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M. T. CAHENZLI, JR.
COMBINATION ACCUMULATOR, METERING TUBE AND HEAT
EXCHANGER FOR REFRIGERATION SYSTEMS
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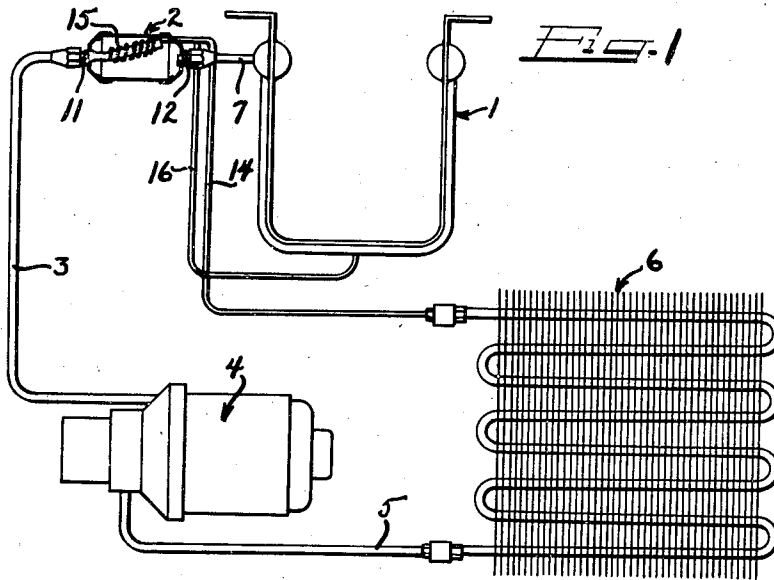
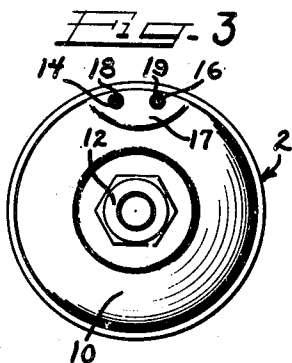
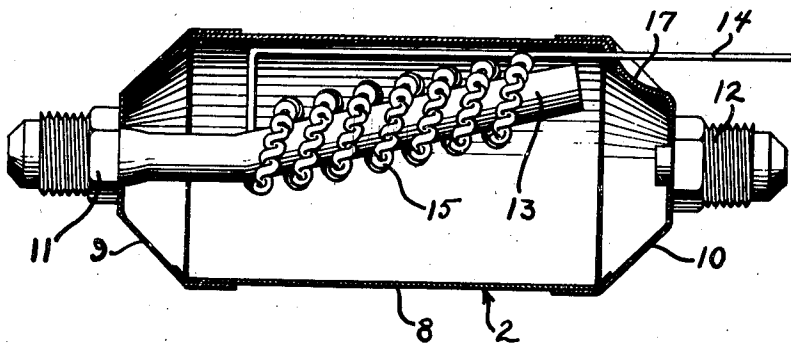


Fig. 2



INVENTOR

MARTIN T. CAHENZLI, JR.

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UNITED STATES PATENT OFFICE

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COMBINATION ACCUMULATOR, METERING
TUBE, AND HEAT EXCHANGER FOR RE-
FRIGERATION SYSTEMSMartin T. Cahenzli, Jr., Chicago, Ill., assignor to
The Harry Alter Company, Chicago, Ill., a cor-
poration of Illinois

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6 Claims. (Cl. 62-8)

1

This invention relates to improvements in a combination unit for refrigerating systems, and more particularly to a single unit embodying an accumulator, a metering tube for the refrigerant, and a heat exchanging arrangement, the unit being highly desirable for use in mechanical refrigerating systems, especially of the household type, although the invention may have other uses and purposes as will be apparent to one skilled in the art.

In a mechanical refrigerating system, wherein there is an evaporator, compressor, condenser, and some arrangement to limit the flow of liquid refrigerant from the condenser to the evaporator, it is desirable to have an accumulator in the low pressure side intimately associated with the outlet of the evaporator. The reason for this is the prevention of a slug of liquid refrigerant reaching the compressor which is built to handle gas and which would be materially injured if a slug of liquid reached it, and the larger the compressor the worse the effect of such a slug of liquid. When the driving unit or motor is started after the mechanism has been at rest for a time, the pressures in both the low pressure side and the high pressure side are approximately equal. In the high pressure side, the metering device slows down the movement of refrigerant into the evaporator so that a partial vacuum is immediately developed in the evaporator and this partial vacuum is sometimes strong enough to cause the withdrawal of a slug of liquid from the evaporator into the suction line, and this liquid would then travel very rapidly into the compressor, were it not for an accumulator. The accumulator holds and retains the slug of liquid until it has gasified before permitting its exit through the suction line to the compressor.

It has also been found desirable in refrigerating systems to employ heat exchanging means to increase the efficiency of the compressor by supplying heat to the gases leaving the evaporator in the suction side of the system, and cooling the liquid refrigerant going to the evaporator in the high pressure side. Such heat exchange arrangement provides less work for the compressor to do.

It has further been found desirable in refrigerating systems to employ a metering tube, sometimes referred to as a capillary tube, to control the amount of refrigerant passing to the evaporator in the high pressure side of the system. Such a metering device comprises a tube of predetermined length, depending upon the capacity of the particular system, and which is of uniform

2

inside diameter, the diameter being sufficiently small to restrict the flow of refrigerant to the desired extent. A tube of this nature embodies no moving parts and nothing to become out of order. Such a tube may be used in lieu of mechanical expansion valves, needle valves, and float valves, all of which do have moving parts, frequently become out of order, and are extremely difficult to repair.

All such devices have been developed in the past, and insofar as I am aware, they required three separate installations in order to provide an accumulator, a metering device, and a heat exchange arrangement. They were difficult to install, objectionably expensive, and required an objectionable amount of labor.

With the foregoing in mind, it is an important object of the instant invention to provide a simple unit readily installed in a refrigerating system and which combines in the single unit both an accumulator and a heat exchanger.

Also an object of this invention is the provision of such a simple unit readily installed in a refrigerating system which combines in the same unit both an accumulator and a metering device.

A further object of the instant invention is the provision of a simple unit readily installed in a refrigerating system which combines in a single unit an accumulator, a heat exchange arrangement, and a metering device.

A further feature of the instant invention resides in the provision of a simple, highly economical, and entirely encased unit combining an accumulator, a heat exchange arrangement, and metering device in a single unit, and which carries sufficient connections and tubing for the adequate installation of the unit in substantially any refrigerating system which the unit may fit.

Still a further feature of the instant invention resides in the provision of a simple combination unit for refrigerating systems, which unit embodies an accumulator, heat exchange arrangement, and metering device, or any two of them, and which is so arranged that no further effort is required to connect it into a refrigerating system than is required for the connection of an accumulator alone.

It is also an object of this invention to provide a single unit combining both an accumulator and a heat exchange arrangement housed within a single casing and in which the refrigerant supply line enters and leaves the casing at the same end thereof to facilitate installation of the device.

While some of the more salient features, characteristics and advantages of the instant inven-

3

tion have been above pointed out, others will become apparent from the disclosures, taken in conjunction with the accompanying drawing, in which:

Figure 1 is a somewhat diagrammatic illustration of a refrigerating system showing a unit embodying principles of the instant invention in section and in operating position in the system;

Figure 2 is an enlarged vertical sectional view, with parts shown in elevation, of the unit itself removed from the system; and

Figure 3 is an end elevational view of the structure of Figure 2 taken from the right-hand side thereof.

As shown on the drawing:

The illustrated embodiment of the instant invention is shown installed in a diagrammatic refrigerating system in Figure 1. The system includes an evaporator generally indicated by numeral 1, a unit embodying principles of the instant invention generally indicated by numeral 2 on the outlet side of the evaporator, a suction line 3 leading to a compressor generally indicated by numeral 4, and a pressure line 5 leading from the compressor to a condenser generally indicated by numeral 6 which in turn is connected to the evaporator in a manner to be later described. In the illustrated system, no reservoir is shown on the outlet side of the condenser 6, but it is obvious that such a reservoir could be employed if so desired.

For purposes of clarity only, an outlet conduit 7 is shown between the evaporator and the unit 2, in order that the connection may better be illustrated, but that outlet may be and preferably is eliminated in actual practice so that the unit 2 is connected as closely as possible to the evaporator.

With reference more particularly to Figure 2, it will be seen that the unit 2 includes a casing made up of a cylindrical body portion 8 to which a cap 9 is brazed or otherwise secured to one end, and to which a cap 10 is similarly secured to the opposite end. The caps are each provided with a frusto-conical portion to reduce their size so that they terminate in an end portion suitable for the connection of a fitting. To the cap 9 a fitting 11 is secured which may be connected in any known manner to the suction line 3. To the cap 10 a fitting 12 is secured which, in the illustrated showing of Figure 1, is connected to the outlet conduit 7 from the evaporator, but which in practice may be connected directly to the evaporator, if so desired. The casing itself functions as an accumulator by virtue of an inside upwardly inclined pipe 13, one end of which is intimately connected with the fitting 11, and the other end of which is open and disposed near the upper side of the accumulator when it is mounted in the position shown in Figure 1. Consequently, any slug of liquid drawn from the evaporator into the accumulator will fall to the bottom of the casing well down below the open end of the tube 13, and the slug cannot possibly exit through the tube 13 until after it has gasified. Thus, there is no opportunity for a slug of liquid to pass through the suction line 3 and enter and injure the compressor 4.

Obviously, the tube 13 functions in reality as the outlet of the evaporator 1. Consequently, with a heat exchanging arrangement, it is desirable to have a portion of the high pressure line between the condenser 6 and evaporator 1 intimately associated with the pipe 13. That is done in connection with the instant invention, but a

4

dual purpose is accomplished in setting up that arrangement in that the metering portion or working portion of a metering tube is disposed about the pipe 13, and that portion of the metering tube not only operates to effect the desired heat exchange, but also operates to control the amount of liquid refrigerant delivered to the evaporator.

To this end, a metering tube is provided which is preferably a soft copper tube of relatively small inside diameter, and which includes an external leg 14 for connection between the outlet conduit of the condenser 6 and a coiled portion 15 of the tube wound about the pipe 13 inside the casing of the unit 2. From this coiled portion another integral leg 16 extends through the end of the casing for connection with the lower part of the evaporator 1 as seen best in Figure 1. With reference again to Figure 2, it will be seen that the coiled portion 15 of the metering tube is in the form of a coiled coil. That is, a part of the tube is wound into a single layer tight coil of relatively small inside diameter, and then this coil is itself coiled around the pipe 13. The coiling of the coil around the pipe 13 causes a separation between the loops or turns of the tightly wound original coil exposing more surface for heat exchange. The tight coiling of the metering tube cuts down the required length of tube since there is considerably greater restriction to the flow of fluid in a tightly coiled tube than in a loosely coiled tube of relatively large inside diameter or a straight tube. The coiled portion 15 of the tube, therefore, is the working portion of the tube or that portion depended upon mainly to control the amount of refrigerant delivered to the evaporator. Of course, the legs 14 and 16 will also aid in controlling the delivery of refrigerant, but the amount of control exercised by these legs is very little in comparison with the control exercised by the coiled portion 15 of the tube. Further, this coiled portion 15 of the tube is preferably in contact as much as the coil loops will permit with the pipe 13 so as to insure a high degree of heat exchange.

As seen best in Figures 2 and 3, both the leg portions 14 and 16 of the metering tube preferably enter the same end wall of the casing of the device so as to facilitate its handling and installation. With this in mind, it will be noted that the cap 10 is struck inwardly to provide a recess 17 and within the upper portion of this recess the cap is provided with two apertures 18 and 19 through which the leg portions 14 and 16 extend respectively. The apertures may be sealed around the tube legs by the provision of a suitable resilient packing, by soldering, or in any other equivalent manner.

It will be noted that in installing the instant invention in a refrigerating system, only one single connection over and above those necessary in a system having no portions of the instant invention is all that is required. In any system, there must be a connection between the suction line and evaporator. With the present device, one end of the device may be connected to the evaporator and the other end to the suction line, making one extra connection only. As for the legs of the metering tube, there would have to be a tube connection line of some form between the compressor and evaporator in any system.

With the instant invention, all embodied in a compact unit, it is only necessary to connect the fitting 12 to the evaporator, the fitting 11 to the suction line 3, the tube leg 14 to the line from the condenser, and the tube leg 16 to the lower

portion of the evaporator. The device is then completely installed. During operation, liquid refrigerant from the condenser 6 passes through the leg 14 into the coiled portion 15 of the device, where its flow is limited so that it will reach the evaporator only at a predetermined rate, and then flows into the evaporator through the leg 13. Gases from the evaporator exit through the conduit 7 by virtue of suction in the line 3, or preferably with the elimination of this conduit exit directly into the interior of the enlarged casing of the device 2. The gases fill the casing, and these cold gases pass through the pipe 13 into the suction line. In the event a slug of liquid is drawn out of the evaporator, that slug will remain in the bottom of the casing until it gasifies and cannot pass to the compressor. At the same time, the liquid refrigerant passing through the coiled portion 15 of the metering tube is chilled by virtue of the cold gases passing through the pipe 13 and these gases pick up heat from the metering tube thereby increasing the efficiency of the compressor by providing less work for the compressor to do.

Before installation, it will be understood that the leg portions 14 and 16 of the metering tube may be sealed at the ends and wound into a haphazard coil for purposes of handling. These haphazard coils may be straightened out at the time of installation, and the ends of the tubes cut off to the desired length.

From the foregoing, it is apparent that I have provided a very simple and economical form of unit combining in a single unit an accumulator and a heat exchanger, or an accumulator and a metering tube, or an accumulator, heat exchanger, and metering tube. The entire device may be readily and easily and very quickly installed in a refrigerating system, and when so installed the system is provided with all three component parts or features of the device in the single installation operation.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In a combination unit for installation in a refrigerating system, a hollow casing, a fitting in one end of said casing for connection to the evaporator outlet of the system, a fitting in the other end of the casing for connection with the suction line of the system, an upwardly inclined pipe in said casing having one end connected to the second said fitting and the other end open near the top of the casing, and a tube for connection in the high pressure side of the system having a pair of legs extending through the casing and a part within the casing intimately associated with said pipe.

2. In a combination unit for installation in a refrigerating system, a hollow casing, a fitting in one end of said casing for connection to the evaporator outlet of the system, a fitting in the other end of the casing for connection with the suction line of the system, an upwardly inclined pipe in said casing having one end connected to the second said fitting and the other end open near the top of the casing, and a metering tube

having a portion coiled intimately around said pipe and a pair of legs extending outside said casing for connection in the high pressure side of the system.

3. In a combination unit for installation in a refrigerating system, a hollow casing, a fitting in one end of said casing for connection to the evaporator outlet of the system, a fitting in the other end of the casing for connection with the suction line of the system, an upwardly inclined pipe in said casing having one end connected to the second said fitting and the other end open near the top of the casing, a metering tube having a portion thereof in the form of a coil which coil is in turn coiled around said pipe, and a pair of legs extending from the opposite ends of said portion through said casing for connection with the high pressure side of the system.

4. In a combination unit for installation in a refrigerating system, a hollow casing, a fitting in one end of said casing for connection to the evaporator outlet of the system, a fitting in the other end of the casing for connection with the suction line of the system, an upwardly inclined pipe in said casing having one end connected to the second said fitting and the other end open near the top of the casing, and a tube having a portion in intimate association with said pipe and having a pair of legs extending through the wall of said casing at closely adjacent points for connection in the high pressure side of the system.

5. In a combination unit for installation in a refrigerating system, a hollow casing, a pair of fittings carried by said casing for connection with the suction line and evaporator of the system, said casing being of larger diameter than the evaporator outlet and the suction line, an upwardly inclined pipe in said casing having the low end connected to the suction line fitting and the high end open, and a metering tube for connection in the high pressure side of the system disposed in said casing and wound intimately around said pipe.

6. In a unit for installation in a refrigeration system, a casing arranged for connection in the suction line of the system, said casing being of greater diameter than the suction line, an upwardly inclined pipe in said casing having an open end near the top of the casing and the other end connected to the suction line connection farthest from the evaporator of the system, and a metering tube for connection in the high pressure side of the system having a part extending into said casing and disposed in heat exchange association with said upwardly inclined pipe.

MARTIN T. CAHENZLI, JR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,181,416	Boles	Nov. 28, 1939
2,188,893	Philipp	Jan. 30, 1940
2,393,854	Carpenter	Jan. 29, 1946

FOREIGN PATENTS

Number	Country	Date
11,177	Great Britain	Oct. 24, 1896