Nov. 30, 1937. L. M. CROSLEY ET AL 2,100,504

RESTRICTED FLOW REFRIGERANT FEEDING DEVICE

Filed Oct. 19, 1934

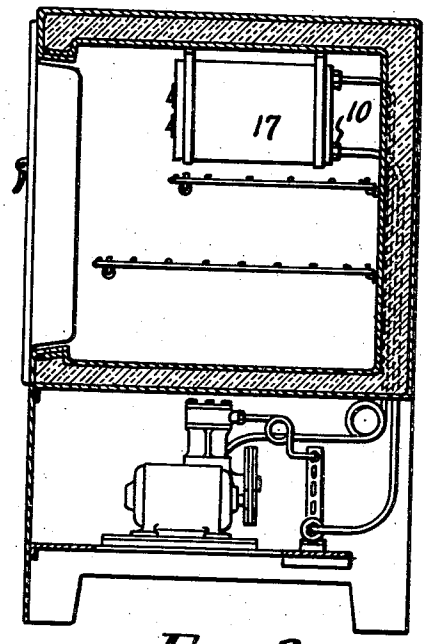


FIG. 3.

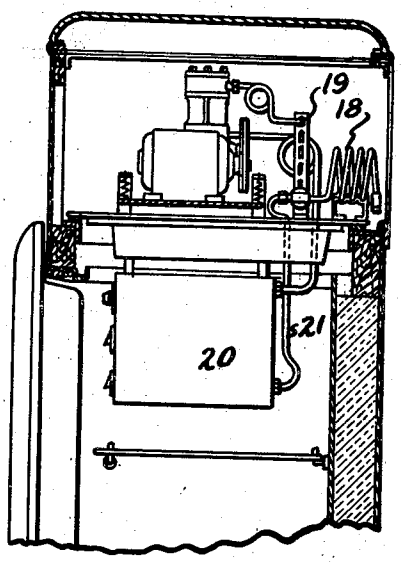


FIG. 4.

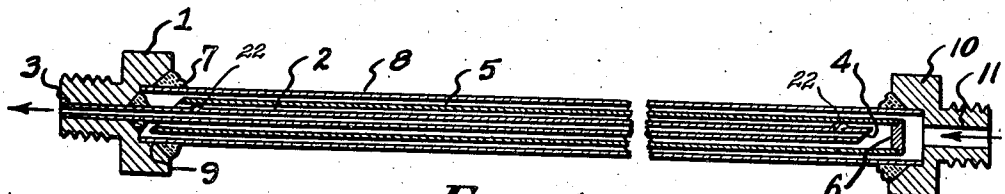


FIG. 1.

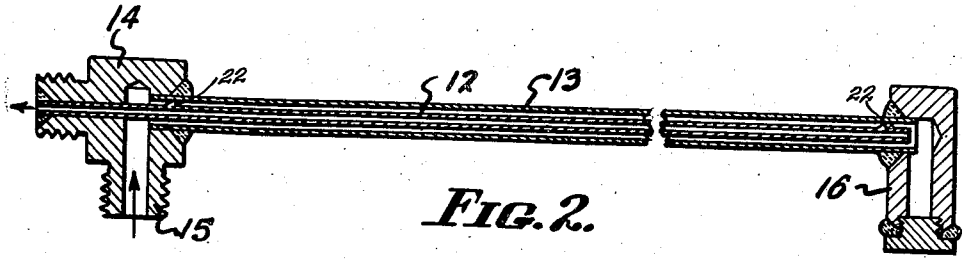


FIG. 2.

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RESTRICTED FLOW REFRIGERANT FEEDING DEVICE

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4 Claims. (Cl. 138—42)

Our invention relates to devices adapted to feed, for example, the evaporator of an electric refrigerator with refrigerant from the condenser, and is designed to supplant the capillary tube. Capillary tubes have been successfully used in refrigeration systems which were properly designed therefor to provide a continuous restricted flow of refrigerant from the condenser to an evaporator which was kept substantially continuously full of the refrigerant and was therefore known as a flooded type evaporator. In an exemplary system of this type eight feet of so-called capillary tubing, which is a relatively thick walled metal tubing of quite small internal diameter, is used. The use of so much tubing involves the problem of condensing it into a suitable space, which has usually been done by coiling it at one or more places in its length. It involves also the use of a relatively great quantity of such tubing, which is essentially of high cost.

It is an object of our invention to provide a restricted flow device which is very much more economical of space. It is also an object of our invention to provide a device which does not involve the use of anything like the same quantity of expensive capillary tubing, but employs a very much shorter length of such tubing, if any.

It is an object of our invention to provide an assembly characterized by restricted passageways using members, some if not all of which, would not be characterized by small internal volume or capacity if used alone. It is another object of our invention to secure restriction by means not hitherto employed in the same or analogous uses.

These and other objects of our invention which will be set forth hereinafter, or will be apparent to one skilled in the art upon reading these specifications, we accomplish by that certain construction and arrangement of parts of which we shall now describe two exemplary embodiments, it being understood that these embodiments do not by any means exhaust the combination characterizing our invention as set forth in the appended claims.

Essentially in the practice of our invention, we have found that restricted flow devices which are much more economical of space, can be constructed to advantage and with economy, by the insertion of tubes or tube-like structures one inside the other, utilizing the space between the external diameter of the smaller tube and the internal diameter of the larger tube as the desired restricted passage-way. Thus by choosing tubes or tube-like structures having a proper relationship of internal to external diameter, we are able in some instances, to do away with exceedingly small tubes entirely, or in the instance where we employ extremely small tubes to use very much shorter lengths thereof. In employing as a restricted passageway the space difference between the external diameter of one tube and the internal diameter of another, no care has to be exercised to maintain the one tube centered inside the other, since whatever its position may be, the space difference between their respective internal and external diameters will remain the same.

Consequently in our structures we contemplate the use of two or more tubes, one inside the other, and employ as respects these tubes, a counter-flow of the refrigerant therein, as will hereinafter be more fully explained. In general within practical limits any number of tubes may be placed one inside the other. Both the number of tubes and the space differences between their internal and external diameters will determine the overall length of the restricted flow device. When employing even numbers of tubes, the refrigerant will be introduced and withdrawn from essentially the same end of the device. When using odd numbers of tubes the refrigerant will be introduced and withdrawn from opposite ends of the device. This is on the assumption that common fittings are used connecting with the several tubes. This, however, is not a limitation on the broadest aspects of our invention, inasmuch as one tube may be passed through the wall of another and soldered or welded thereto, so that separate fittings may be employed, as will be clear.

In the drawing:—

Figure 1 shows an embodiment of our invention employing three tubes.

Figure 2 shows another embodiment employing two tubes.

Figs. 3 and 4 show refrigerators equipped respectively with the devices of Figs. 1 and 2.

In Figure 1 we have shown an exhaust fitting at 1, adapted for example, to be connected to the evaporator 17 of a refrigeration system. The smallest internal tube indicated at 2, is connected to this fitting as at 3. The tube 2 has an open end 4, beveled if desired, to prevent clogging. Over the tube 2 there is slipped another tube 5. This tube has a closed end 6 and an open end 7, likewise beveled if desired. Over both of these tubes there is slipped a third tube 8, one end of which is closed as at 9, by attachment to the fitting 1, and the other end of which is attached to a fitting 10, so as to connect with the bore 11 thereof. The fitting 10 may be thought of as connected to the condenser

of an electric refrigerator, as in Figure 3. If desired, spacing means for the tubes may be provided, comprising a series of kinks formed radialy around the tubes and spaced, for example, 120° apart, as indicated in Figs. 1 and 2 at 22. These means, however, are not necessary to the operativeness of the structure, and may be omitted. In the operation of this device, the refrigerant first enters and passes through the tube 8, the difference between the external diameter of tube 5 and the internal diameter of the tube 8 forming a restricted passageway. Having passed through the tube 8 to the left-hand end therof, the refrigerant blocked by the closed end 9 of tube 8 returns through tube 5 to the right-hand end of the device. To do this it must pass through the space difference between the internal diameter of tube 5 and the external diameter of tube 2, which, if the ratios of these diameters are correctly chosen, again forms a restricted passageway interposing resistance to the flow of the refrigerant. As hereinabove indicated, it makes no essential difference whether the tube 2 is centered in the tube 5 or not. Having passed through the tube 5 to the right-hand end of the device, and being blocked by the closed end 6 of the tube 5, the refrigerant must next travel through the tube 2 in order to reach its outlet at the fitting 3. This tube may be conveniently of small bore and may therefore provide a restricted passageway interposing a useful amount of the total resistance to the passage of the refrigerant. However, this is not necessary and a tube 2 of relatively large internal diameter may be employed if desired, providing the necessary resistance is built up in other parts of the restricted flow device.

The length of the device and the respective ratios of internal to external diameters of the tubes, control the amount of resistance interposed to the flow of the refrigerant. It will be clear that the thickness of the walls of the tubes in and of itself is not a controlling factor as to the resistance of the system. Tubes should, of course, have sufficient wall thickness to withstand the differences between the pressure inside of them and the pressure outside of them, but beyond this limitation their walls may be thick or thin, as is found convenient.

In Figure 2 we have shown a type of device employing but two tubes. Here a tube 12 lies inside an outer tube 13. Tube 12 may pass through a fitting 14, to which the outer tube is connected, and which has a side outlet member 15. The outer tube will be closed at the end which lies furthest from the fitting 14, and this closed end may be provided as at 16 with a sump or trap for the collection of impurities or sludge, which has passed through the inner tube but might not pass through the space between the two tubes. Or the end of the tube 13 may be turned over for a like purpose.

The device of Figure 2 is indicated at 18 in Figure 4 where it is connected to a condenser 19 and also to an evaporator 20 by means of a tube 21.

It will readily be understood how the device of Figure 2 may be modified to include any other given even number of tubes. The combined assembly of tubes in either of the modifications may be coiled or bent or otherwise disposed in such a way as will be found convenient in the assembly of a refrigerator. It will be understood also that the amount of restriction or resistance interposed to the flow of refrigerant as between any two tubes may be controlled in a variety of ways, but perhaps easiest by dressing the outer surface of an inner tube.

Modifications may be made in our invention without departing from the spirit thereof.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:—

1. A restricted flow of device comprising at least two tubes, one inside the other, said tubes being of substantial length and means at the end thereof for introducing fluid and for causing said fluid to traverse a path which comprises the bore of one tube and the space between said tube and the other tube for substantially the entire length of said device, said path being of such dimensions as will serve to feed an evaporator from a condenser in a mechanical refrigerator, and maintain an appropriate level of refrigerant therein.

2. A restricted flow device comprising at least two tubes, one inside the other, said tubes being of substantial length and means at the end thereof for introducing fluid and for causing said fluid to traverse a path which comprises the bore of one tube and the space between said tube and the other tube for substantially the entire length of said device, the number of said tubes so assembled being odd, and means at opposite ends of said assembly for introducing and withdrawing a fluid, said path being of such dimensions as will serve to feed an evaporator from a condenser in a mechanical refrigerator, and maintain an appropriate level of refrigerant therein.

3. A restricted flow device comprising at least two tubes, one inside the other, said tubes being of substantial length and means at the end thereof for introducing fluid and for causing said fluid to traverse a path which comprises the bore of one tube and the space between said tube and the other tube for substantially the entire length of said device, the number of said tubes being even, and means at one end of said assembly for withdrawing a fluid, said path being of such dimensions as will serve to feed an evaporator from a condenser in a mechanical refrigerator, and maintain an appropriate level of refrigerant therein.

4. A restricted flow device comprising a plurality of substantially concentric tubes, alternate tubes being closed at alternate ends and means for introducing and withdrawing a fluid from said assembly, such that said fluid is caused to pass in alternate directions through said assembly in paths comprising the internal space of each tube less the space occupied by members therewithin for substantially the entire length of said device, said paths being of such dimensions as will serve to feed an evaporator from a condenser in a mechanical refrigerator, and to maintain an appropriate level of refrigerant therein.

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