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(54) TUBING ELEMENT FOR A HEAT EXCHANGER MEANS

ROHRELEMENT FÜR EINE WÄRMETAUSCHEREINRICHTUNG

ÉLÉMENT DE TUBAGE POUR SUPPORTS D'ÉCHANGEUR DE CHALEUR

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Description

[0001] The present invention relates to a tubing element for a heat exchanger means, a heat exchanger means and the method of manufacturing of a tubing element.

[0002] In the technical field of heat exchangers such as evaporators, condensers, radiators and coolers there have been many attempts to provide compact and energy efficient heat exchangers. A heat exchanger is hereby generally known to provide for an exchange of thermal energy between a first medium such as, for example, water and/or a cooling agent, and a second medium such as, for example, air.

[0003] For instance, EP 1 840 494 A2 discloses a heat exchanger, whereby the heat exchanger comprises a profile having two flat tubes with several channels and whereby the tubes are connected by means of a bar. The profile is a one-piece profile and may consist of aluminium or an aluminium alloy.

[0004] Moreover, DE 20 2008 006 379 U1 discloses an aluminium or aluminium alloy profile, which can be used for tubes for heat exchangers. The profile has a central channel and several further channels arranged around the central channel.

[0005] DE 2 209 325 discloses a tube for heat exchangers having a helical structure. Furthermore, DE 2 209 329 discloses heat exchanger tubes having ribs on the inner side and the outer side of the tube.

[0006] Additionally GB 1 390 782 discloses a heat-exchange tubing having spaced metal fins projecting inwardly of the tubing from the wall sections of the tubing and extending longitudinally of the tubing.

[0007] Further, EP 0 640 803 A1 relates to heat transfer coil, where a second piece of tubing is wound around the first piece of tubing while the first piece is straight and where the first piece of tubing is then formed to define the overall coil shape and then the first and second pieces of tubing internally sized by internal pressurization to also force the two pieces of tubing to intimate contact with each other.

[0008] Moreover, DE 38 15 647 A1 refers to a circular heat exchanger with a flat tube comprising ribs within the spaces of the different layers.

[0009] Also US 3 662 582 A describes a heat-exchange tubing with a peripheral wall of oblong cross-section and inner fins on the wall. Both this last document and DE 38 15 647 disclose the preamble of claim 1. However, it is still desirable to improve the already known technical solutions in the field of heat exchangers.

[0010] It is therefore an object for the present invention to improve a tubing element for a heat exchanger means, a heat exchanger, the use of a tubing element to manufacture at least partially a heat exchanger means, the use of a heat exchanger to exchange heat and a method of manufacturing of a tubing element, in particular in that the efficiency of the heat exchange is increased and that the overall structure of the tubing element and the heat exchanger is improved and simplified and allows a more compact structure of a heat exchanger.

[0011] The above object is solved according to the present invention by a tubing element for a heat exchanger means with the features of claim 1. Accordingly, a tubing element for a heat exchanger means is provided, the tubing element being at least partially a rigid elongated heat exchanger tubing having at least a first end and at least a second end and having a first side wall and a second side wall, the first side wall and the second side wall being arranged substantially parallel to each other and the distance between the first side wall and the second side wall being considerably smaller than the width of the first side wall and the second side wall resulting in a substantially overall flat tubing structure with connection walls on both sides, the tubing element having a plurality of fins on at least one of the outer surfaces of the first side wall and/or of the second side wall, wherein the fins have a defining angle Y enclosed by the fins and a connection wall.

[0012] The tubing element having a plurality of fins on at least one of the outer surfaces of the first side wall and/or of the second side wall increases the tubing element surface for a better heat exchange between the said second medium, such as air, and the heat exchanger means.

[0013] The defining angle Y, enclosed by the fins and a connection wall, extends the way of the heat exchange between the second medium and the surface of the tubing element having a plurality of fins on at least one of the outer surfaces of the first side wall and/or of the second side wall. The plurality of fins generate a better air path along the fins and the tubing element. The fins can influence the direction of the air flow along the tubing element. Due to the orientation of the plurality of fins on at least one of the outer surfaces of the tubing element, the air flow along the tubing element at the heat exchanger means can be controlled.

[0014] Such a tubing element for a heat exchanger means may be an elongated heat exchanger microchannel tube. Such an elongated heat exchanger microchannel tube may have a first and a second open end. There may be relatively large parallel opposite side walls of the microchannel tube with generally flat surfaces, which are joined with relatively small opposite edge walls between the side walls. These edge walls may be convexly curved.

[0015] Heat transfer vapor or fluid may fill a heat exchanger microchannel tube and may flow from one end of the microchannel tube to the other end. The term microchannel is also known as microport.

[0016] The said second medium such as air may flow around the outer sides of the tubing element and may transport the heat from the tube away or vice versa.

[0017] By providing a plurality of fins on at least one of the outer surfaces of the first side wall and/or of the second side wall the surface for heat exchange is increased. Thus, also the efficiency of the heat exchanger may be significantly improved.

[0018] Moreover, it is possible that the width of the first side wall and the second side wall is approximately at least 10 times larger than the distance between the first side wall and the second side wall and/or that the first side wall and second side wall are connected respectively on both sides by a rounded connection wall.

[0019] Additionally, the tubing element is at least partially tilted or at least partially tilted and sloped and at least partially helically wound and/or twisted so as to form at least a part of a helical structure, whereby preferably the helical structure has an overall cylindrical structure and/or that the helical structure is formed in a cylindrical shape.

[0020] A tubing element having a tilted orientation also creates a tilted orientation of the fins which are grounded on at least one of the outer surfaces of the first side wall and/or of the second side wall.

[0021] The helical structure of the tubing element is determined merely by variables radius r, angle α and angle β. Radius r defines the distance between the center of the tubing element and the central longitudinal axis X of the heat exchanger means. Angle α defines the slope of the tubing element and extends between the central longitudinal axis X of the heat exchanger means and the central axis Z of the tubing element. Angle β defines the tilt of the tubing element and extends between the central longitudinal axis X of the heat exchanger means and the central transversal axis Y of the tubing element.

[0022] Therefore, due to the tilted orientation of the tubing element, there are almost no horizontal surfaces on the tubing element within the heat exchanger means. Natural condensate from air moisture disappears very quickly, because of the tilted and at least partially helically wound and/or twisted tubing element. Natural condensate from air moisture disappears to the outside surface of the heat exchanger means, because of the tilted orientation of the tubing element. So, freezing of condensate from air moisture between each of said tubing elements can be minimized.

[0023] Compared to the prior art, the tubing element, being at least partially tilted and at least partially helically wound and/or twisted so as to form at least a part of a helical structure, is more efficient with less material. Also the heat exchanger means needs a smaller volume in the whole heat exchanger system, due to the compact set of tubing elements. Making this heat exchanger a high power density solution with minimal volumetric footprint.

[0024] Further, this tubing element, being at least partially tilted and at least partially helically wound and/or twisted so as to form at least a part of a helical structure, effects a better interaction between the said second medium such as air and the surface of the tubing element, due to the tilted orientation of the tubing element.

[0025] Furthermore, it is possible that the tubing element has a plurality of fins on both of the outer surfaces of the first side wall and of the second side wall. By providing a plurality of fins on both of the outer surfaces of the first side wall and of the second side wall the advantage is achieved that the surface used for the heat exchange may be increased very easily and that the volume needed for the tubing element is not increased substantially.

[0026] It is also possible that the fins are at least partially covered by a draining plate and/or that the fins are monoblock fins.

[0027] The fins may be substantially perpendicularly arranged on at least one of the outer surfaces of the first side wall and/or of the second side wall.

[0028] Alternatively, the fins are inclined arranged on at least one of the outer surfaces of the first side wall and/or of the second side wall, whereby exemplarily the angle between the fins and the outer surface is chosen within a range of approximately 15° to 85°.

[0029] Additionally, the fins merely extend along the whole width of at least one of the outer surfaces of the first side wall and/or of the second side wall and/or are curved.

[0030] Furthermore, the fins are arranged along a curve extending along the whole width of at least one of the outer surfaces of the first side wall and/or of the second side wall and/or are curved, whereby between the fins being arranged along a curve is a pitch and/or gap.

[0031] It is possible that the fins and/or the curve of fins and at least one of the connection walls are arranged such to each other that they enclose an angle. The angle may be substantially perpendicular. Alternatively, the angle may be chosen within range of about 15° to about 60° and is preferably chosen within a range of about 20° to about 25°. An angle of about 45° between the fins or the curve of fins and at least one of the connection walls is considered to be substantially neutral, in particular as a neutral arrangement with respect to the interference with e.g. fans or the like, which might be connected or used together with a heat exchanger means comprising such a tubing element.

[0032] The fins and/or the curve of fins may be formed slightly concave or convex. In particular, the slightly concave or convex shape of the fins may be achieved by an offset of the center part of the middle section of the fins and/or the curve of fins with respect to the endpoints of the fins and/or the curve of fins within a range of about 0.5 mm to about 5 mm, preferably of about 1 mm to about 2 mm, most preferred of about 1.5 mm.

[0033] It is preferred that the fins are arranged such that the medium flowing against the fins flows against a concave formed part of the fin.

[0034] The fins may have a height chosen within a range of about 0.5 mm to about 5.0 mm, preferably about 2-3 mm.

[0035] Further, it is possible that the fins are arranged in a plurality of rows, preferably substantially parallel rows and/or preferably along at least a part of the length of the tubing element.

[0036] The tubing element may comprise at least one microchannel. Preferably several microchannels with a round or circular cross-section and/or several microchannels with an angular cross-section, exemplarily several microchannels with a triangular cross-section and/or several microchannels with quadrangular cross-section are provided.

[0037] At least some of the microchannels may be arranged with an off-set to each other, whereby exemplarily all microchannels are arranged with an off-set to each other.

[0038] The off-set may result in several chamfers and/or grooves within the first side wall and/or the second side wall.

[0039] Furthermore, the tubing element may comprise at its a first end and at its second end a collecting portion which is reducing the width of the first side wall and the second side wall to a smaller width.

[0040] Moreover, the present invention relates to a heat exchanger means with the features of claim 9. Accordingly, a heat exchanger means is provided, the heat exchanger means having at least one tubing element according to any of claims 1 to 8.

[0041] Additionally, the heat exchanger may comprise several tubing elements are forming as a substantially overall cylindrical structure having a central longitudinal axis and that the tubing elements are spirally curved around the central longitudinal axis and interleaved in the structure.

[0042] The heat exchanger means may be a radiator or a cooler or a condenser or an evaporator.

[0043] Furthermore, the present invention relates to a method of manufacturing of a tubing element with the features of claim 12. Accordingly, a tubing element according to any of claims 1 to 8 is manufactured, whereby exemplarily the tubing element is received by using an extrusion process of a heat transfer material, whereby preferably the extrusion process is a single extrusion process. Moreover, preferably the heat exchanger material is at least partially aluminium or copper or an alloy thereof.

[0044] Further details and advantages of the present invention shall be described hereinafter with respect to the drawings:

Fig. 1: A perspective view of tubing element according to the present invention in a first embodiment;

Fig. 2: A perspective view of a tubing element according to a first embodiment of the present invention;

Fig. 3: A further perspective view of the tubing element shown in Figure 2 showing the angles for the slope and the tilt of the tubing element;

Fig. 4: The perspective view shown in Figure 3 with further details;

Fig. 5: A perspective view of a tubing element according to the present invention and as shown in Figure 2 together with connecting elements;

Fig. 6: A side elevation of the tubing element as shown in Figures 2 to 5;

Fig. 7: A perspective view of a heat exchanger comprising a plurality of tubing elements;

Fig. 8: A perspective view of a tubing element according to the present invention in a second embodiment;

Fig. 9: A perspective view in detail of embodiment shown in Figure 8.

Fig. 10 a, b: The perspective view of a draining plate and the respective tubing element thereto; and

Fig. 11: A perspective view of a further embodiment of a heat exchanger comprising the draining plate and the tubing element according to Figures 10a, b.

[0045] Figure 1 shows the perspective view of a first embodiment of the tubing element 10, however, without fins 60 or fins 60'.

[0046] The tubing element 10 is a rigid elongated heat exchanger tube having a first end 20 and a second end 30. There are relatively large parallel opposite side walls 40 and 50 with generally flat surfaces. The opposite parallel arranged side walls 40, 50 of the tubing element are joined with relatively small opposite edge walls 45, 55, which are rounded connection walls 45, 55. The tubing element 10 is partially tilted and sloped and also helically wound and twisted so as to form at least a part of a helical structure.

[0047] The distance d between the first side wall 40 and the second side wall 50 is considerably smaller than the width W of the side walls 40, 50.

[0048] There are relatively large parallel opposite side walls 40 and 50 with generally flat surfaces. The opposite parallel arranged side walls 40, 50 of the tubing element are joined with relatively small opposite edge walls 45, 55, which are rounded connection walls 45, 55. The tubing element 10 is partially tilted and sloped and also helically wound and twisted so as to form at least a part of a helical structure.

[0049] The opposite side walls 40 and 50 of the heat exchanger microchannel tube 10 are oppositely disposed in general parallel planes in the helix within the tube 10 there may be one or more media flow channels, which are formed between the oppositely disposed side walls 40, 50. A heat transfer vapor or fluid such as water or oil or refrigerant fills the heat exchanger microchannel tube 10 and flows from one end 20 of the microchannel tube 10 to the other end 30. Preferably, the resulting helix of the microchannel tube 10 is formed in a cylindrical shape.

[0050] Figure 2 shows a perspective view of a first embodiment of the tubing element 10. On both outer surfaces 42, 52 of the first side wall 40 and the second side wall 50 several fins 60 are arranged.

[0051] The fins 60 may be monoblock fins and are inclined arranged respective to the outer surface 42, 52 of the first side wall 40 and a second side wall 50. The angle between the fins and the outer surface 42, 52 is 22.5 degrees in this example. The fins 60 merely extend along the whole width W of the outer surfaces 42, 52 of the first side wall 40 and the second side wall 50.

[0052] As can be seen e.g. in Figure 5 and 6, the fins 60 are slightly curved.

[0053] Figure 3 shows the defining angles, i.e. angle $\alpha 1$ defining a slope and angle $\beta 1$ defining the tilt. Furthermore, Figure 3 shows the defining axes X, Y and Z and also the radius r. The heat exchanger microchannel tube 10 may be longitudinally curved around the central axis X into a helix. This axis X is shown in Figure 3 and is the central axis X of the overall and imaginary cylindrical shape of the helix.

[0054] As can be seen in Figure 3, the fins 60 follow the slope and the tilt.

[0055] Angle $\alpha 1$ defining the slope is defined as the angle $\alpha 1$ between axis X and Z. Angle $\beta 1$ defining the tilt is defined as to angle $\beta 1$ between axis X and Y. As can be seen in Figure 3, the radius r is the distance from axis X to the center of the angled finned tubing element 10 and/or to the intersection point of axis Y and axis Z.

[0056] As can be further seen from Figure 4, the fins 60 have two defining angles Y and δ. The angle Y is the angle which is enclosed by the fins 60 and the connection walls 45, 55 as also shown in Figures 2, 5 and 8. The angle δ is the angle of the fin 60 and the outer surface 42, 52 of the first side wall 40 or the second side wall 50.

[0057] As can be seen from the further detail shown in Figure 4, the first distance a between two adjacent fins 60 is larger than a second distance b of these adjacent fins 60. The first distance a 2. is used in the entry section of the gap defined by two adjacent fins 60, i.e. the section for the entry of a heat transfer media flowing through the fins. So, the fins 60 are substantially parallel.

[0058] The fins 60 according to the embodiment shown in Figures 2 to 6 are arranged on angles between 22.5 and 45 degrees to the outer surfaces 42, 52 of the first side wall 40 and of the second side wall 50.

[0059] This is, however, not mandatory. Alternatively, the fins 60 may be inclined arranged on the at least one of the outer surfaces 42, 52 of the first side wall 40 and/or of the second side wall 50, whereby exemplarily the angle between the fins 60 and the outer surface 42 or 52 may be chosen within a range of approximately 15° to 85°.

[0060] The fins 60 merely extend along the whole width W of the outer surfaces 42, 52 of the first side wall 40 and/or of the second side wall 50 and are slightly curved.

[0061] Further, the fins 60 are arranged in a plurality of parallel rows substantially along the whole length of the tubing element 10.

[0062] The fins 60 and the connection walls 45, 55 are arranged such to each other that they enclose an angle γ.

[0063] However, this angle γ may be substantially perpendicular. Alternatively, this angle γ may be chosen within range of about 15° to about 60° and may be preferably chosen within a range of about 20° to about 25°. An angle γ of about 45° between the fins 60 at least one of the connection walls 45, 55 is considered to be substantially neutral, in particular as a neutral arrangement with respect to the interference with e.g. fans or the like, which are connected or used together with a heat exchanger means comprising such a tubing element 10.

[0064] The fins 60 are formed slightly concave or convex, which is, however, not mandatory. In particular, the slightly concave or convex shape of the fins 60 may be achieved by an offset of the center part of the middle section of the fins 60 with respect to the endpoints of the fins 60 within a range of about 0.5 mm to about 5 mm, preferably of about 1 mm to about 2 mm, most preferred of about 1.5 mm. In the embodiment shown in Figure 2, the offset of the center part of the middle section of the fins 60 with respect to the endpoints of the fins 60 is about 1 mm.

[0065] The fins 60 are arranged such that the medium flowing against the fins flows against a concave formed part of the fin.

[0066] Furthermore, the fins 60 according to the embodiment shown in Figure 2 have a height of about 2.5 mm. Generally, the fins 60 may have a height chosen within a range of about 0.5 mm to about 5.0 mm, preferably about 2-3 mm.

[0067] At the ends 20, 30 of the tubing element 10 collecting elements 25, 35 are provided, which reduce width of the tubing element 10 to a broader diameter, i.e. the diameter of the tubular connectors of circular cross-sections 27, 37.

[0068] Figure 7 is a perspective view of a heat exchanger means 100 comprising a plurality of a first set of interlaced tilted helical microchannel tubing elements 10 with adjacent tilted and twisted similarly helically formed tubing elements 10 and a respective second set S2 inside of the first set S1. By this, a compact structure together with an increased surface for heat exchange is received.

[0069] Figure 8 is a perspective view of the second embodiment of the tubing element according to the present invention. The second embodiment of the tubing element 10' is merely the same as the one shown in Figures 2 to 6. However, a different kind of fins is used, i.e. fins 60'. The fins 60' are arranged along a curve extending substantially the whole width W of at least one of the outer surfaces 42, 52 of the sidewall 40 and sidewall 50 and as can be seen from Figure 9, between each fins 60' arranged along one curve a gap is provided. The fins 60' are arranged in a plurality of rows which are arranged parallel.

[0070] The fins 60' are according to the embodiment shown in Figure 8 arranged on an angle of 22.5 degrees to the outer surfaces 42, 52 of the first side wall 40 and of the second side wall 50.

[0071] Alternatively, the fins 60' may be inclined arranged on at least one of the outer surfaces 42, 52 of the first side wall 40 and/or of the second side wall 50, whereby exemplarily the angle between the fins 60' and the outer surface 40, 50 is substantially perpendicular.

[0072] Furthermore, the fins 60' are arranged along a curve extending along the whole width W of the outer surfaces 42, 52 of the first side wall 40 and/or of the second side wall 50 and are also curved, whereby between the fins 60' being arranged along a curve is a gap 62.

[0073] It is possible that the fins 60' and the curve of fins 60' and the connection walls 45, 55 are arranged such to each other that they enclose an angle γ.

[0074] However, this angle γ may be substantially perpendicular. Alternatively, this angle γ may be chosen within range of about 15° to about 60° and may be preferably chosen within a range of about 20° to about 25°. An angle γ of about 45° between the fins 60 at least one of the connection walls 45, 55 is considered to be substantially neutral, in particular as a neutral arrangement with respect to the interference with e.g. fans or the like, which may be connected or used together with a heat exchanger means comprising such a tubing element 10.

[0075] The fins 60' and the curve of fins 60' is formed slightly concave. In particular, the slightly concave shape of the fins 60' is achieved by an offset of the center part of the middle section of the fins 60' and the curve of fins 60' with respect to the endpoints of the fins 60' and the curve of fins 60' within a range of about 0.5 mm to about 5 mm, preferably of about 1 mm to about 2 mm, most preferred of about 1.5 mm.

[0076] The fins 60' are arranged such that the medium flowing against the fins 60' flows against a concave formed part of the fins 60'.

[0077] Furthermore, the fins 60' according to the embodiment shown in Figure 8 have a height of about 3 mm. Generally, the fins 60' may have a height chosen within a range of about 0.5 mm to about 5.0 mm, preferably about 2-3 mm.

[0078] The curves of fins 60' are arranged in a plurality of substantially parallel rows along the tubing element.

[0079] Figure 9 is showing in detail embodiment of a tube 10' with fins 60' as shown in Figure 8 and having a plurality of microchannels 70 with a square cross-section.

[0080] Figure 10a shows in a perspective view a draining plate 80 which is tilted and helically wound such that it can be attached to the helically wound heat exchanger microchannel tube 10 as shown in Figure 10b.

[0081] As can be further seen from Figure 11, several draining plates 80 and heat exchanger tubes 10 may be arranged to a heat exchanger means 100 comprising a plurality of interlaced sloped and tilted helically wound microchannel tubing elements 10 and draining plates 80 between each of the pair of adjacent tubing elements 10.

[0082] The use of draining plates 80 is preferred in cases where the heat exchanger means 100 is an evaporator.

Claims

1. Tubing element (10, 10') for a heat exchanger means (100, 100'), the tubing element (10, 10') being at least partially a rigid elongated heat exchanger tubing having at least a first end (20) and at least a second end (30) and having a first side wall (40) and a second side wall (50), the first side wall (40) and the second side wall (50) being arranged substantially parallel to each other and a distance (d) between the first side wall (40) and the second side wall (50) being considerably smaller than the width (W) of the first side wall (40) and the second side wall (50) resulting in a substantially overall flat tubing structure with connection walls (45, 55) on both sides, the tubing element (10, 10') having a plurality of fins (60, 60') on at least one of the outer surfaces (42, 52) of the first side wall (40) and/or of the second side wall (50), wherein the tubing element is at least partially tilted or at least partially tilted and sloped and at least partially helically wound and/or twisted so as to form at least a part of a helical structure, **characterised in that** the fins (60, 60') are arranged along a curve extending along the whole width (W) of at least one of the outer surfaces (42, 52) of the first side wall (40) and/or of the second side wall (50) and are curved, whereby between the fins (60, 60'), being arranged along a curve, is a pitch and/or gap and that the fins (60, 60') are arranged in a plurality of rows, wherein the fins (60, 60') extend along a curve extending between the connection walls (45, 55),
wherein a first distance (a) in the entry section of the gap defined by two adjacent fins (60, 60') is larger than a second distance (b),
wherein the fins (60, 60') have a defining angle γ enclosed by the fins (60, 60') and a connection wall (45, 55).

2. Tubing element (10, 10') according to claim 1, **characterized in that**
the width (W) of the first side wall (40) and the second side wall (50) is approximately at least 10 times larger than the distance (d) between the first side wall (40) and the second side wall (50) and/or that the first side wall (40) and second side wall (50) are connected respectively on both sides by a rounded connection wall (45, 55).

3. Tubing element (10, 10') according to claim 1, **characterized in that**
the helical structure has an overall cylindrical struc-

ture and/or that the helical structure is formed in a cylindrical shape.

4. Tubing element (10, 10') according to any of the preceding claims,
characterized in that
the tubing element (10, 10') has a plurality of fins (60, 60') on both of the outer surfaces (42, 52) of the first side wall (40) and of the second side wall (50).

5. Tubing element (10, 10') according to any of the preceding claims,
characterized in that
the fins (60, 60') are at least partially covered by a draining plate (80).

6. Tubing element (10, 10') according to any of the preceding claims,
characterized in that
the fins (60, 60') are monoblock fins.

7. Tubing element (10, 10') according to any of claims 1 to 6,
characterized in that
the fins (60, 60') are inclined arranged on at least one of the outer surfaces (42, 52) of the first side wall (40) and/or of the second side wall (50), whereby the angle δ between the fins (60, 60') and the outer surface (42, 52) is chosen within a range of approximately 15° to 85°.

8. Tubing element (10, 10') according to any of the preceding claims,
characterized in that
the tubing element (10, 10') comprises at its first end (20) and at its second end (30) a collecting portion (25, 35) which is reducing the width of the first side wall (40) and the second side wall (50) to a smaller width.

9. Heat exchanger means (100, 100') having at least one tubing element (10, 10') according to any of the preceding claims.

10. Heat exchanger means (100, 100') according to claim 9,
characterized in that
several tubing elements (10, 10') are forming an overall substantially cylindrical structure having a central longitudinal axis (X) and that the tubing elements (10, 10') are spirally curved around the central longitudinal axis (X) and interleaved in the structure.

11. Heat exchanger means (100, 100') according to claim 9 or 10,
characterized in that
the heat exchanger means (100, 100') is a condenser or an evaporator or a radiator or a cooler.

12. Method of manufacturing of a tubing element (10, 10') according to any of claims 1 to 8, whereby the tubing element (10, 10') is received by using an extrusion process of a heat transfer material, whereby preferably the extrusion process is a single extrusion process.

13. Method of manufacturing of a tubing element (10, 10') according to claim 12,
characterized in that
the heat transfer material is at least partially aluminium or copper or an alloy thereof.

Patentansprüche

1. Rohrelement (10, 10') für eine Wärmetauschereinrichtung (100, 100'), wobei das Rohrelement (10, 10') zumindest teilweise ein starres, lang gestrecktes Wärmetauscherrohr ist, das mindestens ein erstes Ende (20) und mindestens ein zweites Ende (30) aufweist und eine erste Seitenwand (40) und eine zweite Seitenwand (50) aufweist, wobei die erste Seitenwand (40) und die zweite Seitenwand (50) im Wesentlichen parallel zueinander angeordnet sind und ein Abstand (d) zwischen der ersten Seitenwand (40) und der zweiten Seitenwand (50) erheblich kleiner ist als die Breite (W) der ersten Seitenwand (40) und der zweiten Seitenwand (50), was einen im Wesentlichen insgesamt flachen Rohraufbau mit Verbindungswänden (45, 55) auf beiden Seiten ergibt, wobei das Rohrelement (10, 10') auf mindestens einer der Außenflächen (42, 52) der ersten Seitenwand (40) und/oder der zweiten Seitenwand (50) eine Vielzahl von Stegen (60, 60') aufweist,
wobei das Rohrelement zumindest teilweise schräg gestellt ist oder zumindest teilweise schräg gestellt und abgeschrägt und zumindest teilweise spiralförmig gewunden und/oder verdreht ist, so dass mindestens einen Teil einer spiralförmigen Struktur gebildet wird,
dadurch gekennzeichnet, dass
die Stege (60, 60') längs einer Kurve angeordnet sind, die sich in der gesamten Breite (W) von mindestens einer der Außenflächen (42, 52) der ersten Seitenwand (40) und/oder der zweiten Seitenwand (50) erstreckt, und bogenförmig gewölbt sind, wodurch zwischen den Stegen (60, 60') entlang einer Kurve eine Teilung und/oder Spalt angeordnet ist, und dass die Stege (60, 60') in einer Vielzahl von Reihen angeordnet sind, wobei die Stege (60, 60') längs einer Kurve verlaufen, die sich zwischen den Verbindungswänden (45, 55) erstreckt,
wobei ein erster Abstand (a) im Eintrittsabschnitt des durch zwei benachbarte Stege (60, 60') definierten Spalts größer ist als ein zweiter Abstand (b),
wobei die Stege (60, 60') einen durch die Stege (60, 60') und eine Verbindungswand (45, 55) einge-

schlossenen abgrenzenden Winkel aufweisen.

2. Rohrelement (10, 10') nach Anspruch 1,
dadurch gekennzeichnet, dass
die Breite (W) der ersten Seitenwand (40) und der zweiten Seitenwand (50) ungefähr mindestens 10 mal größer ist als der Abstand (d) zwischen der ersten Seitenwand (40) und der zweiten Seitenwand (50) und/oder dass die erste Seitenwand (40) und die zweite Seitenwand (50) jeweils an beiden Seiten durch eine gerundete Verbindungswand (45, 55) verbunden sind.

3. Rohrelement (10, 10') nach Anspruch 1,
dadurch gekennzeichnet, dass
die spiralförmige Struktur eine insgesamt zylindrische Struktur aufweist und/oder dass die spiralförmige Struktur in einer zylindrischen Form ausgebildet ist.

4. Rohrelement (10, 10') nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet, dass
das Rohrelement (10, 10') eine Vielzahl von Streben (60, 60') auf beiden der Außenflächen (42, 52) der ersten Seitenwand (40) und der zweiten Seitenwand (50) aufweist.

5. Rohrelement (10, 10') nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet, dass
die Stege (60, 60') zumindest teilweise durch eine Entwässerungsplatte (80) bedeckt sind.

6. Rohrelement (10, 10') nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet, dass
die Stege (60, 60') Stege aus einem Stück sind.

7. Rohrelement (10, 10') nach einem der Ansprüche 1 bis 6,
dadurch gekennzeichnet, dass
die Streben (60, 60') auf mindestens einer der Außenflächen (42, 52) der ersten Seitenwand (40) und/oder der zweiten Seitenwand (50) geneigt angeordnet sind, wodurch der Winkel zwischen den Streben (60, 60') und der Außenfläche (42, 52) innerhalb eines Bereichs von ungefähr 15° bis 85° gewählt ist.

8. Rohrelement (10, 10') nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet, dass
das Rohrelement (10, 10') an seinem ersten Ende (20) und an seinem zweiten Ende (30) einen Sammelabschnitt (25, 35) aufweist, der die Breite der ersten Seitenwand (40) und der zweiten Seitenwand (50) zu einer kleineren Breite verringert.

9. Wärmetauschereinrichtung (100, 100'), die mindestens ein Rohrelement (10, 10') nach einem der vorhergehenden Ansprüche aufweist.

10. Wärmetauschereinrichtung (100, 100') nach Anspruch 9,
dadurch gekennzeichnet, dass
mehrere Rohrelemente (10, 10') eine insgesamt im Wesentlichen zylindrische Struktur mit einer mittleren Längsachse (X) bilden, und dass die Rohrelemente (10, 10') um die mittlere Längsachse (X) spiralförmig gebogen sind und im Aufbau verschachtelt sind.

11. Wärmetauschereinrichtung (100, 100') nach Anspruch 9 oder 10,
dadurch gekennzeichnet, dass
die Wärmetauschereinrichtung (100, 100') ein Kondensator oder ein Verdampfer oder ein Heizkörper oder ein Kühler ist.

12. Verfahren zur Herstellung eines Rohrelements (10, 10') nach einem der Ansprüche 1 bis 8, durch welches das Rohrelement (10, 10') erhalten wird, indem ein Strangpressprozess eines Wärmeträgerwerkstoffs genutzt wird, womit vorzugsweise der Strangpressprozess ein Einzelstrangpressprozess ist.

13. Verfahren zur Herstellung eines Rohrelements (10, 10') nach Anspruch 12,
dadurch gekennzeichnet, dass
der Wärmeträgerwerkstoff zumindest teilweise Aluminium oder Kupfer oder eine Legierung davon ist.

Revendications

1. Élément de tubage (10, 10') pour un moyen échangeur de chaleur (100, 100'), l'élément de tubage (10, 10') étant au moins en partie un tubage d'échangeur de chaleur rigide de forme allongée ayant au moins une première extrémité (20) et au moins une deuxième extrémité (30), et ayant une première paroi latérale (40) et une deuxième paroi latérale (50), la première paroi latérale (40) et la deuxième paroi latérale (50) étant agencées sensiblement en parallèle l'une par rapport à l'autre, et une distance (d) entre la première paroi latérale (40) et la deuxième paroi latérale (50) étant considérablement plus petite que la largeur (W) de la première paroi latérale (40) et de la deuxième paroi latérale (50), résultant dans une structure de tubage sensiblement globalement plate avec des parois de liaison (45, 55) des deux côtés, l'élément de tubage (10, 10') ayant une pluralité d'ailettes (60, 60') sur au moins une des surfaces extérieures (42, 52) de la première paroi latérale (40) et/ou de la deuxième paroi latérale (50),
dans lequel l'élément de tubage est au moins en

partie basculé, ou au moins en partie basculé et en pente, et au moins en partie enroulé en hélice et/ou torsadé, de manière à former au moins une partie d'une structure héliocoïdale, **caractérisé en ce que** les ailettes (60, 60') sont agencées le long d'une courbe s'étendant le long de toute la largeur (W) d'au moins une des surfaces extérieures (42, 52) de la première paroi latérale (40) et/ou de la deuxième paroi latérale (50) et sont incurvées, ce qui a pour effet de créer un pas et/ou un intervalle entre les ailettes (60, 60') étant agencées le long d'une courbe, et **en ce que** les ailettes (60, 60') sont agencées dans une pluralité de rangées,
dans lequel les ailettes (60, 60') s'étendent le long d'une courbe s'étendant entre les parois de liaison (45, 55),
dans lequel une première distance (a) dans la section d'entrée de l'intervalle défini par deux ailettes adjacentes (60, 60') est plus grande qu'une deuxième distance (b),
dans lequel les ailettes (60, 60') ont un angle défini γ inclus par les ailettes (60, 60') et une paroi de liaison (45, 55).

2. Élément de tubage (10, 10') selon la revendication 1, **caractérisé en ce que** la largeur (W) de la première paroi latérale (40) et de la deuxième paroi latérale (50) est approximativement au moins 10 fois plus grande que la distance (d) entre la première paroi latérale (40) et la deuxième paroi latérale (50), et/ou **en ce que** la première paroi latérale (40) et la deuxième paroi latérale (50) sont reliées respectivement des deux côtés par une paroi de liaison arrondie (45, 55).

3. Élément de tubage (10, 10') selon la revendication 1, **caractérisé en ce que** la structure hélicoïdale a une structure globalement cylindrique, et/ou **en ce que** la structure hélicoïdale est formée dans une forme cylindrique.

4. Élément de tubage (10, 10') selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'élément de tubage (10, 10') a une pluralité d'ailettes (60, 60') à la fois sur les surfaces extérieures (42, 52) de la première paroi latérale (40) et de la deuxième paroi latérale (50).

5. Élément de tubage (10, 10') selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les ailettes (60, 60') sont au moins en partie couverte par une plaque de drainage (80).

6. Élément de tubage (10, 10') selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les ailettes (60, 60') sont des ailettes monobloc.

7. Élément de tubage (10, 10') selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** les ailettes (60, 60') sont inclinées en étant disposées sur au moins une des surfaces extérieures (42, 52) de la première paroi latérale (40) et/ou de la deuxième paroi latérale (50), ce qui a pour effet que l'angle δ entre les ailettes (60, 60') et la surface extérieure (42, 52) est choisi à l'intérieur d'une plage d'approximativement 15° à 85°.

8. Élément de tubage (10, 10') selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'élément de tubage (10, 10') comprend, au niveau de sa première extrémité (20) et au niveau de sa deuxième extrémité (30), une portion collectrice (25, 35) qui réduit la largeur de la première paroi latérale (40) et de la deuxième paroi latérale (50) à une plus petite largeur.

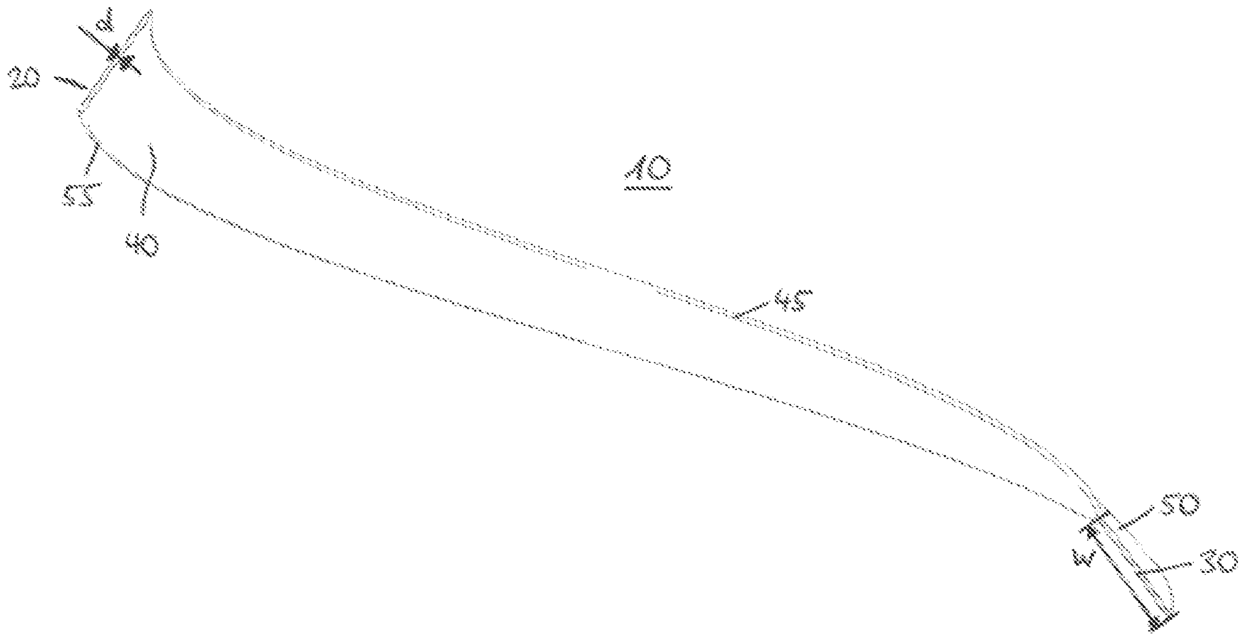
9. Moyen échangeur de chaleur (100, 100') ayant au moins un élément de tubage (10, 10') selon l'une quelconque des revendications précédentes.

10. Moyen échangeur de chaleur (100, 100') selon la revendication 9, **caractérisé en ce que** plusieurs éléments de tubage (10, 10') forment une structure globalement sensiblement cylindrique ayant un axe longitudinal central (X), et **en ce que** les éléments de tubage (10, 10') sont incurvés en spirale autour de l'axe longitudinal central (X) et intercalés dans la structure.

11. Moyen échangeur de chaleur (100, 100') selon la revendication 9 ou 10, **caractérisé en ce que** le moyen échangeur de chaleur (100, 100') est un condenseur ou un évaporateur ou un radiateur ou un refroidisseur.

12. Procédé de fabrication d'un élément de tubage (10, 10') selon l'une quelconque des revendications 1 à 8, dans lequel l'élément de tubage (10, 10') est reçu en utilisant un processus d'extrusion d'un matériau de transfert de chaleur, dans lequel le processus d'extrusion est de préférence un processus d'extrusion unique.

13. Procédé de fabrication d'un élément de tubage (10, 10') selon la revendication 12, **caractérisé en ce que** le matériau de transfert de chaleur est au moins en partie de l'aluminium ou du cuivre ou un alliage de ceux-ci.


d
20
55
40
10
45
50
w
30

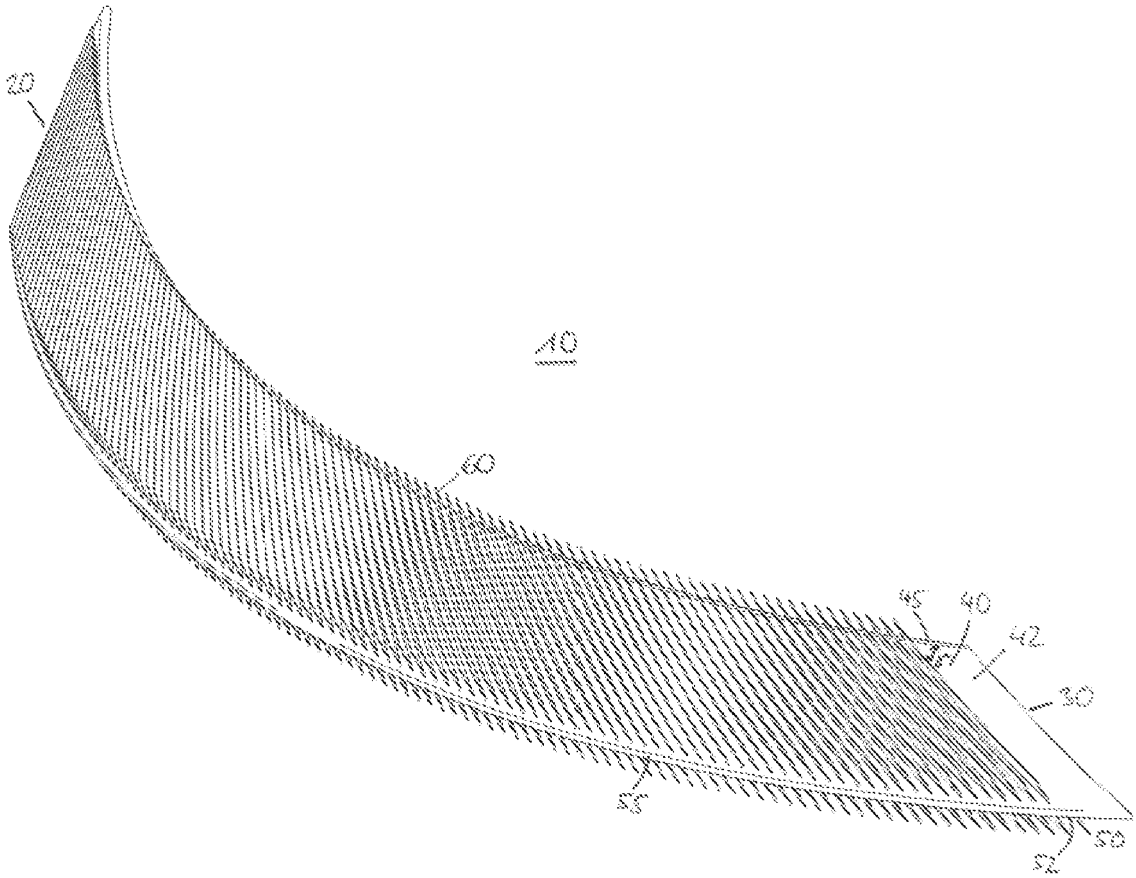


FIG. 2

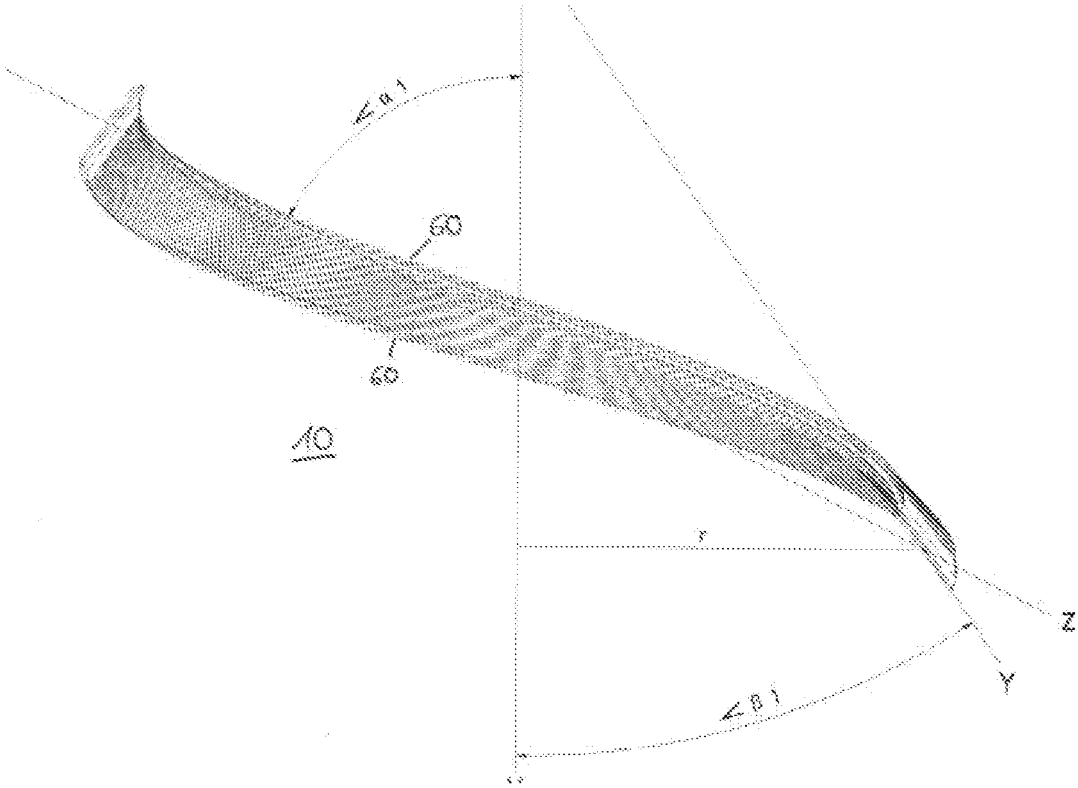


FIG. 3

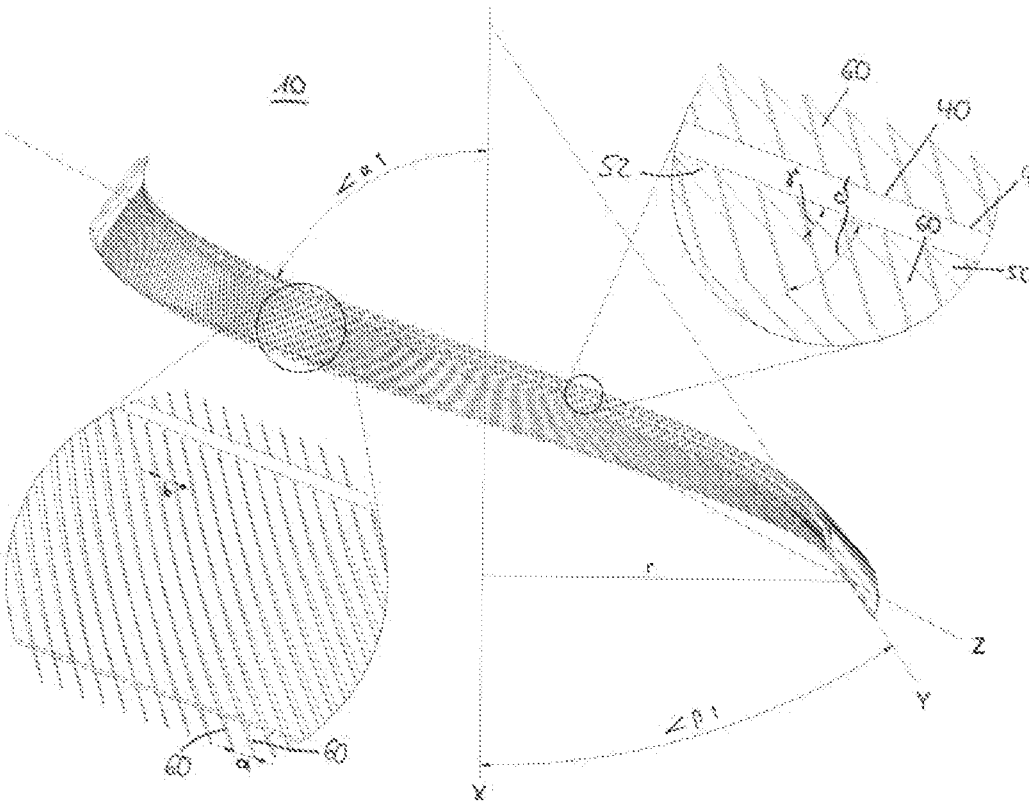


FIG. 4

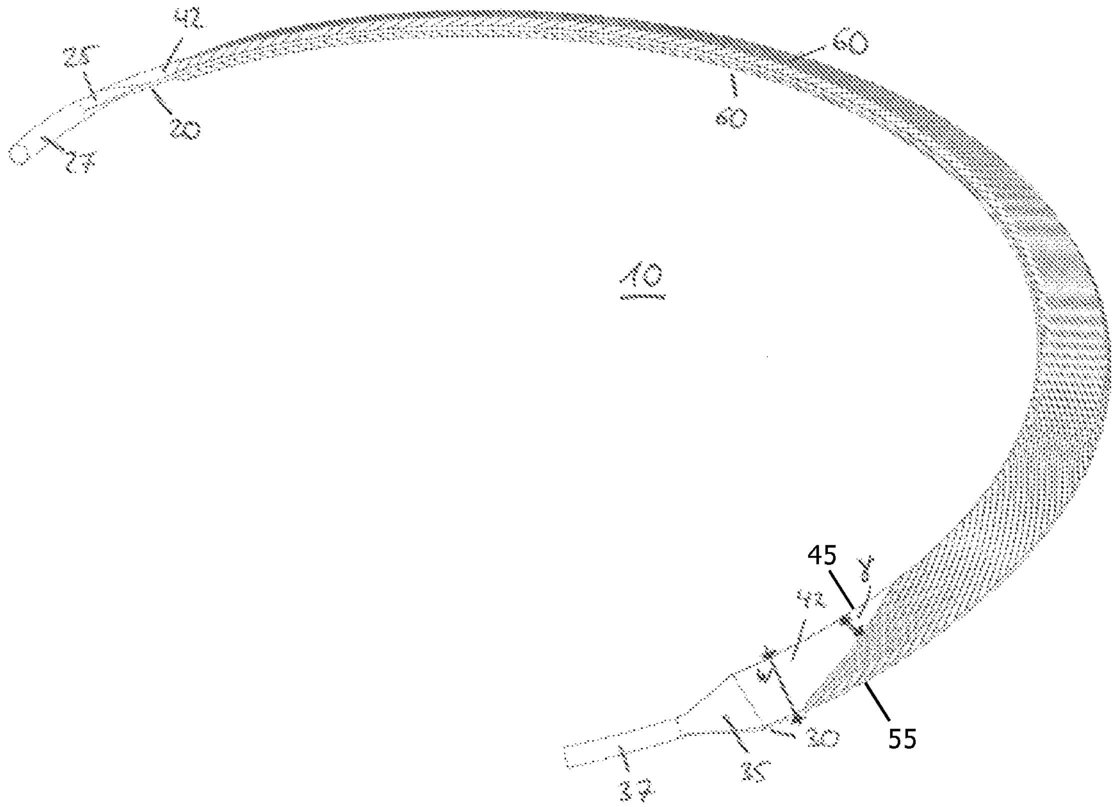


FIG. 5

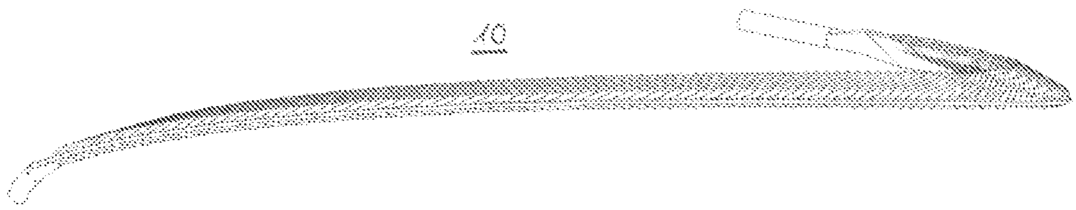


FIG. 6

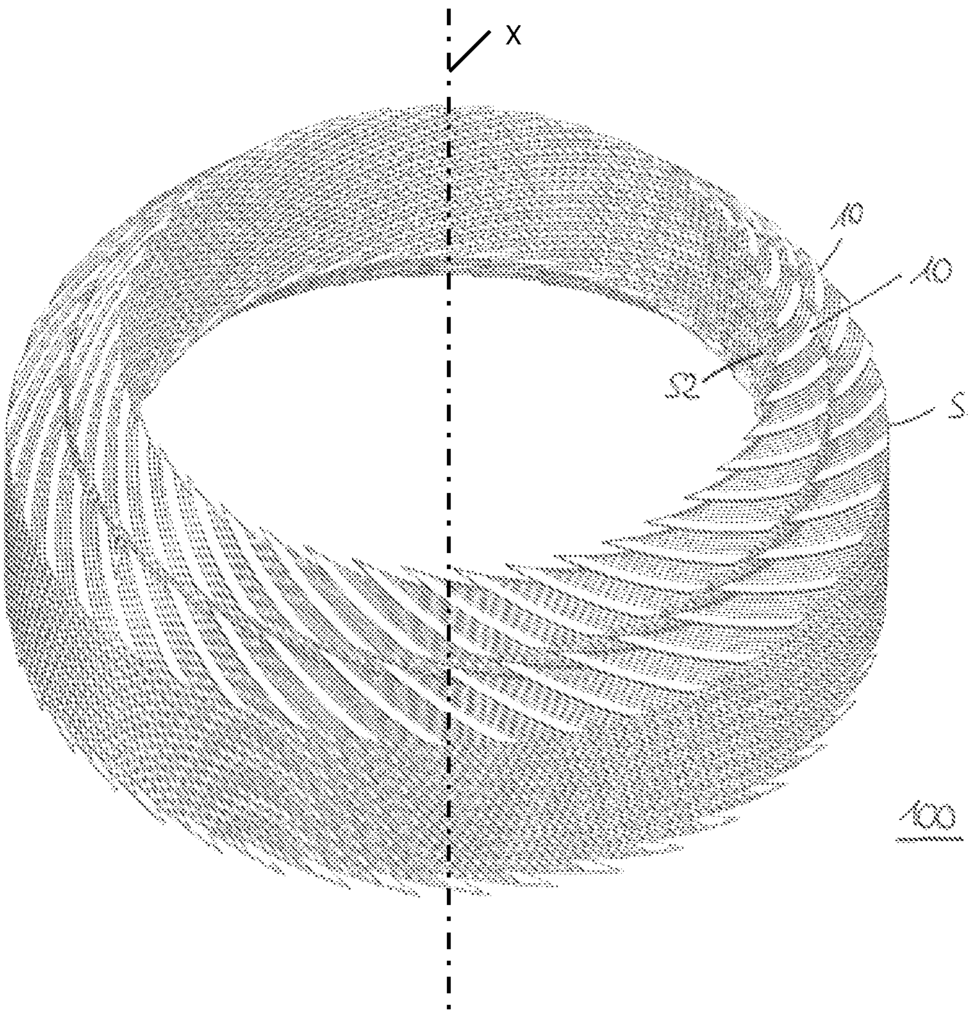


FIG. 7

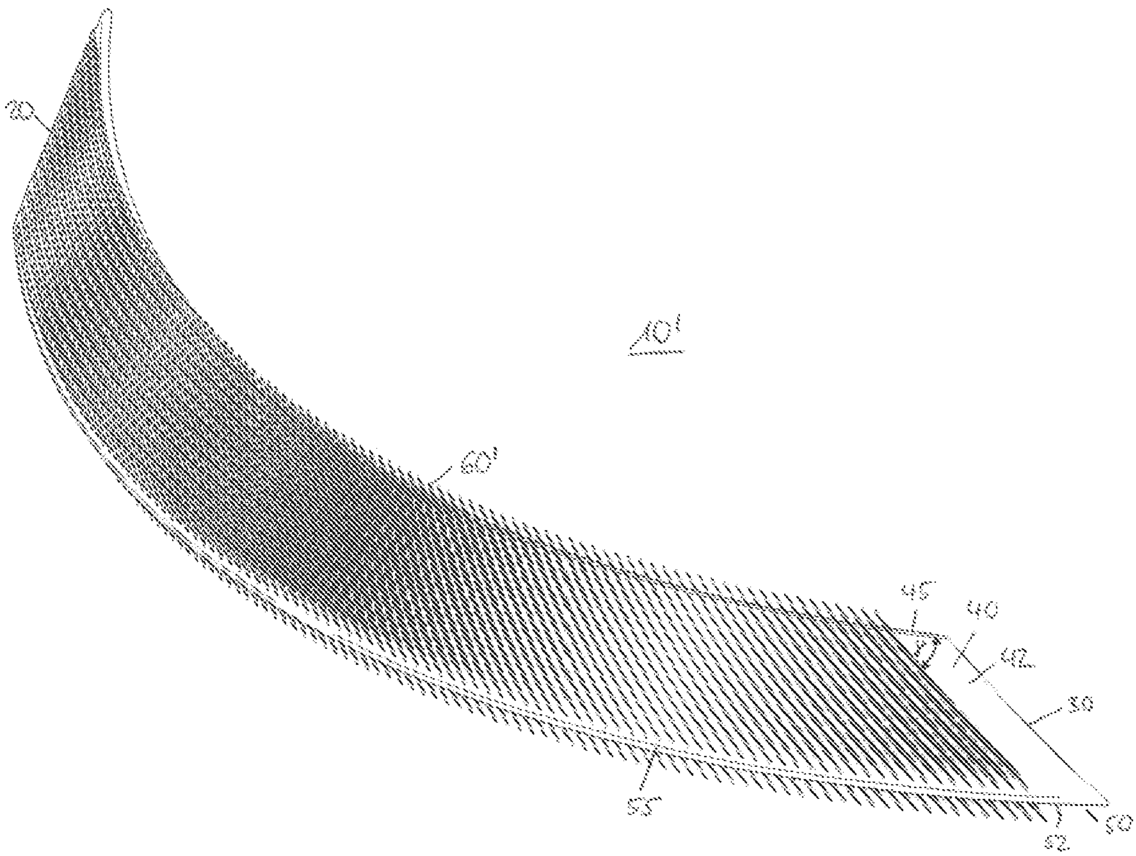


FIG. 8

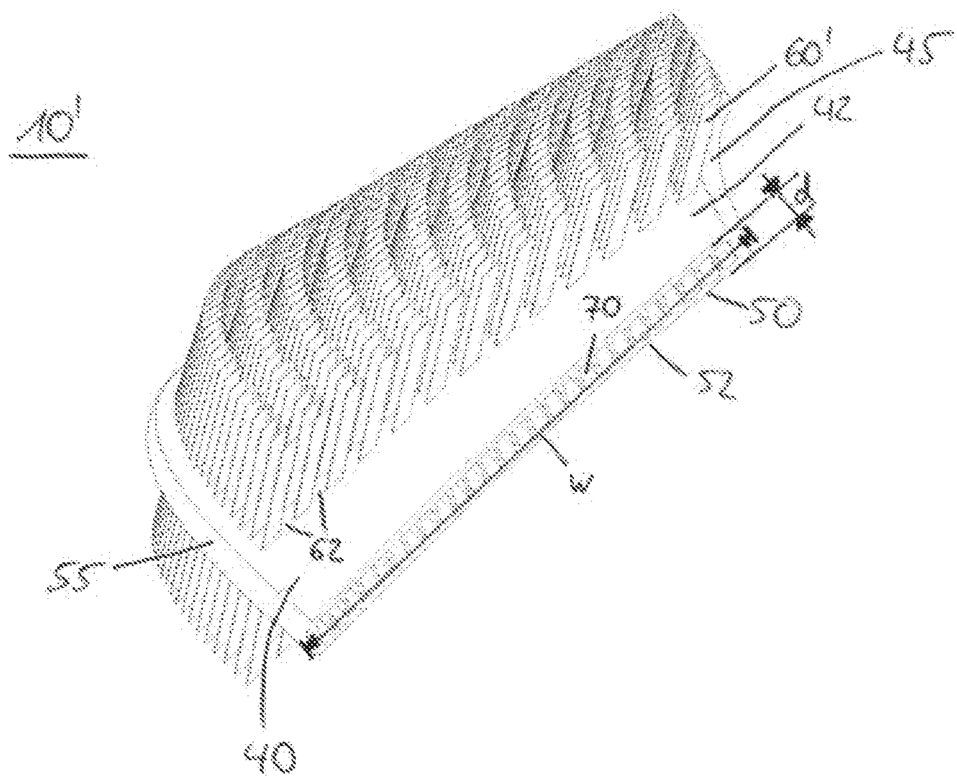


FIG. 9

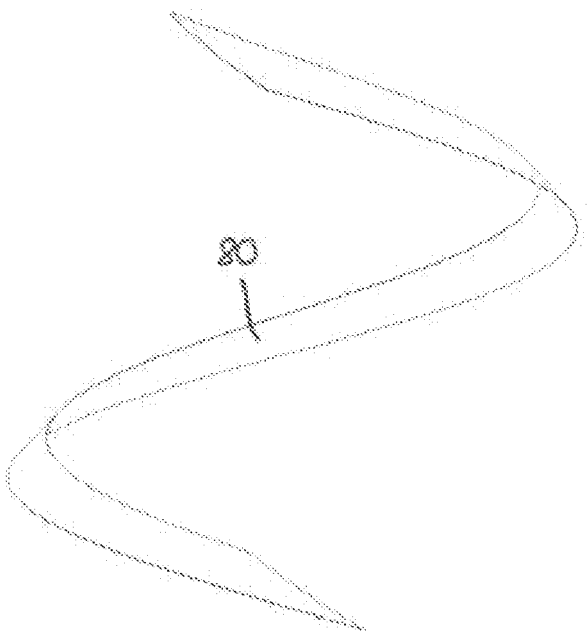


FIG. 10a

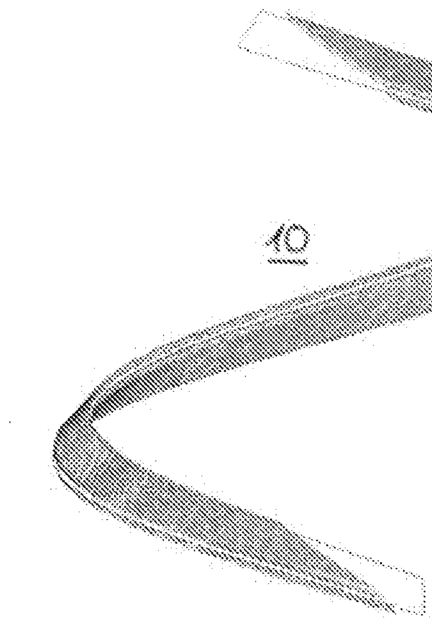


FIG. 10b

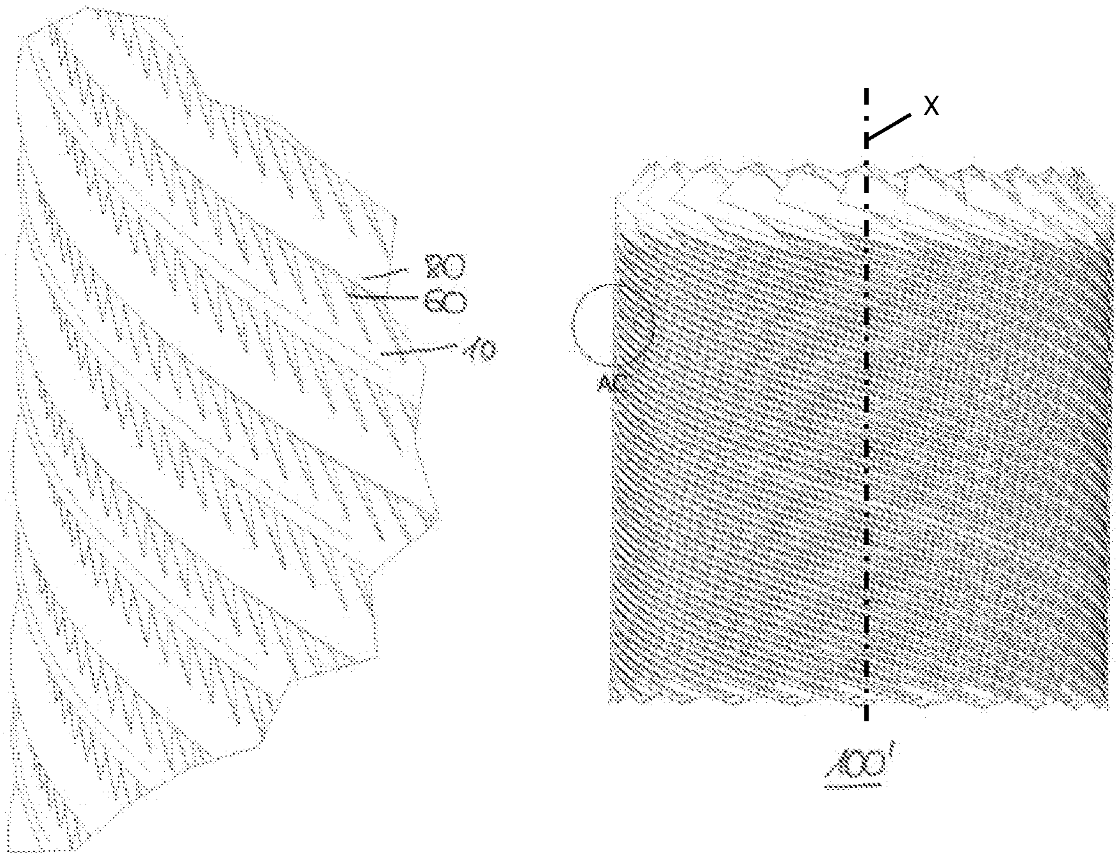


FIG. 11

REFERENCES CITED IN THE DESCRIPTION

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