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(54) **Refrigerant circuit and refrigerator using such circuit**

(57) A refrigerant circuit is used in a refrigerator and comprises a capillary tube and an evaporator, wherein a conduit is interposed between the capillary tube and the evaporator having a conic shape whose narrow end is

adjacent the capillary tube and whose large end is adjacent the evaporator, inside such conduit being placed a filter screen.

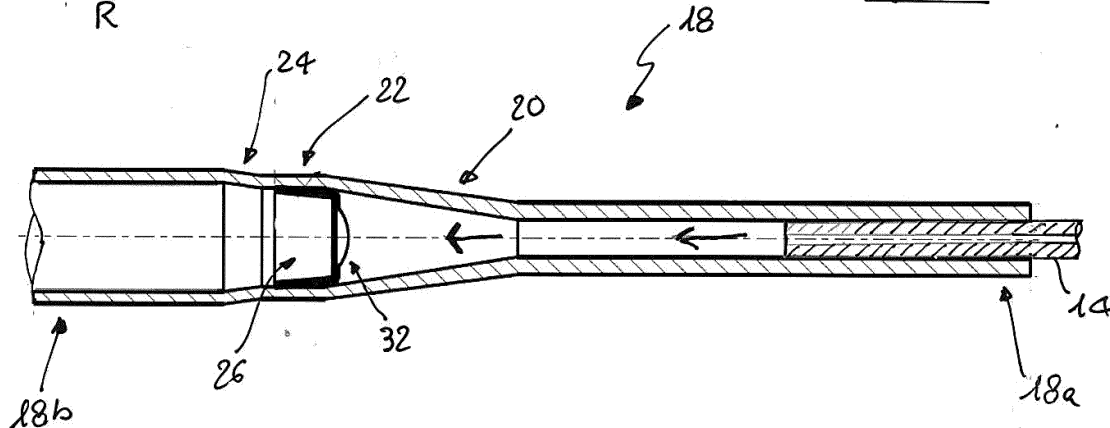
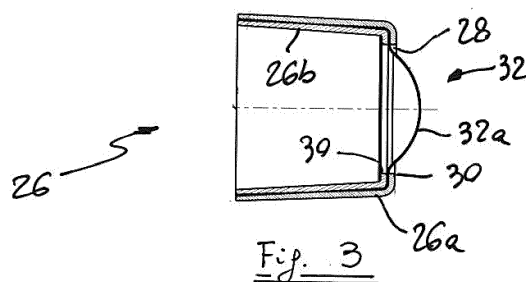
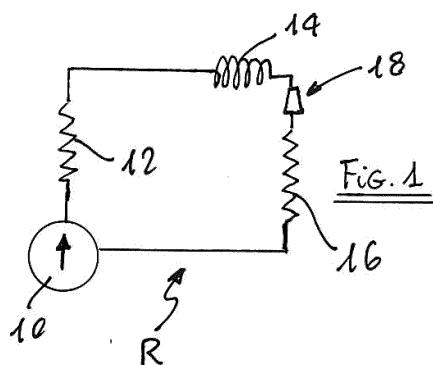


Fig. 2

Description

[0001] The present invention relates to a refrigerant circuit used in refrigeration appliances, comprising a capillary tube and an evaporator.

[0002] It is well known in the art of refrigerators and air conditioners the need of reducing the noise due to expansion of refrigerant between a capillary tube downstream a condenser and a larger pipe of an evaporator. This is particularly true for so called direct cool refrigerators in which the noise of the compressor is negligible. Therefore the only source of noise of the whole appliance is due to the gas expansion noise in the piping zone between the capillary tube and the evaporator.

[0003] There are many known solution for solving this problem. Some domestic appliances producers are using transition pipes usually made of copper between capillary tube and freezer evaporator pipe. Others are using rubber dampers around the junction zones which follow the outside diameters of the tubes. Others are using a first part of the evaporator pipe shaped as a conic tube for assuring a smooth gas expansion. Others are using special cartridges. All these known solutions are either complex or they are not very effective in noise reduction or weld free joint.

[0004] CN2916528 discloses a silencing filter which is cone shaped and in made by pressing metal powder. This solution is pretty expensive and the filter made by metal powder is keen to be clogged.

[0005] Another solution is disclosed by CN102003847 where a transition pipe is provided with a plurality of pressure reducing sections with increased aperture. This solution, even if quite simple, does not reach a sufficient reduction of noise.

[0006] It is an object of the present invention to provide a refrigerant circuit of the type mentioned at the beginning of the description which can be manufactured in a simple way, it is simple and not expensive and which can provide a very good noise reduction when compared to known circuits.

[0007] According to the invention, the above object is reached thanks to the features listed in the appended claims.

[0008] The applicant has discovered that by combining a conical shape of a conduit bridging the capillary tube and the evaporator with a filter screen, particularly a mesh screen, it is possible to obtain noise reduction of the order of 6-8 dB if compared to a solution without silencer.

[0009] According to a preferred embodiment of the invention, the silencer comprises two conical portions with an intermediate cylindrical portion in which the above filter screen is placed. According to another preferred feature of the invention relates to the mesh opening of the filter screen, comprised between 0,08 and 0,16 mm.

[0010] Further features and advantages of a silencer according to the present invention will be clear from the following detailed description, with reference to the attached drawings in which:

- Figure 1 is a simplified refrigerant circuit of a refrigerator provided with the silencer according to the invention;
- Figure 2 in an enlarged sectioned view of a detail of figure 1; and
- Figure 3 is a detail of figure 2.

[0011] With reference to the drawings, a refrigeration circuit R of a refrigerator (not shown) comprises a compressor 10, a condenser 12, a capillary tube 14, and an evaporator 16. Between the capillary tube 14 and the evaporator 16 it is interposed a silencer 18, shown in detail in figure 2. Of course the circuit R shown in figure 1 is a simplified one, since there can be more evaporators (either in parallel or in series) and other branches and valves as well. At any rate, in the light of the present invention it is important to focus on a detail of the circuit only, i.e. the silencer 18. The circuit R is used preferably in a direct cool refrigerator.

[0012] According to the invention, the silencer 18 present the form of a tube having one end 18a welded or glued to the capillary tube 14 and another end 18b welded to the evaporator tube 16 or being integral with such evaporator. The first end 18a of the silencer 18 presents an internal diameter which corresponds to the outside diameter of the capillary tube 14, typically in the range from 1,8 to 2,2 mm. After such cylindrical portion, the silencer 18 presents a first conic portion 20 having a ratio between the diameter of its large end and the diameter of its narrow end preferably comprised between 1,8 and 2,4, with a ratio between its length and said diameter of its large end preferably comprised between 2 and 3.

[0013] After such first conic portion 20, in the flow direction shown by arrows in figure 2, the silencer 18 presents an intermediate cylindrical portion 22, followed by a second conic portion 24 having a ratio between the diameter of its large end and the diameter of its narrow end (corresponding to the diameter of the large end of the first conic portion 20) comprised preferably between 1 and 1,2, with a ratio between the length of the second conic portion 24 and the diameter of its large end comprised preferably between 0,3 and 0,7. The ratio between the length of the cylindrical intermediate portion 22 and the diameter of the narrow end of the second conic portion is preferably comprised between 0,7 and 0,11.

[0014] Even if other dimensional ratio can be used, values in the abovementioned ranges have shown particularly advantageous in terms of noise reduction.

[0015] In the intermediate cylindrical portion 22 it is contained a filter thimble-shaped device 26 which is fixed inside such portion through mechanical interference. As it is shown in figure 3, the filter device 26 comprises an outside thimble-shaped element 26a and an inside thimble-shaped element 26b, both such elements being provided with a central hole 28 contoured by a lip 30. Between such lips 30, it is mounted the round edge of a aluminum mesh 32, having a central dome-shaped portion 32a and preferably a wire diameter around 0,06 mm,

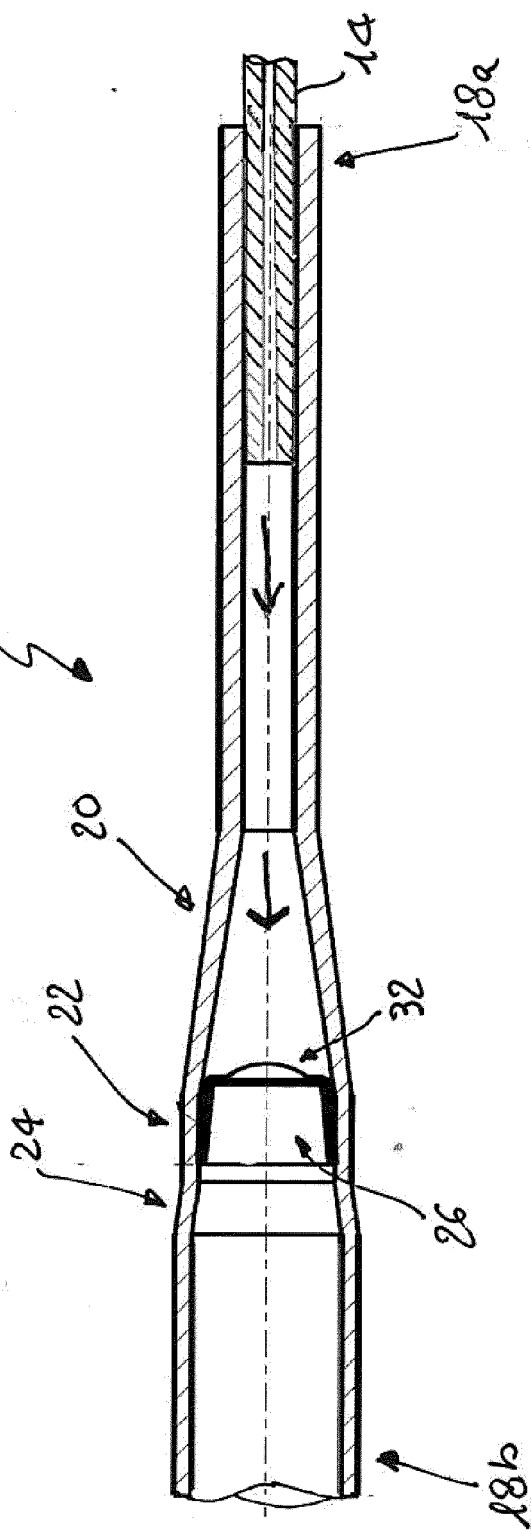
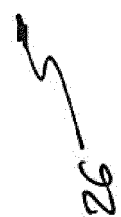
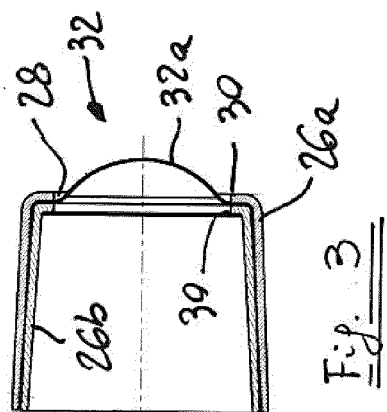
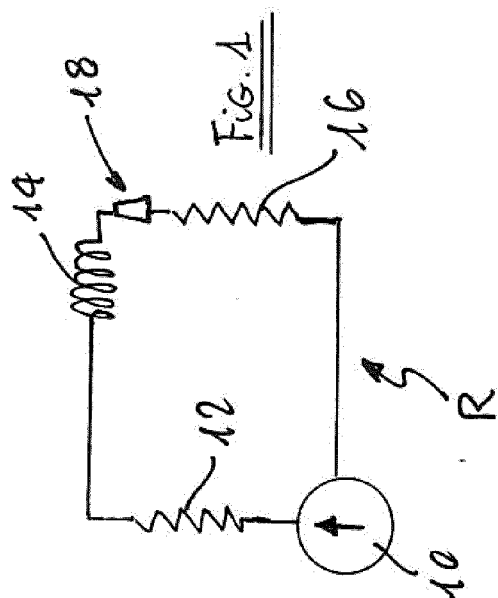
a mesh opening about 0,125 mm and a mesh density around 2916 mesh/cm². The fastening of the filter device 26 inside the cylindrical portion 22 may be obtained by rolling the end of the outside thimble-shaped element 26a against the internal wall of such cylindrical portion. The central portion of the mesh 32 can be also concave or flat in shape.

[0016] All the elements of the silencer 18 may be advantageously made by aluminum.

[0017] Tests have been carried out by the applicant on a commercial refrigerator model 50cm & 60cm by using a silencer 18 as shown in figure 2, having a total length of 78 mm.

Claims

1. Refrigerant circuit (R), particularly for use in refrigeration appliances, comprising a capillary tube (14) and an evaporator (16), **characterized in that** it comprises a conduit (20, 24) interposed between the capillary tube (14) and the evaporator (16) having a conic shape whose narrow end (18a) is adjacent the capillary tube (14) and whose large end (18b) is adjacent the evaporator (16), inside such conduit being placed a filter screen (26, 32).
2. Refrigerant circuit (R) according to claim 1, wherein said conduit (20, 24) comprises, in the refrigerant flow direction, a first conic portion (20), a cylindrical intermediate portion (22), and a second conic portion (24), said filter screen (26, 32) being placed in said cylindrical intermediate portion (22).
3. Refrigerant circuit (R) according to claim 1 or 2, wherein the filter screen (26, 32) is a mesh screen having a mesh opening comprised between 0,08 and 0,16 mm.
4. Refrigerant circuit (R) according to claim 3, wherein the mesh screen (32) is interposed between two thimble-shaped elements (26a, 26b).
5. Refrigerant circuit (R) according to claim 4, wherein each thimble-shaped support (26a, 26b) presents a central hole (28) for mounting the mesh screen (32).
6. Refrigerant circuit (R) according to any of claims 3 to 5, wherein the mesh screen (32, 32a) is dome shaped.
7. Refrigerant circuit (R) according to any of the previous claims 2 to 6, wherein the first conic portion (20) presents a ratio between the inner diameter of its large end and the inner diameter of its narrow end comprised between 1,8 and 2,4, and a ratio between its total length and said inner diameter of its large end comprised between 2 and 3.
8. Refrigerant circuit (R) according to any of the previous claims 2 to 7, wherein the second conic portion (24) presents a ratio between the inner diameter of its large end and the inner diameter of its narrow end comprised between 1 and 1,2, and a ratio between its length and the inner diameter of its large end comprised between 0,3 and 0,7.
9. Refrigerant circuit (R) according to any of the previous claims 2 to 8, wherein the ratio between the length of the cylindrical intermediate portion (22) and the inner diameter of the narrow end of the second conic portion (24) is comprised between 0,7 and 0,11.
10. Refrigeration appliance comprising a refrigerant circuit (R) according to any of the preceding claims.





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 Application Number
EP 14 15 9209

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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 June 2014	Examiner de Graaf, Jan Douwe
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 14 15 9209

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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