(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 141 838 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
27.05.2020 Bulletin 2020/22

(21) Application number: **16187754.3**

(22) Date of filing: **08.09.2016**

(51) Int Cl.:
F24H 1/43 *(2006.01)* ***F24H 9/00*** *(2006.01)*
F28F 9/013 *(2006.01)* ***F28D 7/02*** *(2006.01)*
F28F 1/16 *(2006.01)*

(54) SPACING COMB, AND HEAT EXCHANGER COMPRISING SAID SPACING COMB, AND METHOD FOR MAKING SAID SPACING COMB

ABSTANDSKAMM UND WÄRMETAUSCHER MIT BESAGTEM ABSTANDSKAMM UND VERFAHREN ZUR HERSTELLUNG VON BESAGTEM ABSTANDSKAMM

PEIGNE D'ESPACEMENT ET ÉCHANGEUR DE CHALEUR COMPRENANT LEDIT PEIGNE D'ESPACEMENT ET PROCÉDÉ DE FABRICATION DUDIT PEIGNE D'ESPACEMENT

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **08.09.2015 IT UB20153489**

(43) Date of publication of application:
15.03.2017 Bulletin 2017/11

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Description

[0001] The present invention relates to a spacing comb for a heat exchanger. In particular, the present invention relates to a spacing comb used to space the coils of a tubular member of a heat exchanger of a water heater or domestic boiler.

[0002] A very commonly found heat exchanger for heating water in water heaters or domestic boilers comprises a casing; and a tubular member wound in a helix around a given axis so as to form a plurality of adjacent coils housed inside the casing. A liquid, generally water, passes through the helically wound tubular member, while combustion fumes, or, more generically, hot gases, containing water vapour flow through the casing, releasing most of the heat to the liquid and condensing the water vapour. The coils are spaced apart from each other so as to form gaps for the path of the combustion fumes. In particular, the heat exchanger of the type identified above is configured to define a path for the hot gases that extends between adjacent coils so as to optimize the heat exchange between the hot gases and the liquid. In this regard, the dimensions of the tubular member, the shape of the cross section of the tubular member, and the size of the gap between adjacent coils are very important design parameters in order to optimize the heat exchange. Examples of spacing combs used for spacing the coils of heat exchangers are shown in the documents EP 1,627,190 B1, and GB 914,083.

[0003] JP2006317036 discloses a spacer formed by cutting and having a plurality of stepped protruding portions of a long rectangular plate-like base portion.

[0004] KR101496361 discloses a spacer comprising a plurality of twisted bending insert space pieces formed in a support space piece.

[0005] The purpose of the present invention is to provide a spacing comb that is easy to make and at the same time is capable of satisfying the heat exchanger's design parameters.

[0006] A spacing comb for a heat exchanger is achieved in accordance with the present invention, wherein the heat exchanger comprises a tubular member which is configured to convey water to be heated, and is wound in a helix about a given axis in order to form a plurality of adjacent coils and housed in the casing; the spacing comb being configured so as to keep the adjacent coils a given distance apart and being made from a metal sheet blank which extends along a longitudinal axis and comprises a base; a plurality of tabs, which are placed partially side by side along the longitudinal axis and are configured for being bent at right angles with respect to the base so as to define a plurality of spacers supported by the base. The spacing comb in accordance with the present invention enables it to be made starting from a blank sheet of the tabs, i.e. of the spacers, each having a length greater than the pitch of the tabs themselves.

[0007] In particular, according to the invention the tabs are V-shaped and are - before being bent so as to define said plurality of spacers-inserted one into the other, partly, along the longitudinal axis. The particular V-shape configuration makes it possible to give the tabs a particular solidity and to make tabs having a length greater than the pitch of the tabs.

[0008] In particular, the tabs are bent about bend lines perpendicular to the longitudinal axis.

[0009] In particular the bending lines are distributed along the longitudinal axis with a constant pitch.

[0010] In particular, the spacing comb comprises two end wings, which are bent with respect to the base around further bending lines parallel to the longitudinal axis and extending from opposite sides of the tabs with respect to the base. The end wings give the spacing comb greater stiffness along the longitudinal axis A1. In this case, the wings also have a fluid dynamic function.

[0011] A further purpose of the present invention is to provide a heat exchanger.

[0012] In accordance with the present invention a heat exchanger for a water heater or domestic boiler is provided, the heat exchanger comprising a casing and a tubular member, which is configured to convey the water, and is wound in a helix around a given axis to form a plurality of adjacent coils and is housed within the casing; and at least two spacing combs with at least one of the salient characteristics identified above.

[0013] In particular, the helically wound tubular member defines a cylindrical compartment inside the casing into which hot gases are admitted and an annular compartment from which the gases are evacuated.

[0014] A further purpose of the present invention is to provide a method for making a spacing comb for a heat exchanger.

[0015] In accordance with the present invention, a method is provided for making a spacing comb for a heat exchanger, the method comprising the steps of:

- selecting a metal sheet having a thickness equal to the dimensions of the interstices between the adjacent coils of the heat exchanger;
- shearing a blank from the metal sheet extending along a longitudinal axis and comprising a base; a plurality of tabs, which are placed partially side by side along the longitudinal axis; and
- bending the tabs at right angles with respect to the base so as to define a plurality of spacers supported by the base.

[0016] The method according to the present invention makes it possible to provide tabs having a length greater than the pitch of the tabs.

[0017] The method also provides for bending the tabs about folding lines perpendicular to the longitudinal axis and distributed uniformly along the longitudinal axis.

[0018] The method also provides for the step of bending two end wings with respect to the base about further folding lines parallel to the longitudinal axis so that the

end wings extend on the opposite sides of the tabs with respect to the base.

[0019] Further characteristics and advantages of the present invention will become apparent from the following description of a non-limiting example of an embodiment with reference to the Figures of the accompanying drawings, wherein:

- Figure 1 is a longitudinal cross-section view, with parts removed for clarity, of a heat exchanger made in accordance with the present invention;
- Figure 2 is a cross-section view, in enlarged scale and with parts removed for clarity, of a detail of the heat exchanger of Figure 1;
- Figure 3 is a front view, with parts removed for clarity, of a spacing comb made in accordance with the present invention;
- Figure 4 is a side view, with parts removed for clarity, of the spacing comb of Figure 3;
- Figure 5 is a plan view, with parts removed for clarity, of the spacing comb of Figure 3;
- Figure 6 is a plan view, with parts removed for clarity, of a metal sheet and a metal sheet blank and configured to make the spacing comb of Figure 3; and
- Figure 7 is a perspective view, with parts removed for clarity and in enlarged scale, of the spacing comb of Figure 3.

[0020] With reference to Figure 1, 1 denotes in its entirety a heat exchanger, which in this case is a condensing heat exchanger for heating water in a water heater or a domestic boiler. The heat exchanger 1 comprises a casing 2 of cylindrical shape; and a tubular member 3, which is wound, partly, in a helix around an axis A to form the coils 4. In particular, the tubular member 3 is made from aluminium or an aluminium based alloy, extruded and then wound in a helix. The casing 2 comprises a side wall 5 of substantially cylindrical shape and preferably made from a metallic material such as aluminium, or a plastic material; an end wall 6 being substantially disc-shaped and an end wall 7 having a substantially annular shape. The end walls 6 and 7 are attached to the side wall 5 so as to form the casing 2 and a combustion fumes flow chamber. In this case, the end wall 7 has a central aperture 8 and is configured to support a cylindrically-shaped burner, not shown in the attached Figures, which is arranged, partly, within the combustion fumes flow chamber. Alternatively, the hot fumes are conveyed through the central aperture 8. The side wall 5 comprises an aperture 9 through which combustion fumes are extracted and an aperture, not shown, for extracting the condensate. As a whole, the helically wound tubular member 3 defines a cylindrical compartment inside the casing 2 into which hot gases are admitted and an annular compartment from which gases are evacuated. In use, the gas flows from the cylindrical compartment to a tubular compartment through the interstices between the coils and is then evacuated through the aperture 9. The heat exchanger 1 further comprises two spacing combs 10 each of which has a plurality of tabs 11 arranged between the coils 4 and which function as spacers to precisely define the interstices, as better illustrated in Figure 2.

[0021] With reference to Figure 2, the cross-section of the tubular member 3 is very flattened and has two walls 12 facing each other with a very large radius of curvature and two walls 13 facing each other with a much smaller radius of curvature than the radius of curvature of the walls 12 and which are much shorter than the walls 12. The tubular member 3 also has wings 14 along the walls 13. Accordingly, the cross-section as a whole has much larger dimensions in the radial direction with respect to the axis A (Figure 1) than in its axial dimensions with respect to the axis A (Figure 1). Furthermore, in accordance with the design parameters, the spacing of the coils 4 is very small. In the light of these design parameters of the heat exchanger 1, the length L of the tabs 11 is significantly greater than the pitch P of the tabs 11.

[0022] With reference to Figures 3, 4, 5, and 7 the spacing comb 10 extends along a longitudinal axis A1, and comprises a base 15 for supporting the plurality of tabs 11 and two wings 16. Each tab 11 forms a right angle with respect to the base 15 corresponding with a respective bending line 17 perpendicular to the longitudinal axis A1. In particular, each tab is V-shaped and is attached to the base 15 corresponding with two section of the folding line 17, while the apex of the V defines the free end.

[0023] Each end wing 16 forms an angle with the base 15 corresponding with a respective folding line 18 parallel to the longitudinal axis A1. The end wings 16 have the function of stiffening the spacing comb 10 and, at the same time, the function of slowing down the flow of the gases in the circumferential direction along the tubular compartment. In fact, the distance between the free end of the end wing 16 and the cylindrical part defines the section in which the gases travel in a circumferential direction. The free ends of the end wings 16 have an indented profile.

[0024] The spacing comb 10 is obtained by shearing and bending a metal sheet 19 as better shown in Figure 6. The method involves selecting a sheet 19 with a thickness equal to the size of the gaps. Subsequently, a blank 20 is sheared from the sheet metal 19, which comprises the base 15, the tabs 11 lying in the same plane as the base 15, and the wings 16 lying on the same plane of the base 15. In this case, the wings 16 are located side by side, partly along the longitudinal axis A1, and are joined to the base solely corresponding with the folding lines 17. Subsequently, the tabs 11 and the wings 16 are folded about the respective fold lines 17 and 18 on opposite sides with respect to the base 15.

[0025] Finally, it is apparent that the comb of the present invention may be subject to modifications and variations without departing from the scope of the appended claims.

Claims

1. A spacing comb for a heat exchanger, wherein the heat exchanger (1) comprises a tubular member (3), which is configured to convey water, and is wound in a helix about a given axis (A) in order to form a plurality of adjacent coils (4); the spacing comb (10) being configured so as to keep the adjacent coils (4) a given distance apart and being made from a metal sheet blank (20), which extends along a longitudinal axis (A1) and comprises a base (15); a plurality of tabs (11), which are placed partially side by side along the longitudinal axis (A1), and are configured for being bent at right angles with respect to the base (15) so as to define a plurality of spacers supported by the base (15), **characterized in that** the tabs (11) are V-shaped and - before being bent so as to define said plurality of spacers-partially inserted one in the other along the longitudinal axis (A1).

2. The spacing comb as claimed in claim 1, wherein the tabs (11) are bent about folding lines (17) perpendicular to the longitudinal axis (A1).

3. The spacing comb as claimed in any one of the foregoing claims, and comprising two end wings (16), which are bent with respect to the base (15) about further folding lines (18) parallel to the longitudinal axis (A1) and extend on the opposite side of the tabs (11) with respect to the base (15).

4. The spacing comb as claimed in claim 3, wherein each end wing (16) has a free, indented edge.

5. A heat exchanger for a domestic boiler or a water heater, the heat exchanger comprising a casing (2); and a tubular member (3), which is configured to convey water, and is wound in a helix about a given axis (A) in order to form a plurality of adjacent coils (4) housed in the casing (2); and at least two spacing combs (10), each of which has the features claimed in any one of the claims from 1 to 4, wherein each tab (11) is compressed between two adjacent coils (4) .

6. The heat exchanger as claimed in claim 5, wherein the tubular member (3) wound in a helix defines a cylindrical compartment inside the casing (2) into which hot gases are admitted and an annular compartment from which the gases are evacuated.

7. A method for making a spacing comb for a heat exchanger, the method comprising the steps of:

   - selecting a metal sheet (19) having a thickness equal to the dimensions of the interstices between the adjacent coils (4) of the heat exchanger (1);
   - shearing a blank (20) from the metal sheet (19) extending along a longitudinal axis (A1) and comprising a base (15); a plurality of tabs (11), which are placed partially side by side along the longitudinal axis (A1), the tabs (11) being V-shaped and partially inserted one in the other along the longitudinal axis (A1); and
   - bending the tabs (11) at right angles with respect to the base (15) so as to define a plurality of spacers supported by the base (15).

8. The method as claimed in claim 8, and comprising the step of bending the tabs (11) about folding lines (17) perpendicular to the longitudinal axis (A1) and distributed uniformly along the longitudinal axis (A1).

9. The method as claimed in claim 8 or 9, and comprising the step of bending two end wings (16) with respect to the base (15) about further folding lines (18) parallel to the longitudinal axis (A1) so that the end wings (16) extend on the opposite sides of the tabs (11) with respect to the base (15).

Patentansprüche

1. Ein Abstandskamm für einen Wärmetauscher, wobei der Wärmetauscher (1) ein rohförmiges Teil (3) aufweist, welches derart ausgebildet ist, dass dieses Wasser leitet, und in einer Helix um eine vorgegebene Achse (A) gewunden ist, um eine Mehrzahl von benachbarten Wicklungen (4) zu bilden; wobei der Abstandskamm (10) derart ausgebildet ist, dass die benachbarten Wicklungen (4) in einem vorgegebenen Abstand voneinander gehalten werden, und der Abstandskamm (10) aus einem metallischen, plattenförmigen Rohling (20) besteht, der sich entlang einer Längsachse (A1) erstreckt und ein Basisteil (15) aufweist; eine Mehrzahl von Streifen (11), welche Seite an Seite entlang der Längsachse (A1) teilweise angeordnet sind und zum Biegen in rechten Winkeln in Bezug auf das Basisteil (15) derart ausgebildet sind, dass sie ein Mehrzahl von Abstandshaltern bilden, die von dem Basisteil (15) gehalten werden, **dadurch gekennzeichnet, dass** die Streifen (11) V-förmig sind und - vor dem Biegen, so dass sie die Mehrzahl von Abstandshaltern bilden - einer in den anderen entlang der Längsachse (A1) teilweise eingesetzt sind.

2. Der Abstandskamm wie in Anspruch 1 beansprucht, wobei die Streifen (11) um eine Faltungslinie (17) rechtwinklig zu der Längsachse (A1) gebogen werden.

3. Der Abstandskamm wie in irgendeinem der vorausgehenden Ansprüche beansprucht, und aufweisend zwei Endflügel (16), die in Bezug auf das Basisteil

(15) um weitere Faltungslinien (18) parallel zu der Längsachse (A1) gebogen sind und sich auf der gegenüberliegenden Seite der Streifen (11) in Bezug auf das Basisteil (15) erstrecken.

4. Der Abstandskamm wie in Anspruch 3 beansprucht, wobei jeder Endflügel (16) eine freie, eingezogene Kante hat.

5. Ein Wärmetauscher für einen Haushaltsboiler oder Wassererhitzer, wobei der Wärmetauscher ein Gehäuse (2) aufweist; und ein rohförmiges Teil (3) aufweist, welches derart ausgebildet ist, dass dieses Wasser leitet, und in einer Helix um eine vorgegebene Achse (A) gewunden ist, um eine Mehrzahl von benachbarten Wicklungen (4) zu bilden, die in dem Gehäuse (2) untergebracht sind; und wenigstens zwei Abstandskämme (10) aufweist, von denen jeder die Merkmale hat, die in irgendeinem der Ansprüche 1 bis 4 beansprucht sind, wobei jeder Streifen (11) zwischen zwei benachbarten Windungen (4) zusammengedrückt wird.

6. Der Wärmetauscher wie in Anspruch 5 beansprucht, wobei das rohrförmige Teil (3), das in einer Helix gewunden ist, ein zylindrisches Kompartiment innerhalb des Gehäuses (2) bildet, in welches heiße Gase geleitet werden, und ein ringförmiges Kompartiment bildet, von dem die Gase evakuiert werden.

7. Ein Verfahren zur Herstellung eines Abstandskamms für einen Wärmetauscher, wobei das Verfahren die folgende Schritte umfasst:

- Auswählen einer metallischen Platte (19) mit einer Dicke, die den Abmessungen der Zwischenräume zwischen den benachbarten Windungen (4) des Wärmetauschers (1) entspricht;
- Abscheren eines Rohlings (20) von der metallischen Platte (19), der sich entlang einer Längsachse (A1) erstreckt und ein Basisteil (15) aufweist; einer Mehrzahl von Streifen (11), welche Seite an Seite entlang der Längsachse (A1) teilweise angeordnet sind; wobei die Streifen (11) V-förmig sind und einer in den anderen entlang der Längsachse (A1) teilweise eingesetzt sind; und
- Biegen der Streifen (11) in rechten Winkeln in Bezug auf das Basisteil (15), so dass sie ein Mehrzahl von Abstandshaltern bilden, die von dem Basisteil (15) gehalten werden.

8. Das Verfahren wie in Anspruch 8 beansprucht, und umfassend den Schritt des Biegens der Streifen (11) um Faltungslinien (17) rechtwinklig zu der Längsachse (A1) und gleichmäßig verteilt entlang der Längsachse (A1).

9. Das Verfahren wie in Anspruch 8 oder 9 beansprucht, und umfassend den Schritt des Biegens von zwei Endflügeln (16) in Bezug auf das Basisteil (15) um weitere Faltungslinien (18) parallel zu der Längsachse (A1), so dass die Endflügel (16) sich auf den gegenüberliegenden Seiten der Streifen (11) in Bezug auf das Basisteil (15) erstrecken.

Revendications

1. Peigne d'espacement pour un échangeur de chaleur, dans lequel l'échangeur de chaleur (1) comprend un élément tubulaire (3), qui est configuré pour acheminer de l'eau, et est enroulé en une hélice autour d'un axe (A) donné afin de former une pluralité de bobines (4) ; le peigne d'espacement (10) étant configuré de manière à maintenir les bobines (4) adjacentes espacées d'une distance donnée et étant fabriqué à partir d'une découpe de feuille métallique (20), qui s'étend le long d'un axe longitudinal (A1) et comprend une base (15) ; une pluralité de languettes (11), qui sont placées partiellement côte à côte le long de l'axe longitudinal (A1), et sont configurées pour être pliées à angles droits par rapport à la base (15) de manière à définir une pluralité d'écarteurs supportés par la base (15), **caractérisé en ce que** les languettes (11) sont en forme de V et - avant d'être pliés de manière à définir ladite pluralité d'écarteurs - partiellement insérées l'une dans l'autre le long de l'axe longitudinal (A1).

2. Peigne d'espacement selon la revendication 1, dans lequel les languettes (11) sont pliées autour de lignes de pliage (17) perpendiculaires à l'axe longitudinal (Al).

3. Peigne d'espacement selon l'une quelconque des revendications précédentes, et comprenant deux ailes d'extrémité (16), qui sont pliées par rapport à la base (15) autour d'autres lignes de pliage (18) parallèles à l'axe longitudinal (A1) et s'étendent sur le côté opposé des languettes (11) par rapport à la base (15).

4. Peigne d'espacement selon la revendication 3, dans lequel chaque aile d'extrémité (16) présente un bord libre dentelé.

5. Échangeur de chaleur pour une chaudière domestique ou un chauffe-eau, l'échangeur de chaleur comprenant un carter (2) ; et un élément tubulaire (3), qui est configuré pour acheminer de l'eau, et est enroulé en une hélice autour d'un axe (A) donné afin de former une pluralité de bobines (4) adjacentes logées dans le carter (2) ; et au moins deux peignes d'espacement (10), chacun d'eux présentant les caractéristiques selon l'une quelconque des revendi-

cations 1 à 4, dans lequel chaque languette (11) est comprimée entre deux bobines (4) adjacentes.

6. Échangeur de chaleur selon la revendication 5, dans lequel l'élément tubulaire (3) enroulé en une hélice définit un compartiment cylindrique à l'intérieur du carter (2) dans lequel des gaz chauds sont admis et un compartiment annulaire duquel les gaz sont évacués.

7. Procédé de fabrication d'un peigne d'espacement pour un échangeur de chaleur, le procédé comprenant les étapes de :

- sélection d'une feuille métallique (19) présentant une épaisseur égale aux dimensions des interstices entre les bobines (4) adjacentes de l'échangeur de chaleur (1) ;
- cisaillement d'une découpe (20) dans la feuille métallique (19) s'étendant le long d'un axe longitudinal (A1) et comprenant une base (15) ; une pluralité de languettes (11), qui sont placées partiellement côte à côte le long de l'axe longitudinal (A1), les languettes (11) étant en forme de V et partiellement insérées l'une dans l'autre le long de l'axe longitudinal (A1) ; et
- pliage des languettes (11) à angles droits par rapport à la base (15) de manière à définir une pluralité d'écarteurs supportés par la base (15).

8. Procédé selon la revendication 8, et comprenant l'étape de pliage des languettes (11) autour de lignes de pliage (17) perpendiculaires à l'axe longitudinal (A1) et réparties uniformément le long de l'axe longitudinal (A1) .

9. Procédé selon la revendication 8 ou 9, et comprenant l'étape de pliage de deux ailes d'extrémité (16) par rapport à la base (15) autour d'autres lignes de pliage (18) parallèles à l'axe longitudinal (A1) de telle sorte que les ailes d'extrémité (16) s'étendent sur les côtés opposés des languettes (11) par rapport à la base (15).

FIG. 1

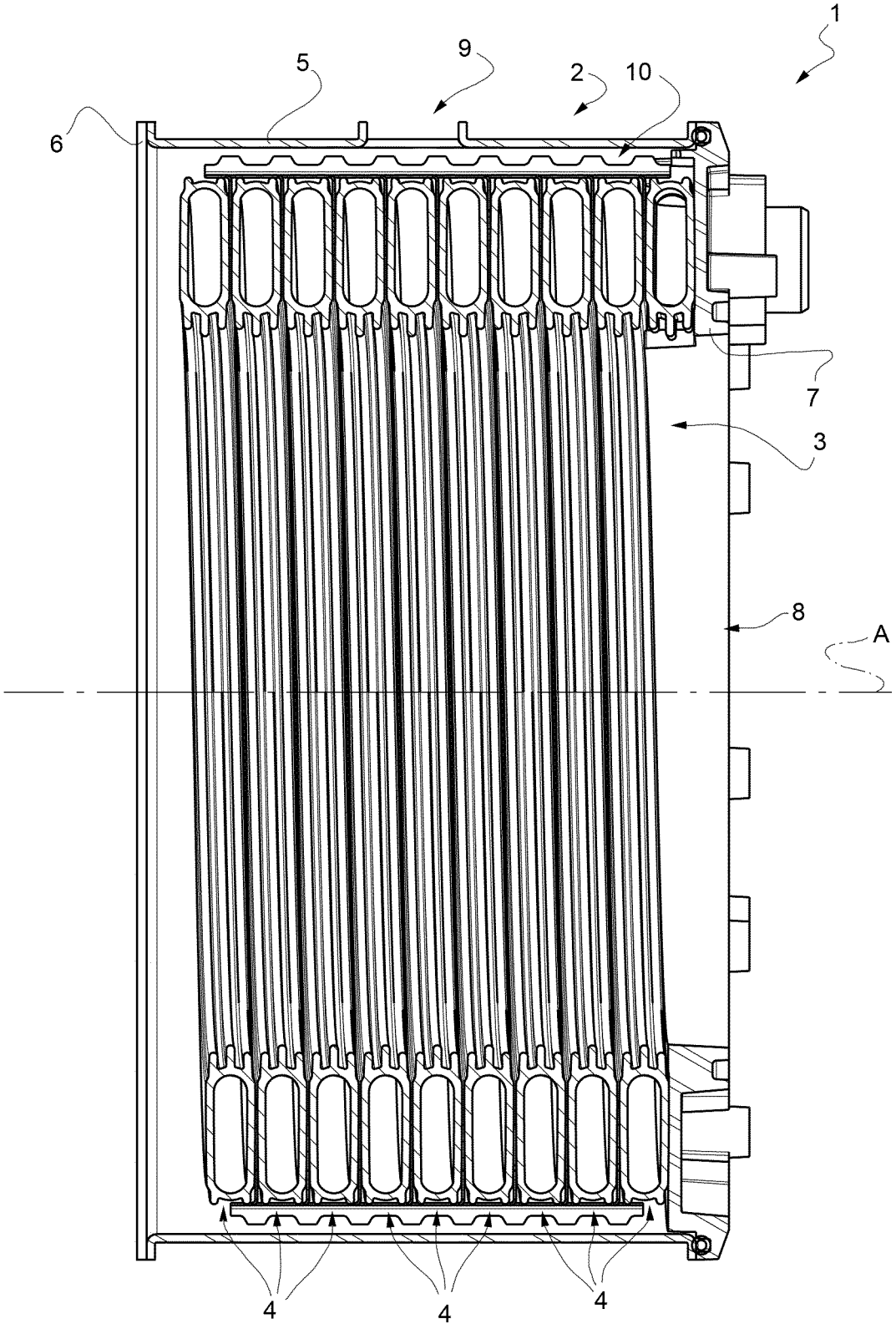


FIG. 2

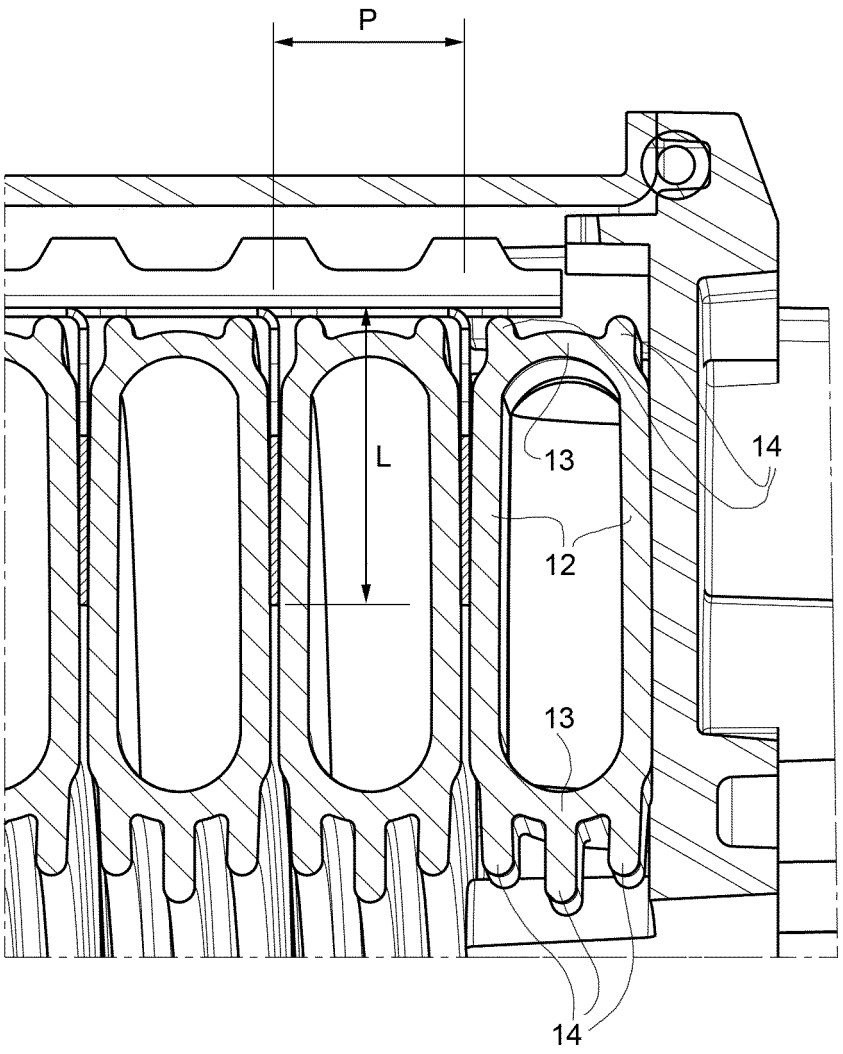


FIG. 3

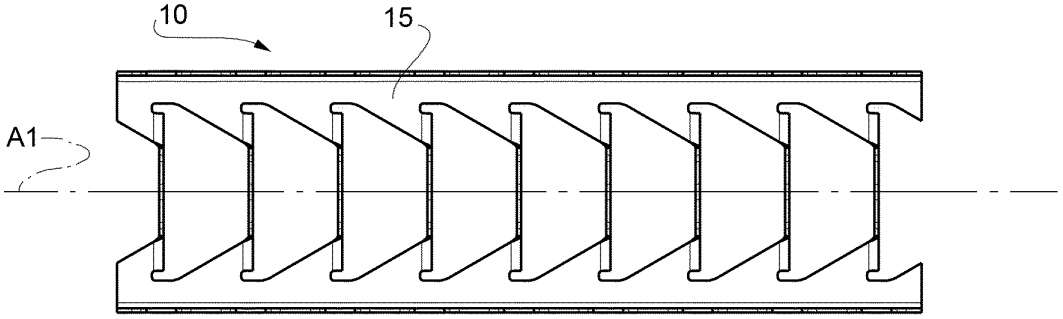


FIG. 4

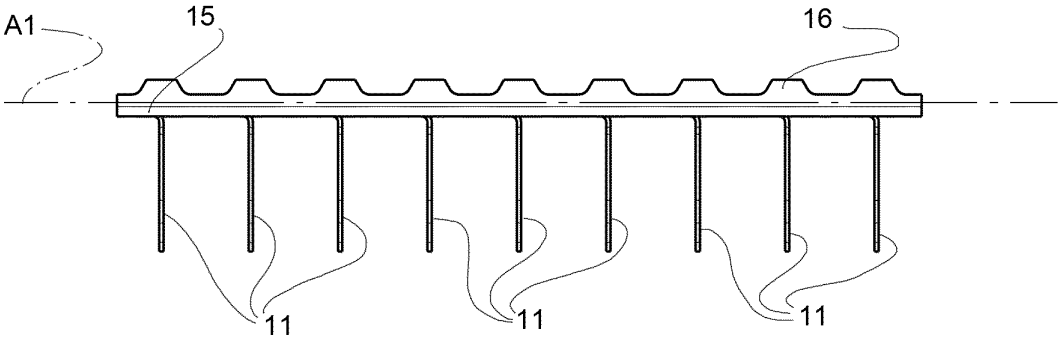


FIG. 5

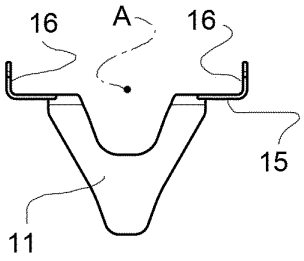


FIG. 6

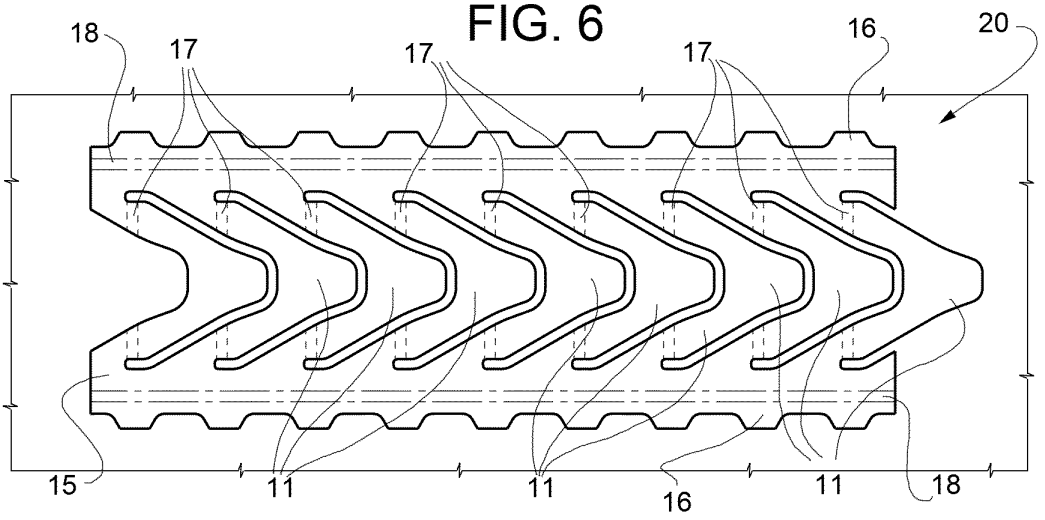
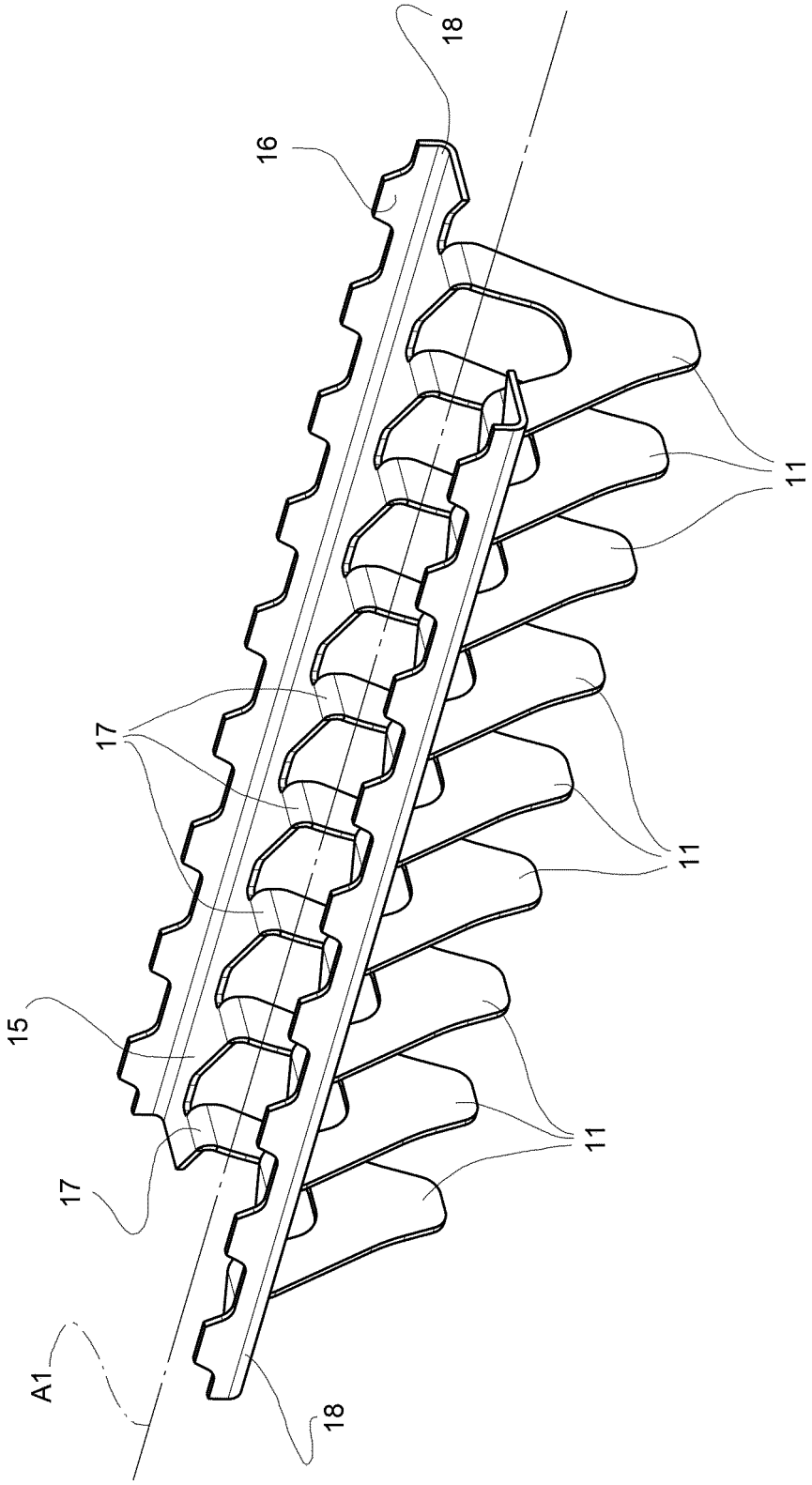


FIG. 7



REFERENCES CITED IN THE DESCRIPTION

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- JP 2006317036 B **[0003]**
- KR 101496361 **[0004]**