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(54) **HAIR DRYER**

(57) A heater frame plate (B) has a plurality of slots (I, II, III) for accommodating a heater wire. The plurality of slots comprises a first group (I) of slots at a first angle to a central axis (A) of said plate, and a second group (II, III) of slots at a second angle to the central axis (A), the second angle being different from the first angle, a depth of a slot of the second group (II, III) exceeding a depth of a slot of the first group (I). The second angle may be between 30 and 60 degrees, and preferably between 40

and 50 degrees. A shape of at least one of the slots in the second group (II) may meander. Part of the slots of the first group (I) may be positioned between respective pairs of slots of the second group (II). A heater module (M) comprises a plurality of such heater frame plates (B), and a heating wire (W) would around the heater frame plates (B). A hair dryer comprises such a heater module, and a fan for blowing air along the heater.

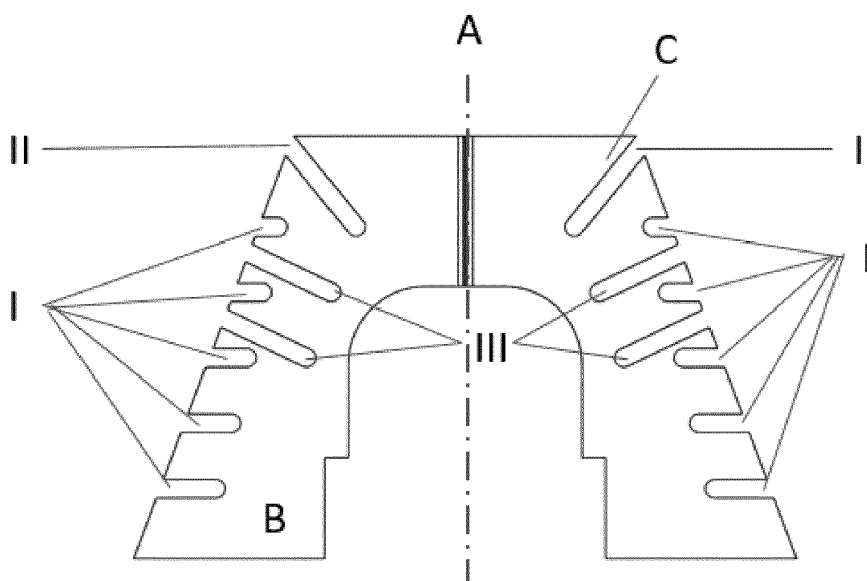


Fig. 6

Description

FIELD OF THE INVENTION

[0001] The invention relates to a heater frame plate, a heater module having a heater wire wound around a heater frame having such a heater frame plate, and a hair dryer having such a heater.

BACKGROUND OF THE INVENTION

[0002] US 4,667,086 discloses a heat element for such appliances as blow dryers, paint strippers, heat guns, and so forth, which consists essentially of a tightly crimped corrugated wire ribbon supported on a form in such a manner that its corrugations are generally perpendicular to the surface of the form. The resulting structure efficiently radiates heat to a mass of flowing gas. A particularly preferred embodiment results when the form is intersecting mica plates.

[0003] A hair dryer temperature performance is determined by the air flow rate through the heater and its heater power. Assuming the motor and fan system is fixed, it holds that the higher the heater wattage, the higher the air stream temperature of the dryer. However, the wattage is either limited by the size of the dryer design, or by the electrical socket regulation. When the size and wattage are limited, there are very few options to increase the air stream temperature by modifying the heater. One can change the winding type of the heater, such as wave heater vs. coil heater, or change the shape of the heating element from a round wire shape to a flat ribbon shape. Another air stream temperature improvement option would be to fine tune the position of the heater wires in the radial direction trying to catch the highest amount of air flow to achieve the highest heat transfer efficiency. Due to safety requirement, the heating wire cannot be too close together to avoid electrical creepage.

SUMMARY OF THE INVENTION

[0004] It is, inter alia, an object of the invention to provide an improved heater frame plate, heater module and hair dryer. The invention is defined by the independent claims. Advantageous embodiments are defined in the dependent claims.

[0005] In accordance with embodiments of the invention, one or more slanted slots are added to each section of a conventional heater wire supporting frame allowing the heater wire to be settled at multiple depths relative to the center axis of the heater. It is an effective way to increase the overall heater wire length and increase heater coverage area at the same time, resulting in higher heat transfer rate between the heater wire and the flowing air and making the air stream temperature higher, without increasing the heater total wattage or the overall length of the heater module.

[0006] While it is known to have horizontal slots of var-

ying depth, addition of relatively deeper horizontal slots requires additional length of the heating wire supporting frame. In contrast, if slanted slots are used in accordance with the invention, the length of the heating wire supporting frame does not need to be extended in the same way as when horizontal slots are added, while it is still possible to have more heating wire windings around the heating wire supporting frame.

[0007] The invention described herein creates new space for the heater wire to be positioned in, which is different from relocating the existing path of the wire. It allows the heater wire to extend to these new spaces while keeping the rest of the optimized path the same, without needing to increase the length of the heater assembly. At the same time, the area of heating wire that can come in contact with the air flow is increased, thereby increasing the air stream temperature.

[0008] If the objective is to reduce the overall length of the heater assembly and not increasing the air stream temperature, the invention described herein can also achieve that by winding the existing wire length to the new spaces located towards the center of the heater instead of needing to be wound in the heater length direction. While keeping the same wire length, the overall heater assembly can be shortened.

[0009] In view of the above considerations, a first aspect of the invention provides a heater frame plate having a plurality of slots for accommodating a heater wire, wherein the plurality of slots comprises a first group of slots at a first angle to a central axis of said plate, and a second group of slots at a second angle to the central axis, the second angle being different from the first angle, a depth of a slot of the second group exceeding a depth of a slot of the first group.

[0010] Each group may include one or more slots. There may be more than two groups of slots. Typically, the first angle will be about 90°. The second group includes the slanted slots. In each group, the respective angles of the slots need not be exactly the same, e.g. as a result of manufacturing tolerances. The slots are not necessarily straight, and may have one or more curves. If the slots have one or more curves, the angle should be measured by drawing a line between an outer point in the slot at the outer boundary of the heater frame plate and an inner point at the bottom of the slot.

[0011] These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 shows an individual mica bracket according to an embodiment of the invention;
Fig. 2 shows an embodiment of an assembled heater wire support bracket;
Fig. 3 shows an embodiment of an assembled heater

module;

Fig. 4 shows a top view of assembled heater module of Fig. 3;

Fig. 5 shows a side view of assembled heater module of Fig. 3;

Fig. 6 shows an individual mica bracket according to an embodiment of the invention;

Fig. 7 shows a cross-sectioned view of heater assembly showing new spaces created for heater wire;

Fig. 8 shows a side view of heater assembly showing a continuous heater wire wound from inner area to outer area; and

Fig. 9 shows an individual mica bracket according to an embodiment of the invention.

DESCRIPTION OF EMBODIMENTS

[0013] A conventional heater has horizontal slots for the heater wire to settle in during winding. As shown in e.g. Figs. 1 and 2, some embodiments of the invention described herein have a single slanted slot of a second group II added to each section of a conventional heater mica bracket B. Fig. 2 shows an assembled heater wire support bracket, having 3 brackets B1, B2, and B3. The slanted slot feature II allows an added section of the heater wire W to be settled deeper radially, i.e. at the bottom of the slanted slot, relative to the center axis A, and does not interfere with the existing outer heater wire in the slots of a first group I of slots. While the second angle may be between 30 and 60 degrees, e.g. between 40 and 50 degrees, if only one set of slanted slots is used, such as in this embodiment, the slanted slots can actually start from the upper edge of the mica sheet and go at a steeper angle than 30° degree.

[0014] These embodiments allow the heater wire W to be wound like a conventional wire heater throughout the heater assembly, but allow the wire to extend towards the center axis A only at the front end of the heater assembly, without needing to add extra length to the mica bracket to create additional room for the extended section of the wire. Figs. 3, 4, and 5 show different views of the assembled heater module M.

[0015] A more complex version of the invention can be made by adding multiple slanted slots of second and third groups II, III of slots on each section of the heater wire supporting mica bracket B as shown in Fig. 6. The slots create new space at the bottoms of the slanted slots of the second and third groups II, III of slots for the heater wire W to be settled in as shown in Fig. 7, which shows a heater module comprising 3 brackets B1, B2, and B3 each having multiple slanted slots II, III according to an embodiment. A coil type heater is used for the illustration of the concept in the figures, but the invention is not limited to only a coil type wire heater.

[0016] Fig. 8 shows how the slanted slots II, III allow the heater wire W to be wound continuously from the inner layer to the outer layer without any interference. More slanted slots can be added to the heater wire sup-

port bracket when a higher air stream temperature or shorter bracket length is desired.

[0017] Fig. 9 shows an individual mica bracket according to an embodiment of the invention. Compared to the embodiments of Figs. 1, 3, 5, 6, in the embodiments of Figs. 2, 7, 8, 9, the sharp corner C on the edge of the mica sheet is rounded, so that during assembling of the heater module M into an inner housing of a hair dryer, the mica sheet corner does not easily get damaged, and it makes a little more clearance to fit into position. In the embodiment of Fig. 9, the slanted slot II has a meandering shape to prevent the wire W from jumping out during impact. The depths of the horizontal slots of the first group of slots I are reduced to reduce the stress on the mica sheets during impact, which is illustrated by interrupted lines. The spacing of the horizontal slots of the first group of slots I is set at 7.5 mm to give more meat around the slanted slot II to improve reliability during impact. Fig. 9 also illustrates how to determine the angle of a non-straight slot, viz. by drawing a line AL thru an inner point at the bottom of the slot and an outer point in the slot at an outer boundary of the plate.

[0018] A heater wire mounting bracket usually uses mica sheet for its construction. Horizontal and slanted slots can be added to the edge of the mica sheet alternately to create settling room at different depths for the heating wire to be settled in throughout the length of the heater assembly. The heater wire can be wound continuously on these slots, starting from the slot that has the deepest depth, around the heater and down the heater length. This winding method would avoid heater wires from interfering from each other. Spacing and angles of the slots can be designed to provide enough clearance between heating wires to avoid electrical creepage.

[0019] This invention can be applied to any hair dryer that uses heating wires for its heater design. Such a hair dryer comprises a heater module M as shown in e.g. Figs. 3, 4, 5, 7 or 8, and a fan for blowing air along the heater module M.

[0020] It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. The word "comprising" does not exclude the presence of elements or steps other than those listed in a claim. The word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The invention may be implemented by means of hardware comprising several distinct elements. In the device claim enumerating several means, several of these means may be embodied by one and the same item of hardware. Measures recited in mutually different dependent claims may advantageously be used in combination.

Claims

1. A heater frame plate (B) having a plurality of slots (I, II, III) for accommodating a heater wire, wherein the plurality of slots comprises a first group (I) of slots at a first angle to a central axis (A) of said plate, and a second group (II, III) of slots at a second angle to the central axis (A), the second angle being different from the first angle, a depth of a slot of the second group (II, III) exceeding a depth of a slot of the first group (I). 5 10
2. A heater frame plate as claimed in claim 1, wherein the second angle is between 30 and 60 degrees, and preferably between 40 and 50 degrees. 15
3. A heater frame plate as claimed in claim 1 or 2, wherein a shape of at least one of the slots in the second group (II) meanders. 20
4. A heater frame plate as claimed in any of the preceding claims, wherein part of the slots of the first group (I) are positioned between respective pairs of slots of the second group (II). 25
5. A heater module (M) comprising a plurality of heater frame plates (B1, B2, B3) as claimed in any of the preceding claims, and a heating wire (W) wound around the heater frame plates (B1, B2, B3). 30
6. A hair dryer comprising a heater module as claimed in claim 5, and a fan for blowing air along the heater. 35

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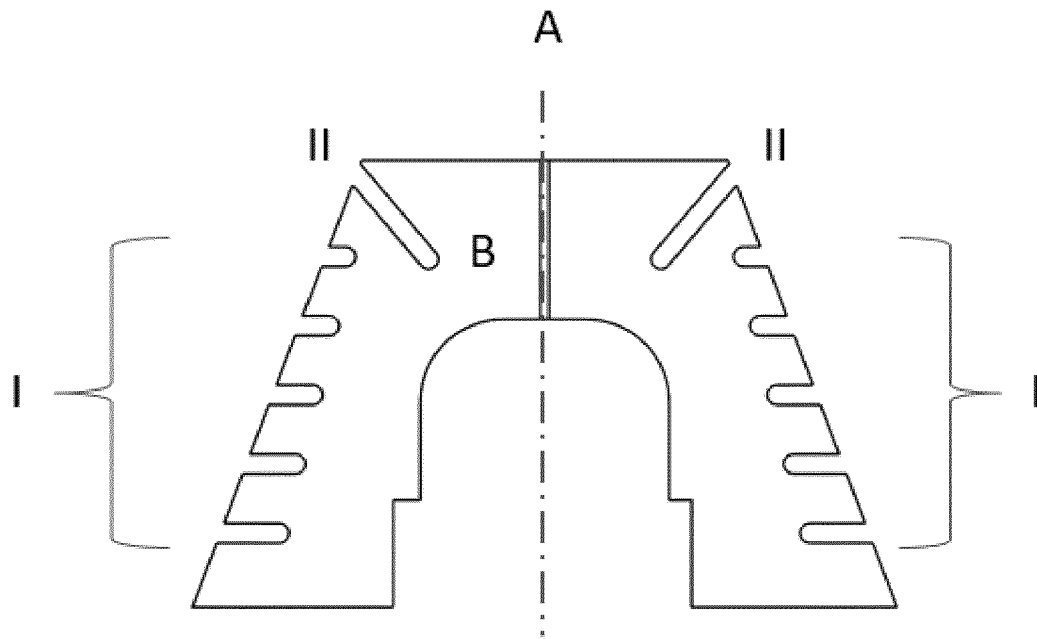


Fig. 1

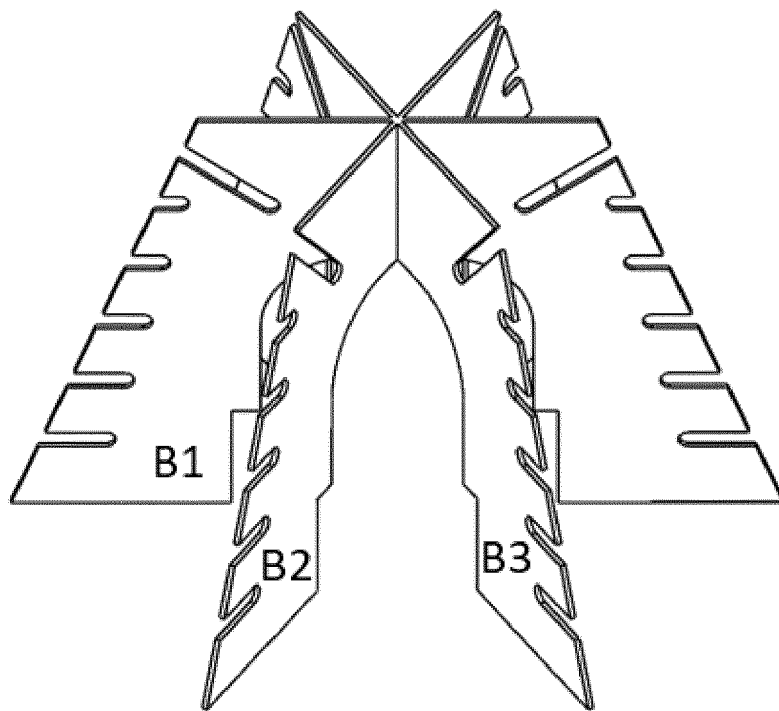


Fig. 2

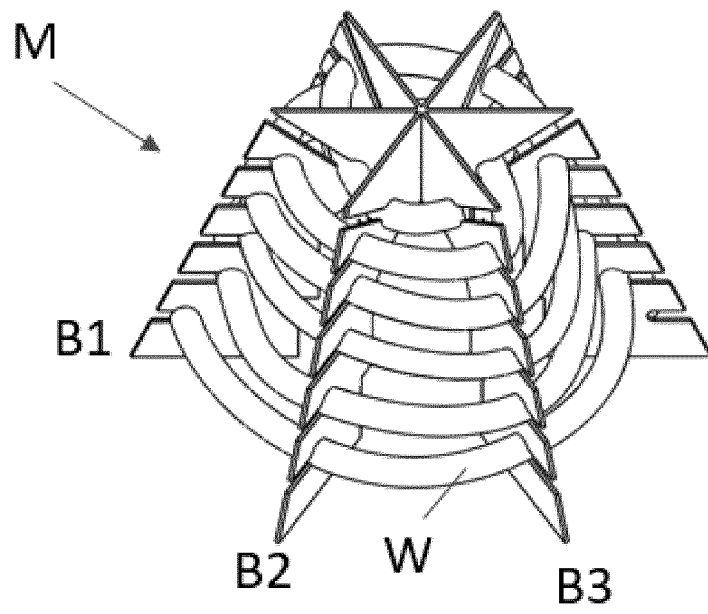


Fig. 3

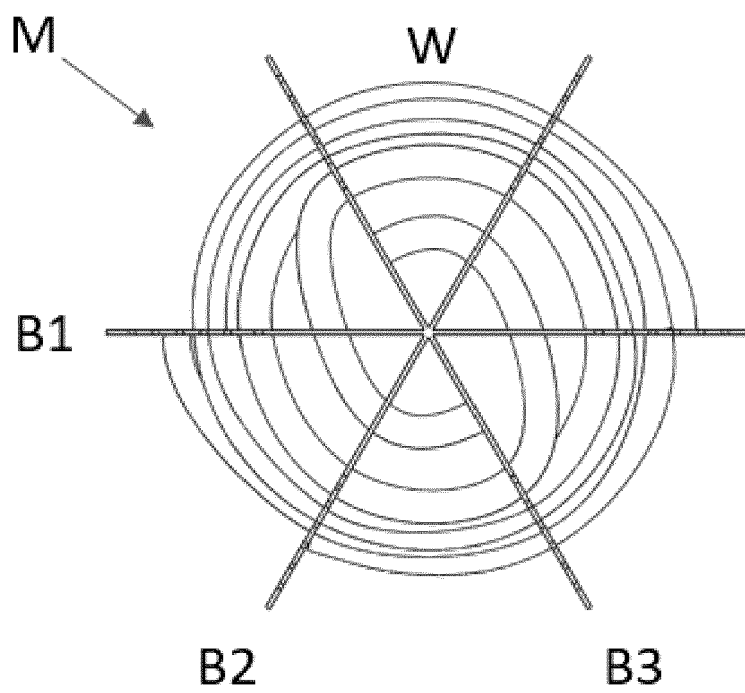


Fig. 4

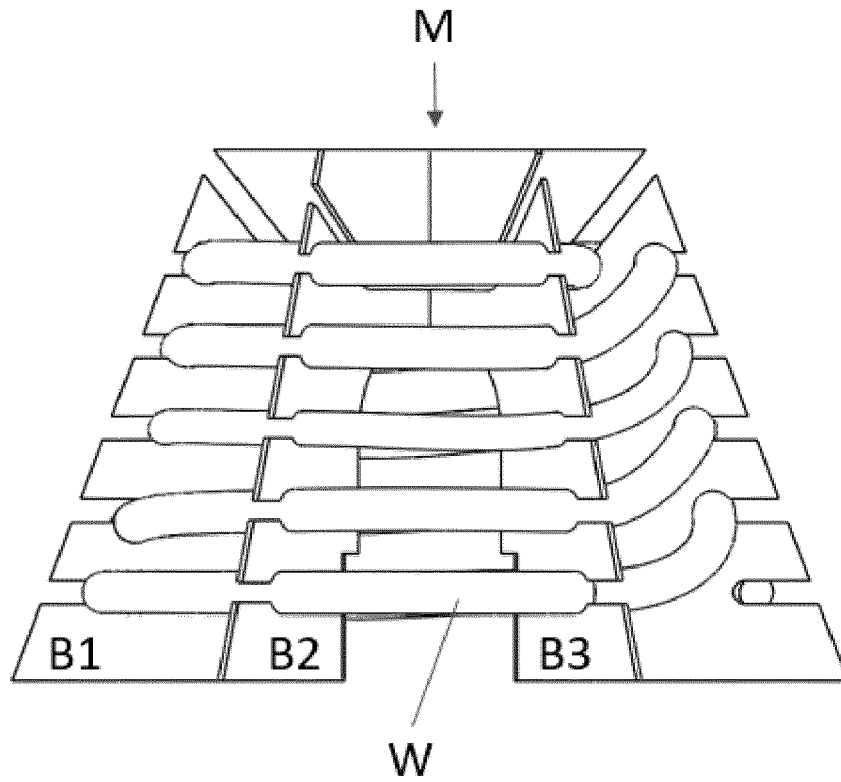


Fig. 5

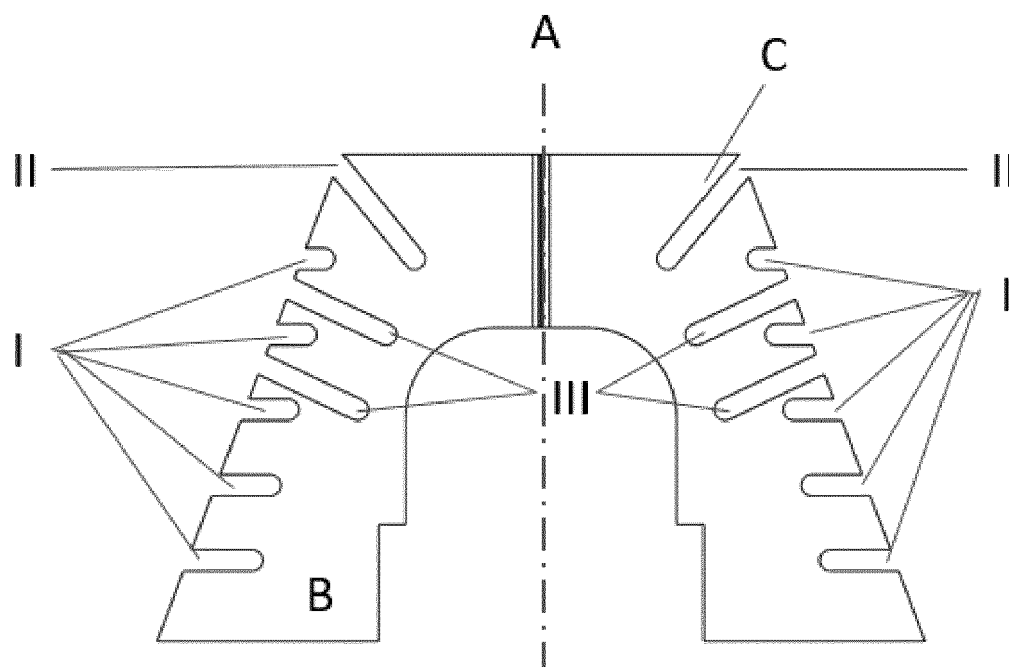


Fig. 6

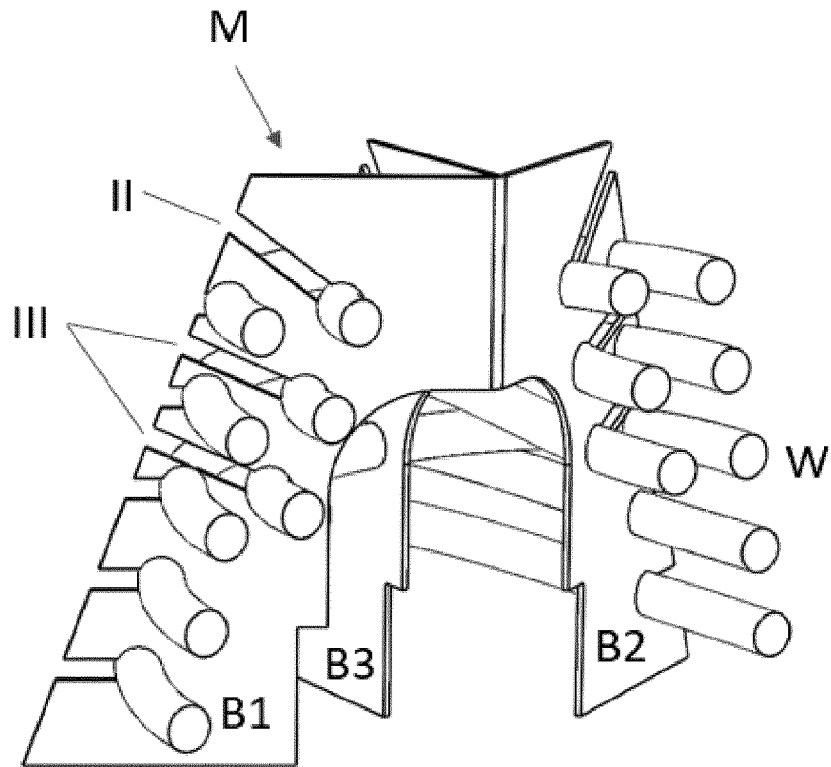


Fig. 7

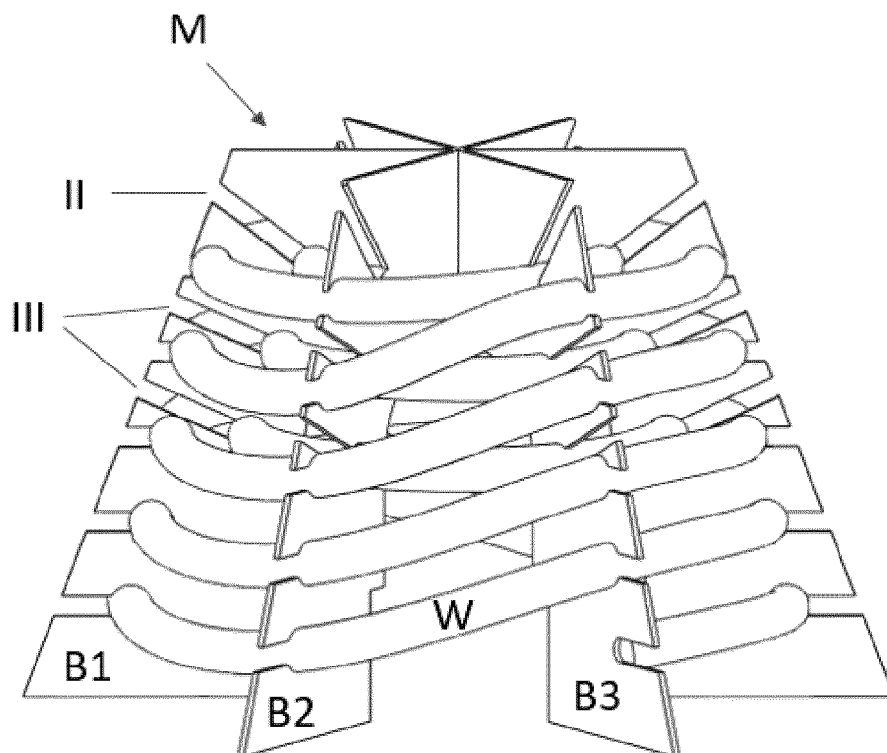


Fig. 8

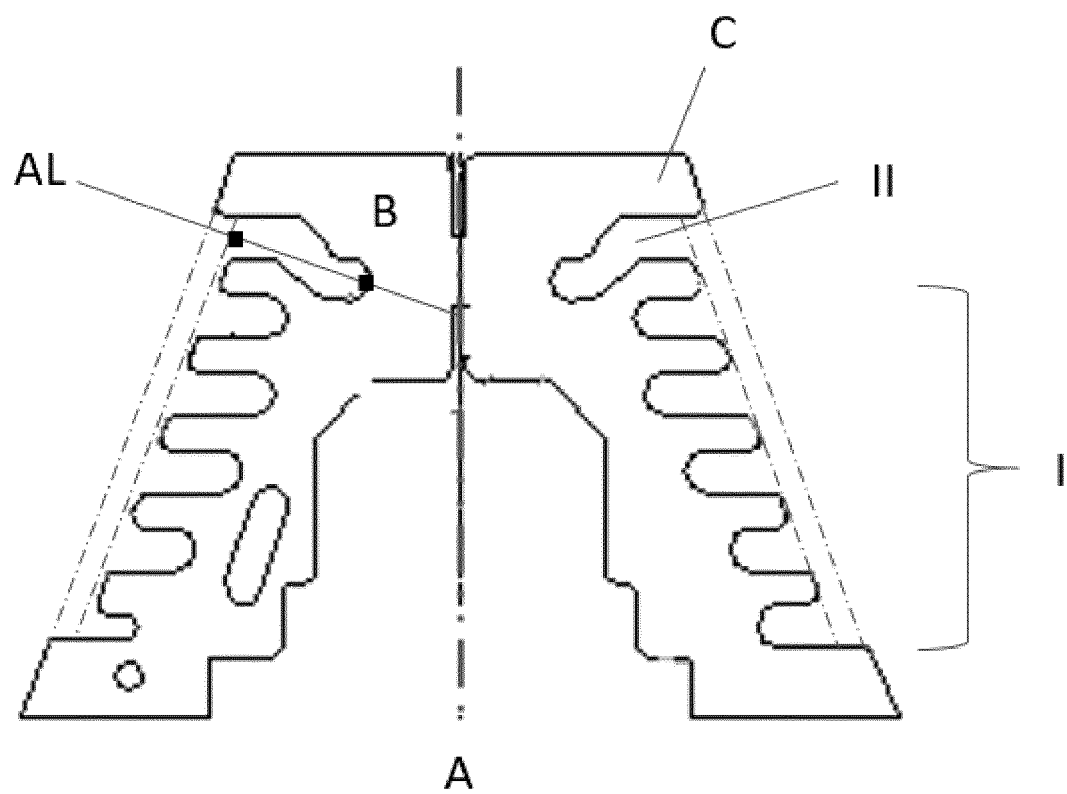


Fig. 9



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 19 0140

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 27 08 117 A1 (WILHELM KRUK NACHF) 31 August 1978 (1978-08-31) * page 8, line 16 - line 31; figures 1,4-6 * * page 4, line 25 - line 27 *	1-6	INV. H05B3/16
X	US 4 628 189 A (DANKO MICHAEL [US]) 9 December 1986 (1986-12-09) * column 1, line 5 - line 15 * * column 5, line 28 - column 8, line 68; figures 2-10 *	1,3,4	
			TECHNICAL FIELDS SEARCHED (IPC)
			H05B A45D F24H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 19 January 2021	Examiner Barzic, Florent
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 19 0140

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The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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