April 30, 1940. J. E. GRAY 2,199,258

DEHYDRATOR

Filed June 17, 1938

FIG .1.

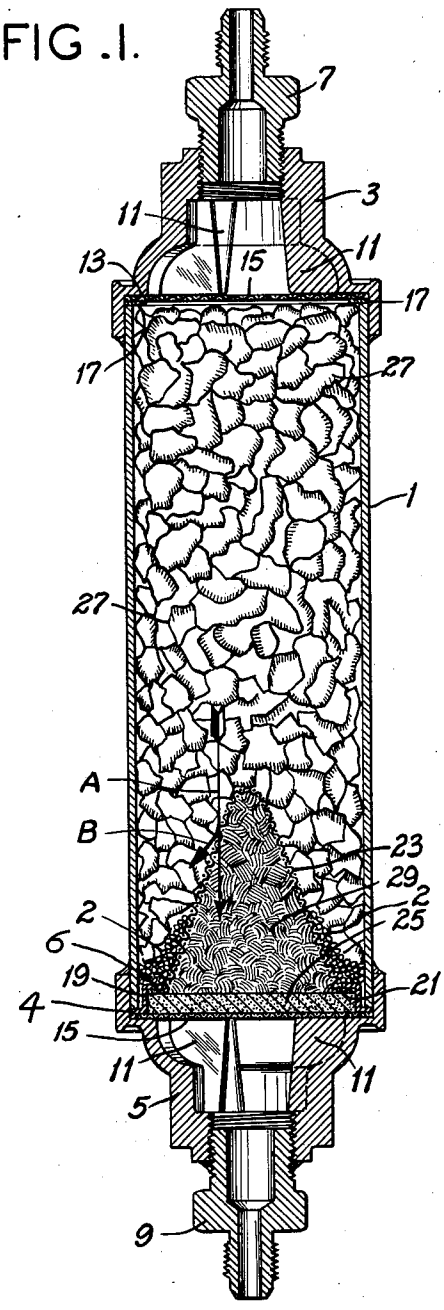
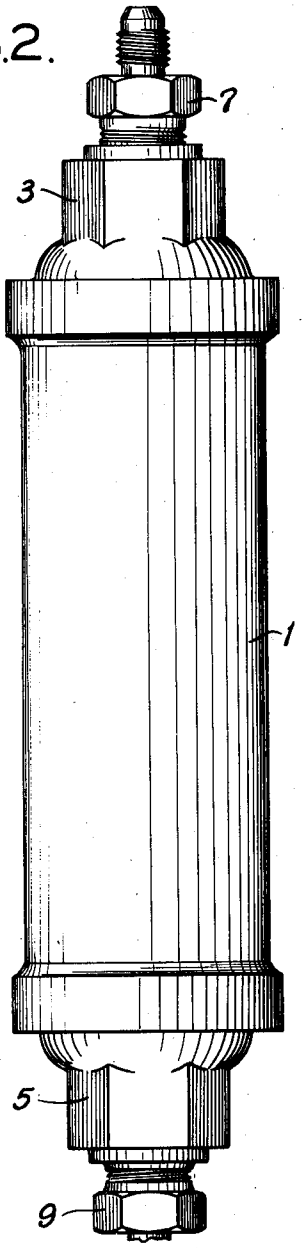


FIG.2.



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DEHYDRATOR

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4 Claims. (Cl. 210—131)

This invention relates to dehydrators, and with regard to certain more specific features to filtering dehydrators for refrigerating and like systems.

Among the several objects of the invention may be noted the provision of a filtering dehydrator by means of which substantially longer periods of operation may occur without clogging and without the excessive pressure drop incident to a clogged condition; the provision of apparatus of the class described which avoids, for longer periods, undesirable evaporation into a gas of refrigerating liquid before the liquid reaches the expansion valve; the provision of a dehydrator of the class described which is simple in form and consequently more economical to make and which is an improvement upon devices such as shown in United States Patents 1,804,836, 1,839,350 and 1,866,659. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing, in which is illustrated one of various possible embodiments of the invention,

Fig. 1 is a longitudinal section of the device; and,

Fig. 2 is a side elevation.

Similar reference characters indicate corresponding parts throughout the several views of the drawing.

The present invention is directed particularly to dehydrators for use in the liquid lines of refrigerating systems. These are generally located between the receiver and the expansion valve or valves. A purpose of the dehydrator is to prevent the passage of moisture to the expansion valve and other parts. In serving this purpose, the dehydrator should not permit the passage into the liquid line of solid particles.

Referring now more particularly to Fig. 1, there is shown at numeral 1 an elongated housing, preferably made of a copper tube or the like. On this housing at one end is an inlet cap 3 having an inlet adapter 7, and at the other end an outlet cap 5 having an outlet adapter 9.

Within the cap 3 are three ribs 11, which, with a shoulder 13 form a support for a fine-mesh inlet screen 15, for example, of the order of 150-mesh. Adjacent the edge of the screen is a gasket 17. The screen and the gasket are held in place by the circular end of the inserted housing 1.

The cap 5 is also provided with ribs 11 for supporting another similar screen 15. However, instead of using a gasket such as 17, there is located between the circular end of the inserted body 1 and the cap 5 a retainer ring 19 which has a cross section of generally S-shape providing an outwardly directed flange 4 and an inwardly directed flange 6. The outer flange 4 is held by the inserted end of the body 1 and the inner flange 6 serves as a holder for the flange 21 of a fine-mesh conical screen 23, the latter also being, for example, of the order of 150-mesh. The apex of the conical screen 23 is directed upstream. Its base is near the wall 1 so as to form a circular trough-like sump.

Between the screen flange 21 and the circular screen 15 is located a disc of standard compressed felt 25. The disc maintains its own shape independently and forms a diaphragm covering the open base of the conical screen 23. Between the cone 23 and the felt disc 25 is located a mass of loose, bulk felt 29. Its conical shape is determined by the conical screen 23. Both portions 25 and 29 are preferably fibrous. Other foraminous material may be used.

On the outside of the cone 23 and within the body 1 is located dehydrating material such as lumps of activated alumina or calcium oxide 27. The lump form of the material renders the total mass of it foraminous. After assembly, both caps 3 and 5 are soldered to the body 1 or otherwise autogenously fastened. A suitable line leading from the accumulator is attached to the adapter 7, and a suitable line is attached to the adapter 9 and leads to the expansion valve. The device may be used elsewhere in a refrigerating system, but it is intended that only liquid refrigerant shall flow through it.

Dehydrating agents such as those above noted partially break down into a fine powder. For example, calcium oxide, upon the addition of moisture, forms calcium hydrate, generally known as slaked lime. Activated alumina will break down because of erosion which is due to rubbing of one particle against another.

In either of the above and similar cases, the small particles will clog the ordinary fine, flat screen, thereby causing a pressure drop in the refrigerant. Such pressure drop in the refrigerant is detrimental because it causes a partial evaporation of the refrigerant and consequently results in delivery of gas bubbles into the liquid line. Thus, the refrigerant (under pressure)

which reaches the expansion valve, instead of being homogeneous is composed of liquid and gas bubbles. Expansion valves do not operate properly if there are gas bubbles in the liquid. A former solution of the problem was to provide a more open filter, thus allowing particles to pass into the piping system. This procedure has obvious disadvantages.

The present invention operates as follows:

The refrigerating fluid, with its entrained moisture, enters through the screen 15. Beyond the screen it passes by the lumps of dehydrating agent 27 and during this passage has the moisture absorbed or adsorbed therefrom by uniting with the dehydrating agent.

Any small particles of the dehydrating agent that break off and become free are carried along with the refrigerating fluid. The general direction of flow of the refrigerating fluid is exemplified by the vertical arrow A which carries the particles along until the screen 23 is reached. Since the very fine screen 23 presents between its interstices only very small (if any) components of its openings in the longitudinal direction, the small solid detachments 2 do not readily find their way through and are deflected, more or less as shown by the arrow B. The straight-line characteristic of the arrow is diagrammatic. Actually, the liquid streams through the lumps of the dehydrating agent 27 in more or less sinuous contour. However, so far as the action at the surface of the screen is concerned, the arrow is illustrative.

It will be seen that the conical shape has advantages in that a sloping surface is presented by the screen, whereby liquid flow is accommodated with little interference while solid particles are deflected. At the same time, the deflected particles are guided into relatively harmless peripheral positions.

The solid particles 2 that are deflected ultimately find their way down to the peripheral trough-like space between the base of the cone 23 and the body 1, thereby letting the apex of the cone and the portion surrounding it free for the passage of fluid. It will be seen that there is an advantage in the fact that the free portion of the screen is centrally located, because it is in the central portions of a tube that the flow is most free, anyway.

Although a vertical position is preferable, such as shown in the drawing, the device may be used in other positions. The operation is substantially the same, because the liquid flow through the device tends to maintain the separated particles more or less as indicated, even if not exactly as indicated, in Fig. 1.

Very fine particles that circulate at the surface of the screen 23, substantially the same as the fluid, and that find their way through the screen are primarily caught by the loose felt 29. Particles that are so fine that they pass through the loose felt 29 are caught by the standard compressed felt pad 25, but, it may be observed that there will be very few of these.

The purpose of making the material within the cone of a loose fibrous structure, whereas that within the disc is of a tightly-packed fibrous structure, is that in a loose structure the blocked particles tend better to distribute themselves rather than to become packed over a definite surface. This lengthens the life during which the apparatus will freely transmit fluid. The tightly packed disc being behind the loosely packed material within the conical screen receives only a very small amount of finely comminuted material to be filtered out. Thus, it will be seen that the larger particles that ordinarily clog are kept from the fibrous material altogether. Those smaller particles that pass the screen get into loosely packed material and thus tend not to become distributed on a surface and hence do not tend to clog operation.

The tightly packed fibrous material is then protected against clogging and serves the function primarily of removing very fine particles. These much more slowly clog the filter than the larger particles would, were they permitted to enter the disc of fibrous material.

Since there is (1) a tendency for a central portion of screen 23 always to be free of large particles, and (2) since the relatively large mass of loose felt 29 requires a long period before clogging occurs from the few particles that may get through the screen, and (3) since there are only a few exceedingly fine particles that reach the surface of felt disc 25, it follows that the device has a relatively long effective life during which free passage exists therethrough without excessive pressure drop.

Besides the above advantages, it will be seen that the conical screen presents a larger area so that the screen 23 may have a substantial part of its base portion completely clogged before the free area becomes less than the free area of either of screens 15.

Structurally, the device has the advantage that the cone 23 is springingly held down on the disc 25 by the flanged ring 19. The natural tendency of the loose material 29 to expand when packed in place serves to insure that the space within the cone 23 remains substantially filled and without deleterious voids. These facts eliminate the requirement of niceties in manufacture.

In view of the above, it will be seen that there is avoided, by means of the present apparatus, the quick reduction in capacity which occurs with ordinary fine-mesh screens or materials, and at the same time the apparatus avoids the ineffectiveness of non-clogging coarse-mesh screens.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a dehydrator, a tubular body member having an inlet, and an outlet cap having a passage therethrough covered by a relatively flat screen, a preformed disc of resilient filtering material on said screen, a conical screen extending into said body member and spaced from said flat screen and having a flange on said disc, an inwardly and outwardly flanged ring having its inward flange over the screen flange and its outward flange adapted to be held upon assembly by the body member and outlet cap whereby the conical screen is springingly held in position against the disc.

2. A dehydrator comprising a tubular body member having an inlet, an outlet cap for the body having a passage therethrough covered by a relatively flat screen, a preformed disc of relatively dense filtering material on said screen, a conical screen spaced from said flat screen and having a flange on the margin of said disc, an

inwardly and outwardly flanged ring having its inward flange over the screen flange and its outward flange adapted to be held upon assembly by the body member and outlet cap, whereby the conical screen is springingly held in position against the disc, and relatively loose filtering material contained within the body member between the disc and the conical screen.

3. A dehydrator comprising a body portion having an inlet, an outlet cap fastened to the body portion having a passage therethrough covered by a relatively flat screen, a preformed disc of relatively dense filtering material on said screen, a conical screen spaced from said flat screen and having a flange on said disc, an inwardly and outwardly flanged ring having its inward flange over the screen flange and its outward flange adapted to be held by said body portion and outlet cap upon assembly, whereby the conical screen is springingly held in position against the disc, and loose fibrous material between the disc and said conical screen, the apex of said conical screen being directed upstream with respect to the flow through the body portion, and said body portion being filled with a foraminous mass of dehydrating agent.

4. A dehydrator comprising an inlet cap, a tubular body fastened thereto, a screen disc held between said cap and body, an outlet cap fastened to the body and having a passage therethrough covered by a screen disc, a preformed disc of relatively dense felt on said screen, a projecting screen spaced from said flat screen and having a flange on said felt disc, an inwardly and outwardly flanged ring containing the felt disc and having its inward flange over the screen flange and its outward flange adapted to be held upon assembly by said tubular body, whereby the projecting screen is springingly held in position against the disc, and loose fibrous material between the disc and said projecting screen, the end of said projecting screen being directed upstream with respect to the flow through the tubular body, and said body being filled with a foraminous dehydrating mass which is contained between the first-named screen and the projecting screen.

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