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(54) Method for producing a one-piece evaporator for refrigeration circuits, and the evaporator obtained

(57) The method comprises dividing one and the same hairpin coil (2), fixed between two conductive sheets (3, 4), into two sections (G, F) of different refrigeration power by providing a separation cut (10) between the sheets (3, 4) in a position in which the hairpin coil (2) comprises greater-length rectilinear portions (2'A). That part of said longer portions which projects from the sheets (3, 4) is bent to flank one side of said sheets. The evaporator comprises two sections (G, F) of different refrigeration capacity, formed from one and the same hairpin coil (2) which at the point in which said sections join together comprises a loop bent towards one side of said sheets (3, 4).

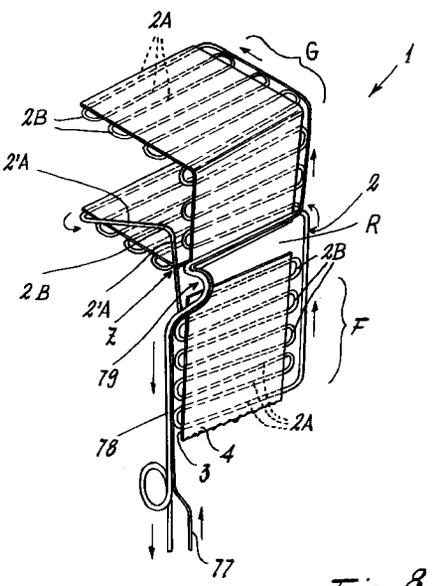

Fig. 8

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Description

[0001] This invention relates to a method for producing evaporators for refrigeration appliances, in particular for domestic refrigerators, and to the evaporator obtained. Both the method and the resultant evaporator are of the type stated in the introduction to the accompanying main claims, to which reference should be made.

[0002] Italian patent application MI96A000895 filed on 6/5/96 describes a method for producing evaporators and an evaporator obtained by the method. In this patent application a hairpin-bent tube is interposed, at least along its rectilinear portions, between two metal sheets, which are joined together and to the said portions by adhesive applied to one of the sheets. This sheet is also made adhesive on its outer side to enable the evaporator to be fixed to the refrigerator compartment, to the shape of which the evaporator is adapted by bending.

[0003] In refrigeration appliances provided with two compartments for preserving food at different temperatures, one for freezing and the other for cooling, two separate evaporators are used, they being connected in series and joined together by welds which involve a considerable amount of work.

[0004] The main object of the invention is to eliminate the need for these welds by providing a one-piece evaporator, the two sections of which involve both the compartments of the refrigeration appliance.

[0005] This and further objects which will be more apparent from the ensuing detailed description are attained by a method and an evaporator in accordance with the teachings of the accompanying claims.

[0006] The invention will be more apparent from the ensuing detailed description of a preferred embodiment thereof given hereinafter by way of non-limiting example and illustrated on the accompanying drawing, on which:

Figure 1 is a plan view of a evaporator in two sections (one for the refrigeration compartment and the other for the freezer compartment of a domestic refrigerator), shown during its production;
Figure 2 is a section on the line A-A of Figure 1, but on a different scale;
Figures 3 to 6 show part of the evaporator of Figures 1 and 2 in different but successive stages of its production;
Figure 7 is a very schematic partial side view of the evaporator obtained, seen in the direction of the arrow X of Figure 6; and
Figure 8 is a perspective view of the evaporator of the invention.

[0007] In the figures, the reference numeral 1 indicates the evaporator overall. It comprises a tube 2 (hereinafter known as the hairpin coil) bent to hairpin shape and comprising a series of approximately parallel rectilinear portions 2A connected together by curved portions or loops 2B. As taught in the aforementioned Italian patent application, the hairpin coil 2 is enclosed, preferably along only its rectilinear portions 2A, between two thin metal sheets 3 and 4, for example of aluminium of 0.15 mm thickness. The sheets 3 and 4 adhere to the tube 2 and to each other by virtue of the sheet 4 being provided with a layer of adhesive 6 which in Figure 2 is represented by a thicker line. The sheet 4 is also provided with a layer of adhesive 7 on its outer face (this layer is also represented by a thicker line in Figure 2). The adhesive layer is protected by a repellent sheet 8 (for example of silicone-coated paper), which is removed when the evaporator is to be applied to the compartments of a refrigerator, it being fixed to the compartments by the adhesive layer 7.

[0008] The evaporator of the invention serves for both the refrigeration compartment and the freezer compartment, notwithstanding the fact that it is in one piece in the sense that the relative hairpin coil has no discontinuities such as to require welding.

[0009] In the example shown on the drawings, it has been assumed that the refrigeration compartment requires seven rectilinear portions 2A of the hairpin coil 2 and the freezer compartment requires seventeen rectilinear portions. The seven portions for the refrigeration compartment are those to the right D of the line R in Figure 1, the seventeen portions for the freezer compartment being those to the left S of the line R.

[0010] On the two sides of the line R the adjacent rectilinear hairpin coil portions, indicated by 2'A, are of greater length such as to project to a given extent from one side 3, 4 of the evaporator.

[0011] Along the line R, which in the example lies between the seventh rectilinear portion 2'A from the right of Figure 1, and the eighth portion 2'A (which is the first of the seventeen of the freezer compartment) a cut 10 is made through the sheets 3, 4 and 8 such as to separate them and hence obtain two evaporator sections, one F relative to the refrigeration compartment and the other G relative to the freezer compartment.

[0012] Using for example three locators 20, 21, 22 consisting for example of pegs projecting from a working table (not shown) on which the evaporator is rested, the two portions 2'A are made to mutually overlie (as shown in Figure 4). The locators are positioned two on one edge and the other on the opposite edge of the sheets 3, 4, 8. In the example the locator 20 is of circular cross-section and occupies the space between two connection loops 2B of the hairpin coil 2 on one side of the evaporator, the two locators 21, 22 being positioned on the other side of the evaporator to fix the position of the loops 2B relative to the portions 2'A when superposing these portions.

[0013] As a result of this superposing, the prolongations of the portions 2'A which distinguish them from the remaining portions 2A form with their connecting loop 2B a kind of eyelet (Figure 4) which is bent (Figure 5) parallel to the longitudinal direction of the evaporator,

the eyelet then by further bending (Figure 6) being made substantially coplanar with a plane perpendicular to that of the evaporator (this plane coinciding with the plane of the drawing).

[0014] The aforesaid operations can also be effected by hand, or my other means, including automatic means, different from those shown by way of example. The important aspects are the presence of two adjacent rectilinear portions 2'A of greater length projecting from one side of the evaporator, the cut (along R) separating the evaporator into two sections G and F, the approach and, preferably, the subsequent superposing of these unilaterally prolonged portions 2'A at least along that part of them sandwiched between the sheets 3 and 4 in proximity to the locator 20, and the bending of that part of said prolonged portions 2'A which projects external to the sheets so that it lies on one side of the evaporator approximately parallel to the rectilinear direction, followed by twisting these prolonged portions 2'A such that they finally lie in an ideal plane substantially perpendicular to said sections G and F. In this manner a syphon is formed which aids the refrigerator operation in that it ensures adequate filling of the freezer section G with the refrigerant fluid.

[0015] The tube 2 can be of other than the circular cross-section shown, for example semi-circular or oval. The sections G and F can have a number of rectilinear, ie active, sections 2A different from the number shown in the example, depending on the refrigerator design.

[0016] According to a particular aspect, an electrical resistance element (in the form of electrically insulated resistive wire) is provided between the sheets 3 and 4 close to the hairpin coil 2 and following its path. This resistance element is indicated by 30 and is shown by dashed lines in Figure 1. It can involve either the entire hairpin coil 2 or alternatively only the freezer section G of the evaporator. Two resistance elements can however be provided, one for each of the evaporator sections G, F. In this latter case they can be powered either jointly or separately by switches or similar contactor means. For this purpose connecting the two sections of the resistance element in parallel and with a switch in each branch of the parallel connection is sufficient.

[0017] With the hairpin coil there is associated a usual capillary tube 77 which is bent to follow the shape of the evaporator and lie in a suitable position to facilitate its connection to a refrigeration compartment when the evaporator is shaped for use (see Figure 8). As can be seen from this figure, both the capillary tube 77 and the terminal portion 78 of the hairpin coil 2 comprise a loop-shaped part 79 to facilitate the bending of the assembly.

[0018] The said connection is simple to effect as a result of the "pre-shaping" of the evaporator to suitably fit the said compartment, the evaporator also comprising evaporator sections which although being different are connected together without any weld, the resultant evaporator hence being in one piece.

[0019] In a further embodiment of the invention, at least one of the two sheets 3 and 4 is provided with a resistance element positioned such that it lies in proximity with the hairpin coil 2 after this has been placed on said sheet. In addition, the two portions of one and the same sheet 3 and 4 can be provided with resistance elements arranged to cooperate operationally with the sections G and F of the hairpin coil.

[0020] The term "freezer compartment" as used herein indicates a compartment in which the product is preserved in the frozen state and/or can be brought into that state.

Claims

1. A method for producing an evaporator for a domestic refrigeration appliance comprising a refrigeration compartment and a freezer compartment, characterised by: forming a hairpin coil (2) provided with joined-together rectilinear portions (2A), of which two predetermined adjacent rectilinear portions (2'A) have an axial length greater than that of the remaining portions; joining the hairpin coil to thermally conducting sheets (3, 4) so that it lies interposed between said sheets, with part of the hairpin coil portions (2'A) of greater length projecting from said sheets; cutting the sheets (3, 4) applied to the hairpin coil in correspondence with the greater-length portions (2'A) to obtain to evaporator sections (G, F), then bending the projecting parts of said greater-length rectilinear portions (2'a) so that they lie laterally flanking the hairpin coil (2), one of said sections being intended for the refrigeration compartment and the other for the freezer compartment.

2. A method as claimed in claim 1, wherein the projecting parts of the two greater-length portions (2'A) project from one side of the sheets (3, 4).

3. A method as claimed in claims 1 and 2, wherein the joint between the sheets (3, 4) and the hairpin coil (2) is made by adhesive.

4. A method as claimed in claim 1, characterised by positioning a resistive element on one of the sheets, this element being associated with said sheet in a position suitable for cooperating with the hairpin coil (2).

5. A method as claimed in claim 4, characterised in that different portions of one and the same sheet (3, 4) comprise different resistive elements arranged to cooperate with different sections (G, F) of the hairpin coil (2).

6. An evaporator obtained by the method claimed in at least claim 1, characterised by comprising two sections (G, F) of different refrigeration capacity

formed from one and the same hairpin coil (2) consisting of rectilinear portions (2A) joined together and interposed between and joined to conductive sheets (3, 4), said hairpin coil forming between the two sections (G, F) a loop positioned laterally to said sections (Figures 6, 7).

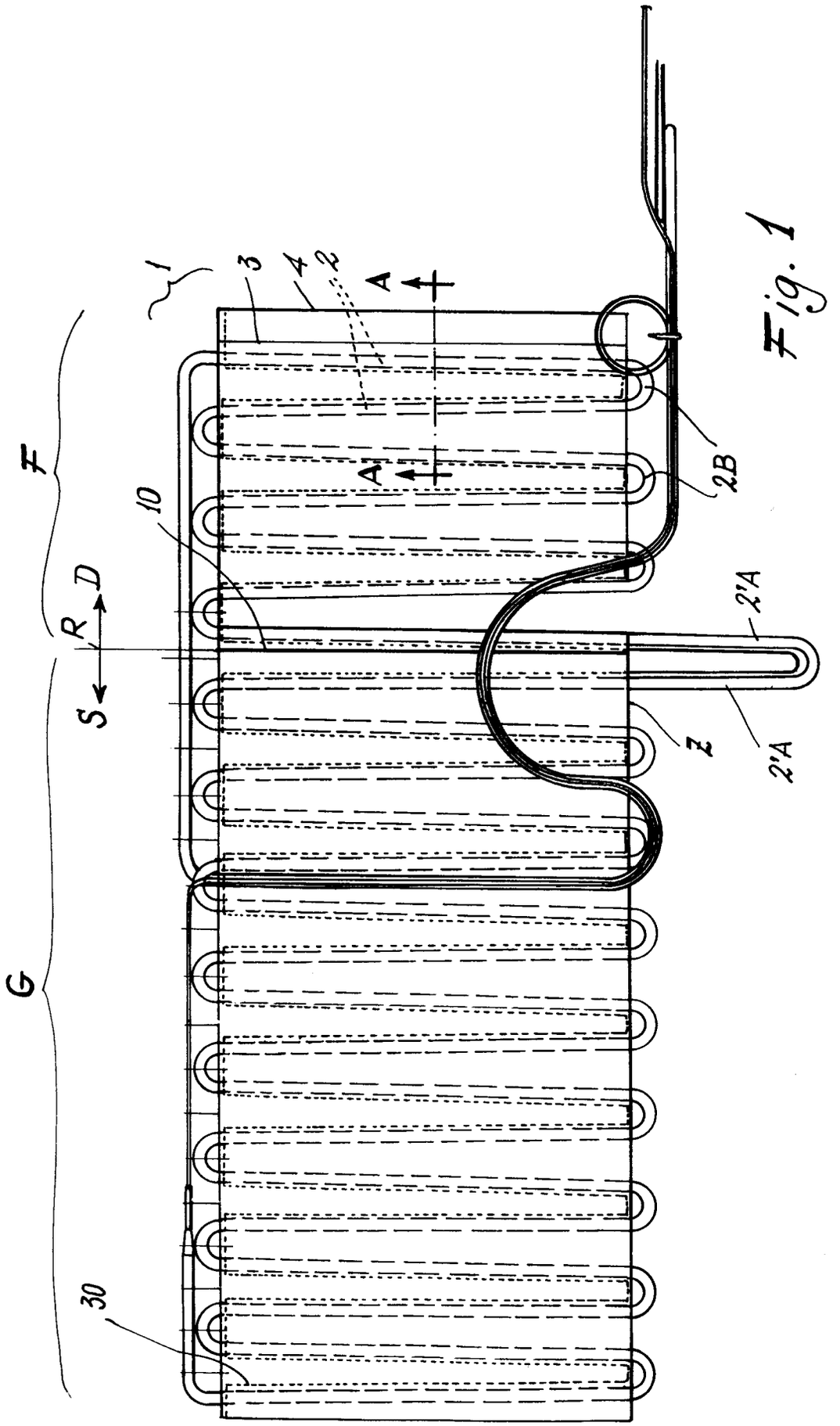

Fig. 1

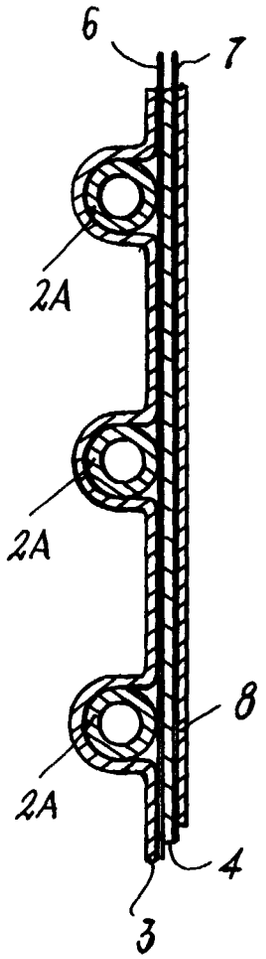

Fig. 2

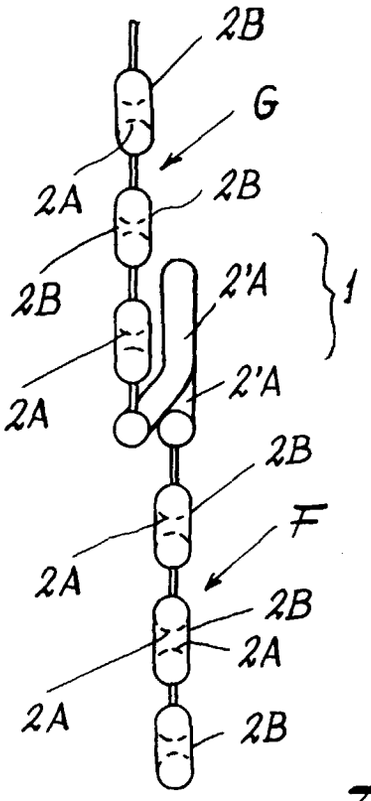

Fig. 7

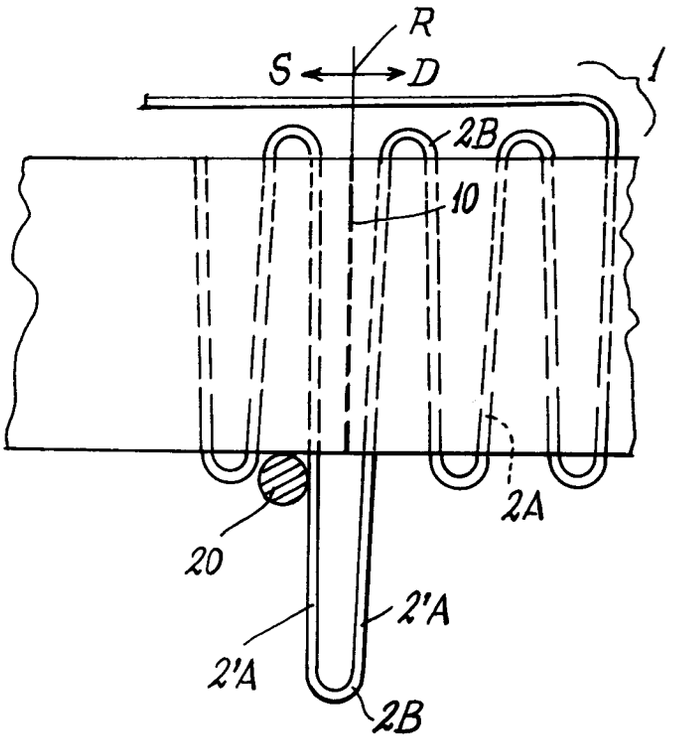

Fig. 3

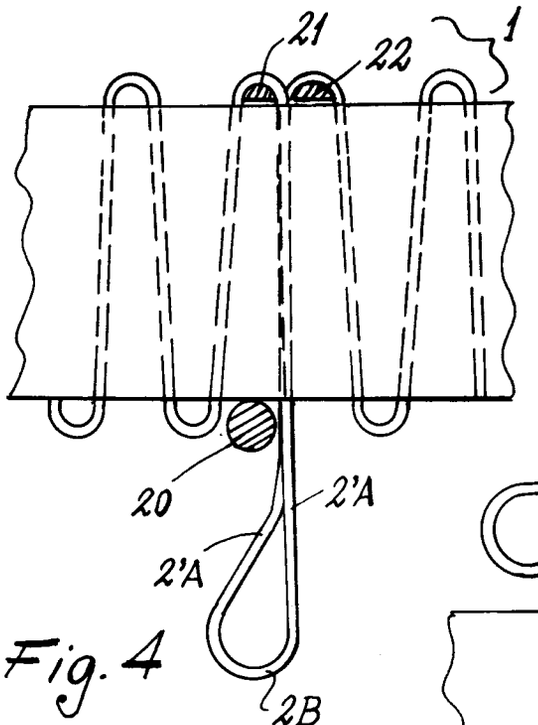

Fig. 4

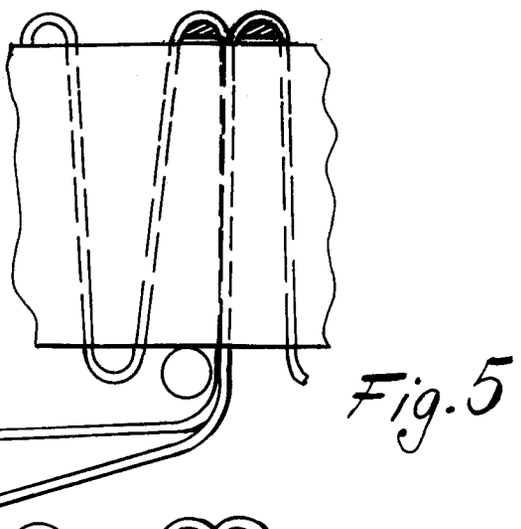

Fig. 5

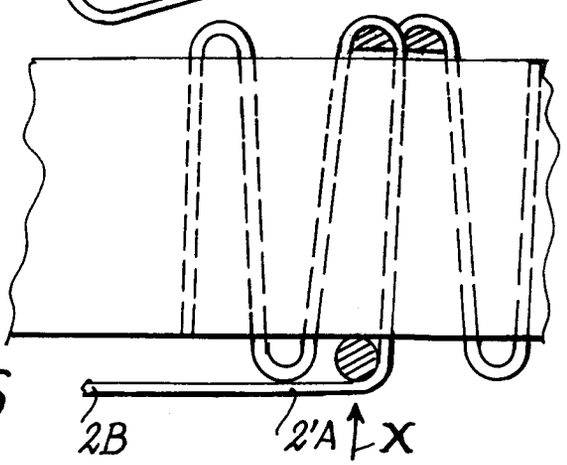

Fig. 6

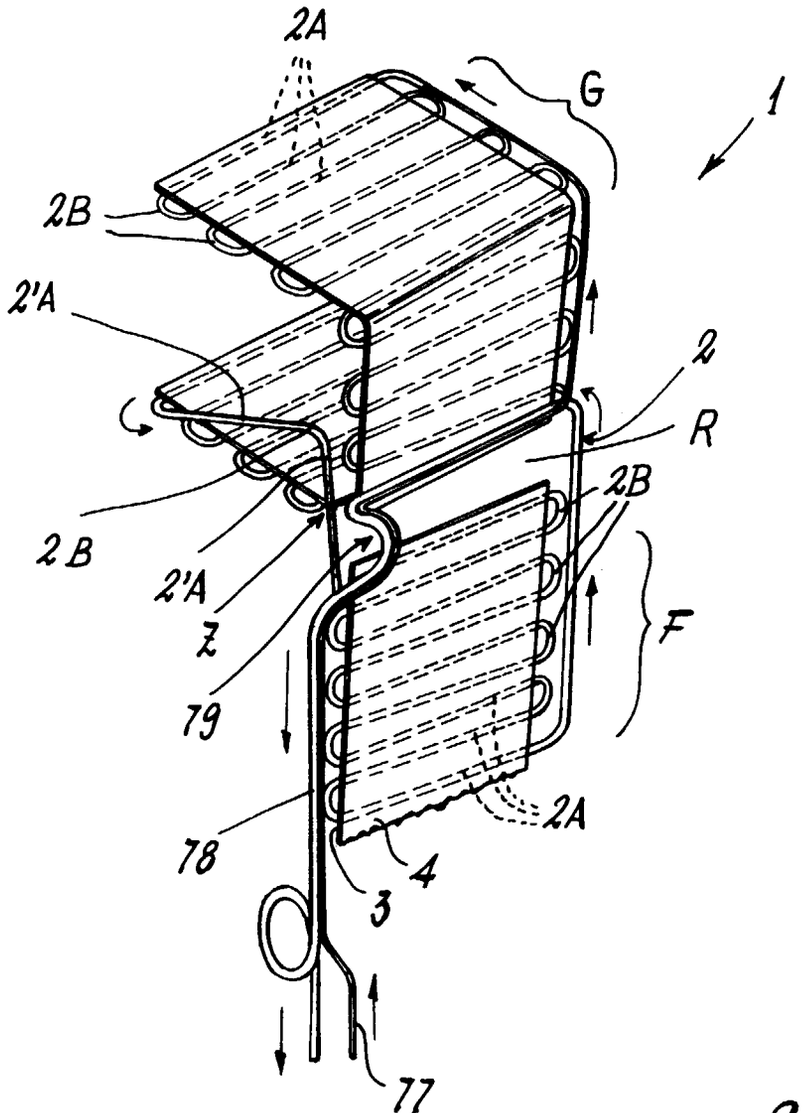

Fig. 8