March 18, 1952 J. K. TOUBORG 2,589,457

REFRIGERANT SEPARATOR AND DEHYDRATOR

Filed Dec. 16, 1946

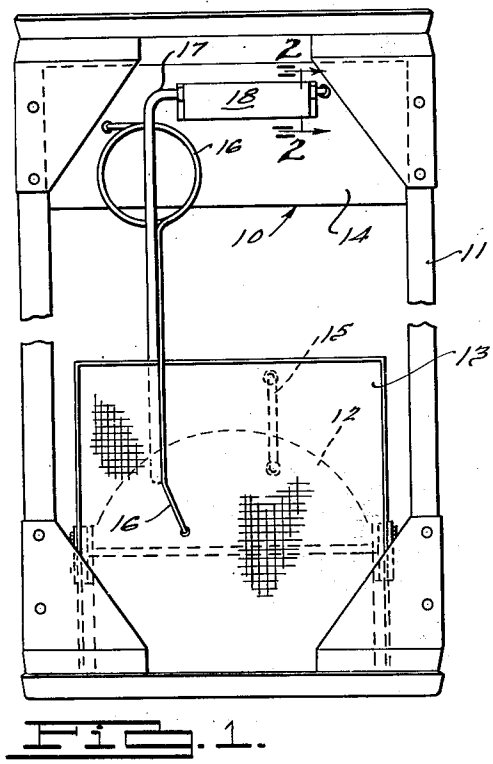


FIG. 1.

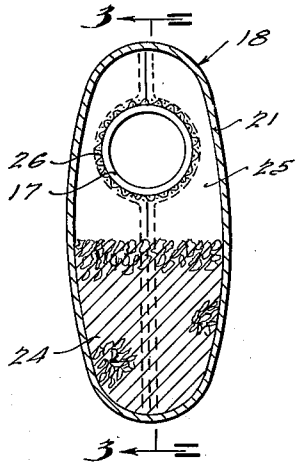


FIG. 2.

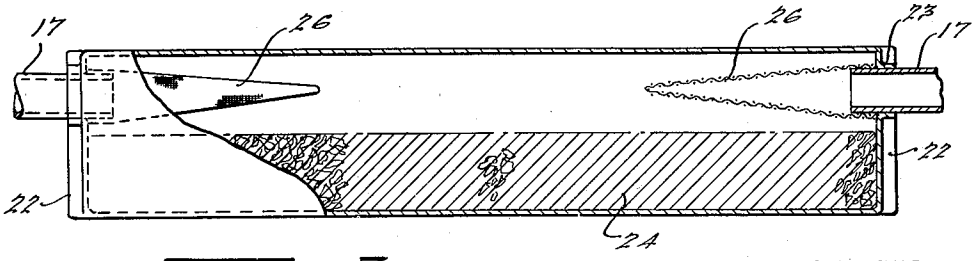


FIG. 3.

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Patented Mar. 18, 1952 2,589,457

UNITED STATES PATENT OFFICE

2,589,457

REFRIGERANT SEPARATOR AND DEHYDRATOR

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Application December 16, 1946, Serial No. 716,633

7 Claims. (Cl. 183—4.0)

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This invention relates to separating and dehydrating units and particularly to a unit for separating the liquid refrigerant from that in gaseous form and for dehydrating the refrigerant of a refrigerating system.

While separators have been employed heretofore in the low side of a refrigerating system ahead of the compressor for separating the liquid form of refrigerant from that in a gaseous state being delivered to the compressor, and while dehydrating units have been utilized in the system for removing moisture from the refrigerant therein, the present invention pertains to a combined unit which produces the desired separation of the liquid from the gas ahead of the compressor and the dehydration of any of the moisture which may be contained therein. Should a quantity of liquid refrigerant be collected in the compressor unit, damage might occur to the compressor since this was designed to operate on a refrigerant when in gaseous form. Similarly, if too much moisture content is present in the refrigerant, difficulty results from the freezing of the passageway either in the capillary tube or at the expansion valve. The present unit functions as a safety element in eliminating the hazards above recited.

The unit of the present invention embodies a sealed casing having an inlet and outlet disposed above the medial line of the casing. The casing is preferably of elongated form, with the longitudinal axis disposed horizontally. The bottom portion of the casing is filled with irregular particles of a dehydrating substance, such as silica gel and the like. Strainers are preferably provided over the ends of the inlet and outlet conduits within the casing for preventing any of the particles from entering the interior of the conduits before or after assembly and while operating. The unit is sealed in the return line of the system leading from the evaporator to the compressor to have the gas being returned to the compressor pass therethrough. Any liquid refrigerant mingling with that in a gaseous state in the return line from the evaporator will be separated by the unit and collected in the bottom portion thereof among the particles of dehydrating material, leaving that in gaseous form free to pass through the upper part of the unit above the collected liquid and out through the suction line to the compressor. The refrigerant in both gas and liquid form in contact with the dehydrating material will be relieved of any moisture which may be present therein as the moisture is absorbed by the material. The liquid

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refrigerant collected about the irregular particles of dehydrating material will immediately start boiling as the sharp projections on the particles induce ebullition and the continuous boiling of the liquid to convert it to a gaseous state so that it can be drawn into the compressor and again circulated through the refrigeration system. Lacking the ebullient action induced by the sharp projections on the particles, the liquid would not readily change to a gaseous state but would accumulate in the unit until a critical pressure and temperature would be reached, at which time all of the liquid might immediately change to a gaseous form, building up an undesirable pressure.

Accordingly, the main objects of the invention are: to provide a separating and dehydrating unit ahead of the compressor of the refrigeration system for separating any liquid refrigerant from that in gaseous form being drawn into the compressor and for dehydrating the refrigerant; to provide an elongated unit for separating and dehydrating a refrigerant which is provided with inlet and outlet openings above the medial plane thereof so that when disposed in a horizontal position in the suction line of the refrigerating system, particles of dehydrating material disposed below the medial plane will leave a free path for the gas thereabove; to provide a separating and dehydrating unit of elongated form disposed horizontally so as to have an elongated reservoir, the upper portion of which provides a gas passageway while the portion therebelow forms a reservoir of a dehydrating material in the form of irregular particles having sharp projections for aiding in the conversion of the liquid refrigerant collected therein back to a gaseous form while dehydrating the refrigerant; and, in general, to provide a unit for separating and dehydrating a refrigerant which is simple in construction, positive in operation and economical of manufacture.

Other objects and features of novelty of the invention will be specifically pointed out or will become apparent when referring, for a better understanding of the invention, to the following description taken in conjunction with the accompanying drawing, wherein:

Figure 1 is a view in elevation of a refrigerating device having in the suction line thereof a separating and dehydrating unit embodying features of this invention;

Fig. 2 is an enlarged sectional view of the structure illustrated in Fig. 1, taken on the line 2—2 thereof, and

Fig. 3 is a reduced sectional view of the structure illustrated in Fig. 2, taken on the line 3—3 thereof.

In Fig. 1, a refrigerating device 10 is illustrated mounted upon a shipping frame 11. The device embodies a compressor 12, a condenser 13 and an evaporator 14 of conventional form. A discharge line 15 from the compressor is connected to the condenser 13 from which a capillary tube 16 connects the condenser to the evaporator 14. A suction line 17 connects the evaporator 14 back to the compressor unit 12. The compressor unit illustrated is that of the sealed type, but it is understood that any type of compressor can be utilized in the refrigeration system in which the unit for separating and dehydrating the refrigerant is employed. The separating and dehydrating unit 18 of the present invention is disposed in the suction line 17 of the refrigerating unit in a horizontally disposed portion thereof.

As illustrated more specifically in Figs. 2 and 3, the separating and dehydrating unit 18 embodies a tubular casing 21 which is elliptical in cross section and having the end portions swaged inwardly to provide abutting flanges 22 and semicircular flanges 23. The flanges 23 receive and encompass the ends of the suction conduit 17 in which the unit is disposed and sealed. The sealing is effected by brazing or otherwise sealing the flanges 22 and 23 to each other and the conduit 17.

The unit is mounted to have its longitudinal dimension disposed substantially horizontal and the major axis of the elliptical section disposed vertical. This provides a reservoir 24 in the lower half of the unit for collecting the liquid refrigerant which is separated from that in a gaseous state as it passes through the upper unrestricted chamber 25 of the unit. The ends of the suction conduits 17, projecting within the casing 21, are preferably provided with screens 26 for preventing the particles of dehydrating material 27 contained in the reservoir 24 from entering the conduits before or after installation and operation. The particles of dehydrating material 27 are preferably irregular in shape, having sharp points which accelerate the boiling of the liquid as it collects in the reservoir before a critical boiling point is reached, to thereby have the liquid continuously changed back to a gaseous state. The refrigerant in liquid and gaseous form contacting the particles of dehydrating material 27 will have the moisture released therefrom to prevent defective operation of the refrigerating device from the presence of the water vapors in the refrigerant. The moisture in the refrigerant would cause freezing in the capillary tube, expansion valve or like parts of the device, and by having the separating and dehydrating unit disposed in the suction line of the refrigeration system, any moisture remaining in the system of the device after it is sealed and dehydrated or any small amounts picked up by the system while in use, will be collected by the particles of material 27 in the reservoir and the interruption or the defective operation of the system is thereby avoided. By having the dehydrating unit combined with the separating unit, utilization is made of the dehydrating particles to produce the the continuous change of the collected liquid back to a gaseous form without the necessity of waiting for a critical boiling point to be reached. Thus, the unit functions to separate the liquid from the gas, to dehydrate the liquid and gas refrigerant and to expedite the return of the collected liquid to a gaseous state.

The particles of dehydrating material may be silica gel, activated alumina, or other suitable material having dehydrating properties known in the art to be suitable for such purpose and having no deleterious effect upon the refrigerant itself.

What is claimed is:

1. A separating and dehydrating unit including, in combination, an elongated tubular casing having a vertical diameter greater than the horizontal diameter and having sealed end walls, inlet and outlet ports at the ends of said casing above the longitudinal axis thereof, screens covering said ports, and dehydrating material filling the lower portion of said casing when said casing is positioned with its longitudinal axis disposed horizontally.

2. A separating and dehydrating unit including, in combination, an elongated casing of oval shape having the wall portions near the ends drawn inwardly and flanged outwardly in abutted relation except for a portion above the longitudinal central axis of the casing where an opening is defined by the flanges, a tube extending into the opening in each end wall and sealed by the flanges, conical screens disposed within the casing and sealed to the openings to be an extension of said tubular elements, and dehydrating material filling the lower portion of the casing below said tubular elements and screens.

3. A separating and dehydrating unit including, in combination, an elongated casing having the ends drawn inwardly into sealed relation to each other except for openings therein above the longitudinal axis of the casing, inlet and outlet conductors sealed to said openings, conical screens within the casing sealed to said openings with the axis thereof disposed parallel to the axis of the casing, and dehydrating material filling the lower portion of the casing below the conical screens.

4. A separating and dehydrating unit including, in combination, an elongated casing having a vertical dimension greater than the lateral dimension, the ends of the casing being formed inwardly in sealing relation to provide closed end walls having an aperture therein above the longitudinal axis of the casing, inlet and outlet conductors secured to the openings, screens extending inwardly from the end walls of the casing about said openings the axes of which are disposed parallel to the axis of the casing, and dehydrating material filling the casing below said screens.

5. A separating and dehydrating unit including, in combination, an elongated casing having a vertical dimension greater than the lateral dimension and having apertures in the end walls thereof above the longitudinal axis of the casing, inlet and outlet conductors secured to the end walls and communicating with the interior of the casing through said apertures, elongated screens within the casing disposed in extension of the inlet and outlet conductors, and dehydrating material in the lower portion of the casing below said screens.

6. A separating and dehydrating unit for a refrigerant including, in combination, an elongated tubular element having in the end walls thereof intake and outlet conduits, screens disposed within the casing in extension of the conduits in the upper portion thereof, and dehydrating particles in the lower portion of the casing below the screens, said particles being of irregular form to present sharp points to the liquid refrigerant collected thereabout for in-

ducing ebullition and accelerating the change of the liquid to a gaseous form.

7. A separating and dehydrating unit for a refrigerant including, in combination, an elongated tubular element having in the end walls thereof intake and outlet conduits, elongated screens within the casing in extension of each other, said screens being substantially in aligned relation with their axes parallel to the longitudinal axis of the casing, and dehydrating material filling the bottom of the casing below the screens.

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