting the liquid heat exchanger line to the input side of the injection nozzle.

2. An injection type refrigerant metering device as in claim 1 wherein a capacity control nozzle is located in the line between the liquid heat exchanger line and the input side of the injection nozzle.

3. An injection type refrigerant metering device as in claim 1 wherein a hot gas defrost tube has its input end

4

mounted on the main valve body and extends first through the space between the bore of the large tube and the extension tube outside diameter and then through the inside of the extension tube to discharge into the evaporator.

References Cited

UNITED STATES PATENTS

2,117,506	5/1938	Reinhardt	62—512
2,164,081	6/1939	Phillips	62—500
2,462,329	2/1949	Mojonnier	62—512

MEYER PERLIN, Primary Examiner

U.S. Cl. X.R.

62—500, 512