



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**25.01.2017 Bulletin 2017/04**

(51) Int Cl.:  
**A46B 3/14 (2006.01) A46B 3/16 (2006.01)**

(21) Application number: **16178880.7**

(22) Date of filing: **11.07.2016**

(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**  
Designated Extension States:  
**BA ME**  
Designated Validation States:  
**MA MD**

(71) Applicant: **Torneria Bergamini SNC di Bergamini  
E. & C.**  
**25013 Carpenedolo (IT)**

(72) Inventor: **BERGAMINI, Sara**  
**25013 Carpenedolo (IT)**

(74) Representative: **Tirloni, Bartolomeo**  
**BTA Srl**  
**2nd floor**  
**Viale Papa Giovanni XXIII, 106**  
**24121 Bergamo (IT)**

(30) Priority: **21.07.2015 IT UB20152373**

(54) **BROOM FOR SELF-POWERED VEHICLE**

(57) A broom (1) for surfaces comprising:  
- a frame (2) provided with a mounting portion (6) for mounting the broom to a self-powered vehicle:  
- at least one attaching bar (9) rigidly attached to the frame on the side opposite to said mounting portion and provided with a plurality of pairs of through holes (13), and  
- a plurality of bundles (14) of elongated elements (15), each elongated element having a substantially U-shaped major development line (16) and comprising, along said major development line (16), a first (17) and a second bending (18) and being composed of a first stretch (30) between a first (17) and a longitudinal end (31) of the elongated element, a second stretch (32) between said second bending (18) and a second longitudinal end (33) of the elongated element, and an intermediate stretch (34) between said first and second bendings, where each bundle (14) is inserted in a respective pair of holes (13) in such a way that said intermediate stretch (34) is interposed between said attaching bar (9) and the frame (2), and the said first stretch (30) and the second stretch (32) pass through respective hole (13) of said pair of holes, and protrude from the said attaching bar on the side opposite to said intermediate stretch, the first (30) and second stretches (32) of the elongated elements forming a plurality of bristles (8) of the broom.

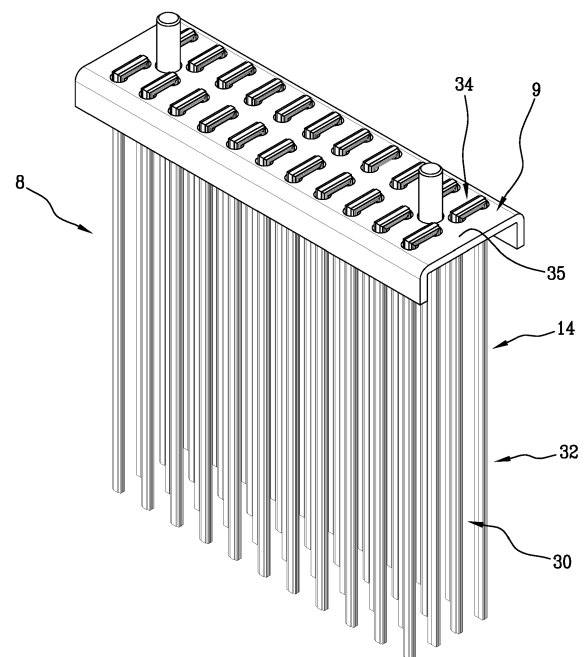


Fig.3

## Description

**[0001]** The present invention relates to a broom suitable to be mounted to a self-powered vehicle in order to brush or treat large surfaces. More precisely, the invention concerns a "static" broom, that is a broom where the bristles are not, during use, moved by proper motion (as it occurs for instance to the so-called 'rotating' brooms) additional to the motion deriving from the translation of the vehicle on the surface. Static brooms are cheaper and easier for maintenance and they have the advantage of kicking up less dust.

**[0002]** Typically, static brooms include a frame provided with a mounting portion for mounting the broom to the self-powered vehicle, in particular to the two prongs of a vehicle for handling loads, generally called "fork lift". To the frame is rigidly fixed a plurality of tufts of bristles that protrude in an orthogonal way from the frame.

**[0003]** During use, the bristles lay with their free ends opposite to the frame, on the surface to be brushed, typically supporting thus the whole weight of the broom.

**[0004]** Following the movement of the self-powered vehicle, the bristles brush with their free end on the surface, brushing away existing dirt.

**[0005]** Patent EP 2269484 B1 describes an example of static broom.

**[0006]** Applicant understood that usual brooms are not lacking of inconveniences and/or can be improved in many ways.

**[0007]** Applicant understood that in usual brooms tufts of bristles are fixed to the frame in such a way that bristles belonging to the same tuft protrude from the frame substantially with the same orientation. In other words, the free ends of the bristles of each single tuft are aligned each other and/or grouped in a limited portion of three-dimensional space.

**[0008]** Since tufts are identical (and typically aligned with each other), it follows that all bristles are spatially oriented substantially at the same way (and that free ends of all bristles are aligned in a few rows).

**[0009]** According to the applicant, this fact produces some drawbacks.

**[0010]** For instance, alignment of bristles into space is so made that all bristles tend to be bent at the same way, and even considerably, when exposed to the weight of the broom and/or to the rubbing on surface, so that they provide less support to the weight of the broom, and/or less stability to the broom, and/or limited effectiveness of brushing (for instance because dirt can easily escape from the strongly bent bristles).

**[0011]** The Applicant has faced the problem of developing a broom for large surfaces, able to overcome the drawbacks of current state of the art and able to have, for instance, high capacity and/or effectiveness of brushing and/or high capacity of bearing broom weight, and able at the same time to have a simpler and/or more economical structure and production.

**[0012]** Applicant believes that one or more of above

said problems (and any other better specified hereinafter), can be solved by a broom for surfaces and a related production method following the present invention according to one or more of the following claims and/or one or more of the following aspects and/or one or more of the preferred embodiments.

**[0013]** In a first aspect, the present invention relates to a broom for surfaces comprising a frame provided with a mounting portion for mounting the broom to a self-powered vehicle and a plurality of bristles (rigidly) attached to the frame so as to protrude from the frame on the side opposite to said mounting portion.

**[0014]** Preferably, the broom comprises at least one attaching bar rigidly attached to the frame on the side opposite to said mounting portion and provided with a plurality of pairs of through holes.

**[0015]** Preferably, the broom comprises a plurality of bundles of elongated elements, each elongated element having a substantially U-shaped major development line and comprising, along said major development line, a first and a second bending and being composed of a first stretch between said first bending and a first longitudinal end of the elongated element, a second stretch between said second bending and a second longitudinal end of the elongated element, and an intermediate stretch between said first and second bendings.

**[0016]** By the term "longitudinal" and similar, reference is made to local direction of the major development line of the elongated element. Due to bending, this local direction can vary into space depending on the considered stretch of the elongated element.

**[0017]** Preferably, each bundle of elongated elements is inserted in a respective pair of holes in such a way that, for each elongated element, said intermediate stretch is interposed between said attaching bar and said frame, and said first and second stretch pass through a respective hole of said pair of holes, and protrude from said attaching bar on the side opposite to said intermediate stretch, and so that said bristles are formed by said first and second stretches of the elongated elements.

**[0018]** Applicant believes that such characteristics, namely the fact that the bristles are formed by stretches of U-shaped elongated elements and put in bundles inserted in a respective pair of holes of the attaching bar, provide the broom with a high capacity and/or effectiveness of brushing and a high capacity of bearing broom weight. Indeed, bristles are organised in tufts corresponding to bundles of the first and second stretches of elongated elements, and the bristles of the same tuft are kept mutually close at the crossing section of the corresponding hole and from here, going toward the free ends, tend to spatially spread in a substantially random way within a cone having its vertex in the hole. That's because each elongated element has a specific conformation along the major development line, that is different from the other elements of the same bundle (for instance because of a difference between the angles of the first and second bendings, and/or because of dimensional varia-

tions within the range of tolerance, and/or because of plastic and/or elastic small deformations. At the hole, elongated elements are forced to stick together, therefore offloading onto the free stretches (the first and the second stretches) their conformation differences, that can result enhanced comparing to the condition of free bundle (without hole). In this way, the free ends of the bristles of the same tuft are distributed on a large surface (which is curved, to be precise), providing therefore the broom with a support evenly distributed on surface, with a consequent improvement of the stability and/or effectiveness of brushing.

**[0019]** Furthermore, thanks to said random spreading, bristles of a same tuft assume a substantially random spatial orientation, even if within the said cone. This is so made that, under the weight of the broom and/or during scrubbing surfaces, not every bristles lean in the same way following the movement direction (as it is in the state of art described above), because a sub-set of the bristles leans less or keeps a substantially perpendicular orientation, or is leant the other way. This subset of bristles, according to the Applicant, increases effectiveness of brushing because the final portions of the bristles work better on the surface.

**[0020]** According to the Applicant, said characteristics also ensure that the broom has a simple and/or economical structure (for instance with a small number of components).

**[0021]** Furthermore, the broom can also be produced in a simple and economical way (for instance without the need for welding, because the bundles of elongated elements are kept clamped between the frame and the attaching bar). For instance, in order to clamp the bristles's tufts to the frame, it's enough to insert each U-shaped bundle in each respective pair of holes and fix the attaching bar to the frame.

**[0022]** Preferably, the elongated elements are made of metal, such as iron or steel (more preferably spring steel), aluminium or alloys thereof, or a plastic material, such as polypropylene. In such advantageous way, it is possible to bend the elongated elements thanks to plastic deformation's properties of the material (even if the present invention considers also the case of U-shaped elongated elements made by moulding or pressing). Plastic material is particularly suitable for uses in zootechnical environments, because it does not harm animals if swallowed.

**[0023]** Preferably, the frame and/or the attaching bar is/are made of metal such as iron, steel, aluminium or alloys thereof.

**[0024]** Preferably, each elongated element has an overall longitudinal length greater than or equal to 200 mm, more preferably greater than or equal to 300 mm, and/or less than or equal to 800 mm, more preferably less than or equal to 700 mm.

**[0025]** Preferably, said intermediate stretch is in a position substantially equidistant from said first and second longitudinal end (free). This ensures an equal length of

the first and second stretches.

**[0026]** Preferably, said intermediate stretch has a longitudinal length greater than or equal to 5 mm, more preferably greater than or equal to 10 mm, and/or less than or equal to 100 mm, more preferably less than or equal to 50 mm.

**[0027]** Preferably, each elongated element has a constant cross-section along said major development line. In this way, producing broom is simpler.

**[0028]** Preferably, each elongated element has a cross-section circular or elliptical or lenticular or square or, more preferably, rectangular in shape. In this way, elongated elements are particularly suitable to be kept together in a bundle.

**[0029]** Preferably, each elongated element has a cross-section having a first dimension greater than or equal to 1 mm, more preferably greater than or equal to 2 mm, and/or less than or equal to 10 mm, more preferably less than or equal to 5 mm.

**[0030]** Preferably, each elongated element has a cross-section having a second dimension, orthogonal to the first one, greater than or equal to 0.2 mm, more preferably greater than or equal to 0.3 mm, and/or less than or equal to 5 mm, more preferably less than or equal to 3 mm.

**[0031]** Preferably, each hole of said pair of holes has a cross-section having a dimension (typically a diameter), greater than or equal to 2 mm, more preferably greater than or equal to 3 mm, and/or less than or equal to 20 mm, more preferably less than or equal to 15 mm.

**[0032]** Preferably, each bundle of elongated elements has a maximum dimension (typically a diagonal) in a cross-section, wherein a difference between a dimension (typically a diameter) of said respective hole and said maximum dimension of the cross-section of the bundle of elongated elements is (positive and) less than or equal to 5 mm, more preferably less than or equal to 4 mm. In such advantageous way, the bundle is tightly clamped at the hole, because of its little space, although the insertion of the bundle into the hole remains adequately easy.

**[0033]** Preferably, said major development line forms an acute angle at each of said first and second bending greater than or equal to 60°, more preferably greater than or equal to 70°, and/or less than or equal to 120°, more preferably less than or equal to 110°. Preferably, each bundle of elongated elements contains a number of elongated elements greater than or equal to 4, more preferably greater than or equal to 6, and/or less than or equal to 30, more preferably less than or equal to 20.

**[0034]** Preferably, all the elongated elements are substantially identical to each other.

**[0035]** Preferably, a bundle of said intermediate stretches is in contact to said attaching bar and/or to said frame, more preferably it is pressure-clamped between said frame and said attaching bar. In this way, on one end the bundles of elongated elements are strongly fixed to the frame, and on the other end the pressure-clamping

of intermediate stretch towards the attaching bar contributes to further widen the free stretches of the elongated elements.

**[0036]** Preferably, an interaxis distance between the two holes of said respective pair of holes is comparable with a longitudinal length of said intermediate stretch.

**[0037]** Preferably, said pairs of holes are aligned with each other.

**[0038]** Preferably, adjacent pairs of holes are positioned in such a way that the free longitudinal ends of the first and second stretches of adjacent bundles interpenetrate each other.

**[0039]** Preferably, said attaching bar is plate-shaped.

**[0040]** Preferably, said attaching bar has a U-shaped profile in a cross-section, wherein a convexity of said U-shape faces said frame.

**[0041]** Preferably, said attaching bar is attached to said frame by means of screws or bolts that engage further through holes in the attaching bar.

**[0042]** Preferably, the broom comprises a plurality of attaching bars, each of them having the fore-mentioned characteristics.

**[0043]** Preferably, said frame comprises a plate-shaped body, typically rectangular in plan, shaped in such a way to have a compartment open at the bottom, in which said attaching bar(s) is/are housed.

**[0044]** In a second aspect, the present invention concerns a method for manufacturing a broom for surfaces comprising a frame provided with a mounting portion for mounting the broom to a self-powered vehicle and a plurality of bristles (rigidly) attached to the frame so as to protrude from the frame on the side opposite to said mounting portion, the method comprising:

- forming a plurality of bundles of elongated elements having a substantially U-shaped major development line and comprising, along said major development line, a first and a second bending, each elongated element being composed of a first stretch between said first bending and a first longitudinal end of the elongated element, a second stretch between said second bending and a second longitudinal end of the elongated element, and an intermediate stretch between said two bendings;
- inserting each bundle of elongated elements into a respective pair of holes of an attaching bar in such a way that, for each elongated element, the said intermediate stretch is located in proximity to a surface of the said attaching bar, and said first and second stretches pass through a respective hole of said pair of holes, and protrude from said attaching bar on the side opposite to said intermediate stretch, and
- rigidly attaching said attaching bar to the frame on the side opposite to said mounting portion, so that said intermediate stretch is located between said attaching bar and said frame, and in such a way that said bristles are made from said first and second stretches of the elongated elements.

**[0045]** Preferably, forming a plurality of bundles of elongated elements comprises, for each bundle, combining in a bundle a plurality of elongated elements having development line substantially rectilinear and mutually parallel, and bending the whole bundle, more preferably by mean of a press, so as to form said first and second bending.

**[0046]** The characteristics of the present invention, and its goals, will be further clarified in the following detailed description of some exemplary embodiments, made by way of example and non-limiting of the more general claimed concepts.

**[0047]** The following detailed description refers to the attached figures, wherein:

- FIG 1 is a schematic perspective of a broom according to the present invention;
- FIG 2 is an exploded schematic perspective of FIG 1 without some elements;
- FIG 3 is a schematic perspective of a magnified element of the broom shown in FIG 1;
- FIG 4 is an exploded schematic perspective of the element shown in FIG 3;
- FIG 5 is a schematic and purely illustrative perspective of a bundle of elongated elements of the broom shown in FIG 1 in a closed configuration;
- FIG 6 is a schematic and purely illustrative perspective of a bundle of elongated elements of the broom shown in FIG 1 in a spread configuration;
- FIG 7 shows an enlarged and partial view of the element shown in FIG 3 from the bottom.

**[0048]** With regard to the attached figures, reference number 1 refers to a broom for large surfaces, according to the present invention.

**[0049]** The broom comprises a frame 2, preferably comprising a plate-shaped single body 3, typically rectangular in plan, shaped (for instance by appropriate bending) in such a way to present a shallow compartment open to the bottom.

**[0050]** In an exemplary way, the plate-shaped body shows appropriate ribbings 5 made by bending.

**[0051]** The frame 2 is equipped with a mounting portion 6 for mounting the broom to a self-powered vehicle. In an exemplary way, mounting portion 6 includes two cavities 7 for inserting the prongs of a vehicle for handling loads, generally called "fork lift".

**[0052]** The broom comprises a plurality of bristles 8 rigidly fixed to the frame 2 so that they protrude from the frame on the side opposite to the mounting portion 6.

**[0053]** Preferably the broom comprises at least one attaching bar 9 rigidly attached to the frame 9 on the side opposite to the mounting portion 6.

**[0054]** Typically, as exemplarily shown in the figures, the broom comprises a plurality of attaching bars 9 having similar characteristics.

**[0055]** In an exemplary way, each attaching bar 9 is plate-shaped and it has a U-shaped profile in a cross-

section (as exemplarily shown in FIG 4), with convexity facing the frame. The U-shaped profile is made by means of bending along two parallel bending lines 10.

**[0056]** Preferably, each attaching bar is attached to said body 3 of the frame 2 by means of screws or bolts 11, which engage further through holes 12 in the attaching bar (nuts for fixing bolts are not shown in the pictures).

**[0057]** Attaching bars can vary in dimensions, in particular, as exemplarily shown, in length (FIG 2). Furthermore, in FIG 2 they are shown as being parallel each other, however the present invention contemplates whatever orientations they can have each other and with respect to the major movement direction during use (shown with the arrow 20 in FIG 1).

**[0058]** Each attaching bar has a plurality of pairs of through holes 13. In FIG 4, pairs of holes are shown as being parallel and aligned each other, however the present invention takes into account whatever mutual orientation of such pairs. With the expression "pair of holes", it is meant each pair of holes 13 filled with a respective bundle of elongated elements, as described below.

**[0059]** Preferably, the broom comprises a plurality of bundles 14 of elongated elements 15, the latter (and the bundles they form) having a substantially U-shaped major development line 16 (in an un-deformed condition, as shown in FIG 5) and comprising a first 17 and a second bending 18 along said line.

**[0060]** Preferably, each elongated element is thus composed of a first stretch 30 between the first bending 17 and a first longitudinal end 31 of the elongated element, a second stretch 32 between the second bending and a second longitudinal end 33 of the elongated element, and an intermediate stretch 34 between said first and second bendings. In the herein described and shown examples, it is noted that the two bendings 17 and 18 are separate and distinct from the intermediate stretch 34 that is mainly rectilinear. However, the present invention takes into account also the case (not shown in the pictures) wherein each elongated element is bent continuously at the intermediate stretch, so that this intermediate stretch becomes therefore curved (for instance semicircle). In that case, a first and a second bendings can be fictitiously identified at the ends of the curved intermediate stretch, even if the so identified first and second bendings belong to a unique greater bending (for instance semicircle bending). In an analogous way, the present invention includes embodiments (not shown) wherein the major development line is irregularly U-shaped, V or W-shaped, or in any other shape suitable for inserting in a pair of holes.

**[0061]** It is noted that with the term "bundle", it is meant generally (in the case wherein there is more than one elongated element per bundle) a disposition of the elongated elements with major development lines that are substantially parallel to each other (however see discussion below concerning FIG 6).

**[0062]** Preferably (as exemplarily illustrated in FIG 3), each bundle 14 of elongated elements is inserted in a

respective pair of holes 13 so that, for each elongated element, the intermediate stretch 34 is between respective attaching bar 9 and the frame (typically the body 3 of the frame), and the first and the second stretch 30 and 32 pass through a respective hole 13 of the pair of holes and they protrude from the attaching bar at the opposite side to the intermediate stretch 34, and in such a way that the bristles 8 are made of the first and second stretches 30 and 32 of the elongated elements.

**[0063]** In this way, it is noted that the bristles 8 are made of tufts corresponding to the first and the second stretches 30 and 32 of the elongated elements 15.

**[0064]** In all the figures from 1 to 5, it is noted that the bundles 14 of elongated elements are shown in an undeformed configuration, wherein all the elongated elements 15 have exactly the same shape and configuration and they are tidily parallel and all together in mutual contact along the whole longitudinal development of the bundle, including the "free" stretches 30 and 32.

**[0065]** In reality, the bundles 14 of elongated elements do not have this un-deformed configuration, but they have a "spread" configuration in which bristles 8 of the same tuft (that is of the same bundle of the first and the second stretches 30 and 32) are kept tied at the cross-section of the respective hole 13 and from this point toward the free ends 31 and 33 they tend to spatially widen in a substantially random way within a cone having hole 13 as its vertex.

**[0066]** FIG 6 is a purely illustrative view of a such a "spread" configuration, even if in this view, for purely technical reasons, the bristles widening follows an ordered and regular development (for instance, bundle 14 is substantially symmetric with respect to at least two orthogonal planes) whereas in reality the widening is substantially random without any plane of symmetry, and the bristles of the same tuft take a substantially random spatial orientation, even if within said cone. For instance, typically, even if not shown above, the free ends 31 and 33 of the first and second stretches' bundles belonging to the same bundle 14 interpenetrate each other.

**[0067]** In this context, preferably adjacent pairs of holes 13 are located in such a way that free ends 31 and 33 of the bundles of first and second stretches belonging to adjacent bundles 14 interpenetrate mutually (not shown), when the tufts are in an "spread" configuration. In this way, it is formed a unique cloud of bristles mutually interpenetrated seamlessly over the whole surface of the broom.

**[0068]** In the example shown above, each elongated element is a band or a foil having total longitudinal length exemplarily equal to about 540 mm and a cross-section (which is constant along the whole major development line 16) rectangular having a first dimension (long side) at least about 3 mm and a second dimension (short side) at least about 0,5 mm.

**[0069]** Typically, the acute angle 40 formed by the major development line 16 at the first and second bending is substantially a right angle (see below for more details).

**[0070]** Preferably, the intermediate stretch 34 lays on a position substantially equidistant from the first and the second free ends 31 and 34. In an exemplary way, the intermediate stretch has a longitudinal length between 14 and 21 mm (substantially comparable to the interaxis distance of each pair of holes 13, equal to about 17 mm), that can vary depending on the layer to which the elongated element belongs. In an exemplary way, the total length of each first and second stretch (that is each bristle 8) is at least about 260 mm.

**[0071]** In the above-illustrated example, each bundle 14 of elongated elements 15 contains thirteen elongated elements set on two adjacent piles made by six elements each wherein the thirteenth element is set on top, bridging the two piles. However, the present invention takes into account any number of elongated elements, including a single one for each "bundle", even if this solution requires that each pair of bristles 8 be singularly inserted in a respective pair of holes.

**[0072]** In an exemplary way, the diameter of each hole 13 is equal to 9 mm. In an exemplary way, the difference between hole's diameter and the cross-section diagonal (that is the maximum dimension) of the bundle of elongated elements (in a "closed" configuration) is at least 2 mm (see FIG 7).

**[0073]** Preferably, the elongated elements are made of spring steel or polypropylene.

**[0074]** Preferably the frame and/or the attaching bar are made of iron or anodized aluminium.

**[0075]** Preferably all elongated elements are substantially equal to each other.

**[0076]** According to the present invention, a possible production method for the broom 1 for surfaces includes:

- forming a plurality of bundles 14 of the elongated elements 15;
- inserting each bundle 14 of elongated elements in a respective pair of holes 13 of the attaching bar so that, for each elongated element, the intermediate stretch 34 lays on the upper surface 35 of the attaching bar, and the first and second stretch 30 and 32 pass through a respective hole 13 belonging to the pair of holes and they protrude from the attaching bar on the side opposite to the intermediate stretch 34, and
- rigidly fixing the attaching bar 9 to the (unique body 3 of the) frame 2 on the side opposite to the mounting portion 6 (that is in the compartment 4), so that the intermediate stretch 34 lays between the attaching bar 9 and the frame 2, and in such way that the bristles 8 are formed by the first and second stretches 30 and 32 of the elongated elements 15.

**[0077]** It is noted that, in order to insert the bundle 14 into the holes 13, it is advantageous that the bundle is kept in its "closed" configuration, as shown in FIG 5, for instance keeping manually closed the bundles of the first and the second stretches 30 and 32. In this configuration,

those bundles of first and second stretches 30 and 32 are inserted into the holes 13 starting from their free ends 31 and 33 as long as the bundle of intermediate stretches 34 (more precisely the intermediate stretches of the two most inner elongated elements in the U-shape) enter into contact to the attaching bar's upper surface 35.

**[0078]** Once the attaching bar is fixed to the frame 2 (for instance by tightening bolts' nuts) the bundle of intermediate stretches is pressure-clamped between the bottom surface of the unique body of the frame 3 and the attaching bar's upper surface. In this way, on one end, the bundles 14 of elongated elements are tidily attached to the frame, and on the other end, the free stretches 30 and 32 of the elongated elements 15 can spatially widen as described above.

**[0079]** Preferably, in order to give a U-shape to each bundle 14 of elongated elements 15, firstly a bundle is formed with parallel and rectilinear elongated elements mutually in contact; then the whole bundle is bent, for instance by means of a press, so that it forms a first and second bending 17 and 18 for all the elongated elements 15.

**[0080]** In this way, although all the elongated elements preferably are substantially (namely) identical to each other, they receive slightly different bendings each other, due to the fact that they are piled together, thus contributing to the spreading of the bristles 8, as described above.

**[0081]** During use, the two prongs of a forklift are inserted into cavities 7 and lift up so that the whole broom is raised off the ground. Once reached the surface to clean up, prongs are lowered as far as the broom's whole weight is supported by bristles 8 and no more by forks (that are actually pulled off the upper surface of the cavities 7). The broom can be then pushed by the forklift onto the surface along movement direction 20 (because of its symmetry, broom 1 can be mounted in both ways of direction 20), the surface being so brushed.

## Claims

1. A broom (1) for surfaces comprising a frame (2) provided with a mounting portion (6) for mounting the broom to a self-powered vehicle and a plurality of bristles (8) attached to the frame so as to protrude from the frame on the side opposite to said mounting portion, wherein the broom comprises:

- at least one attaching bar (9) rigidly attached to the frame on the side opposite to said mounting portion and provided with a plurality of pairs of through holes (13), and
- a plurality of bundles (14) of elongated elements (15), each elongated element having a substantially U-shaped major development line (16) and comprising, along said major development line (16), a first (17) and a second bending

(18) and being composed of a first stretch (30) between said first bending (17) and a first longitudinal end (31) of the elongated element, a second stretch (32) between said second bending (18) and a second longitudinal end (33) of the elongated element, and an intermediate stretch (34) between said first and second bending,

wherein each bundle (14) of elongated elements is inserted in a respective pair of holes (13) in such a way that, for each elongated element, said intermediate stretch (34) is interposed between said attaching bar (9) and said frame (2), and said first (30) and second stretch (32) pass through a respective hole (13) of said pair of holes, and protrude from said attaching bar on the side opposite to said intermediate stretch, and so that said bristles (8) are formed by said first (30) and second stretches (32) of the elongated elements.

2. A broom according to claim 1, wherein the elongated elements (15) are made of metal, preferably spring steel, or a plastic material, preferably polypropylene, and wherein the frame (2) and/or the attaching bar (9) is/are made of metal, preferably of iron or steel or aluminium, or alloys thereof.
3. A broom according to claim 1 or 2, wherein each elongated element (15) has an overall longitudinal length greater than or equal to 200 mm, and/or less than or equal to 800 mm, wherein said intermediate stretch (34) is in a position substantially equidistant from said first (31) and second longitudinal end (33), wherein said intermediate stretch has a longitudinal length greater than or equal to 5 mm, and/or less than or equal to 100 mm, and wherein said major development line (16) forms an acute angle (40) at each of said first and second bending greater than or equal to 60°, and/or less than or equal to 120°.
4. A broom according to any one of the preceding claims, wherein each elongated element (15) has a constant cross-section along said major development line, said cross-section being circular or elliptical or lenticular or square or rectangular in shape, and having a first dimension greater than or equal to 1 mm, and/or less than or equal to 10 mm.
5. A broom according to claim 4, wherein said cross-section has a second dimension, orthogonal to the first one, greater than or equal to 0.2 mm, and/or less than or equal to 5 mm, and wherein each hole (13) of said pair of holes has a cross-section having a dimension greater than or equal to 2 mm, and/or less than or equal to 20 mm.
6. A broom according to any one of the preceding

claims, wherein each bundle (14) of elongated elements (15) has a maximum dimension in a cross-section, wherein a difference between a dimension of said respective hole (13) and said maximum dimension of the cross-section of the bundle of elongated elements is positive, and less than or equal to 5 mm.

7. A broom according to any one of the preceding claims, wherein each bundle (14) of elongated elements (15) contains a number of elongated elements greater than or equal to 4, and/or less than or equal to 30, all the elongated elements being substantially identical to each other.
8. A broom according to any one of the preceding claims, wherein an interaxis distance between the two holes (13) of said respective pair of holes is comparable with a longitudinal length of said intermediate stretch (34), wherein said pairs of holes (13) are aligned with each other, wherein adjacent pairs of holes (13) are positioned in such a way that said longitudinal ends (31, 33) of the first (30) and second stretches (32) belonging to adjacent bundles (14) interpenetrate each other.
9. A broom according to any one of the preceding claims, wherein said attaching bar is plate-shaped and has a U-shaped profile in a cross-section, wherein a convexity of said U-shape faces said frame, said attaching bar being fixed to said frame by means of screws or bolts (11), which engage further through holes (12) in the attaching bar, so that a bundle of said intermediate stretches (34) is in contact to said attaching bar (9) and said frame (2), and it is pressure-clamped between said frame and said attaching bar, wherein the broom comprises a plurality of attaching bars (9) and wherein said frame (2) comprises a rectangular-plan plate-shaped body (3), which is shaped so as to have a compartment (4) open at the bottom, in which said attaching bars are housed.
10. Method for manufacturing a broom (1) for surfaces comprising a frame (2) provided with a mounting portion (3) for mounting the broom to a self-powered vehicle and a plurality of bristles (8) attached to the frame so as to protrude from the frame on the side opposite to said mounting portion, the method comprising:
  - forming a plurality of bundles (14) of elongated elements (15) having a substantially U-shaped major development line (16) and comprising, along said major development line, a first (17) and a second bending (18), each elongated element being composed of a first stretch (30) between said first bending and a first longitudinal

end (31) of the elongated element, a second stretch (32) between said second bending and a second longitudinal end (33) of the elongated element, and an intermediate stretch (34) between said two bendings, wherein forming a plurality of bundles of elongated elements comprises, for each bundle, combining in a bundle a plurality of elongated elements (15) having said development lines substantially rectilinear and parallel to each other, and bending the whole plurality of elongated elements so as to form said first and second bending (17, 18);

- inserting each bundle (14) of elongated elements into a respective pair of holes (13) of an attaching bar (9) in such a way that, for each elongated element, said intermediate stretch (34) is located in proximity to a surface (35) of said attaching bar, and said first and second stretches (30, 32) pass through a respective hole (13) of said pair of holes, and protrude from said attaching bar on the side opposite to said intermediate stretch, and

- rigidly attaching said attaching bar to the frame on the side opposite to said mounting portion, so that said intermediate stretch is located between said attaching bar and said frame, and in such a way that said bristles (8) are made from said first and second stretches (30, 32) of the elongated elements.

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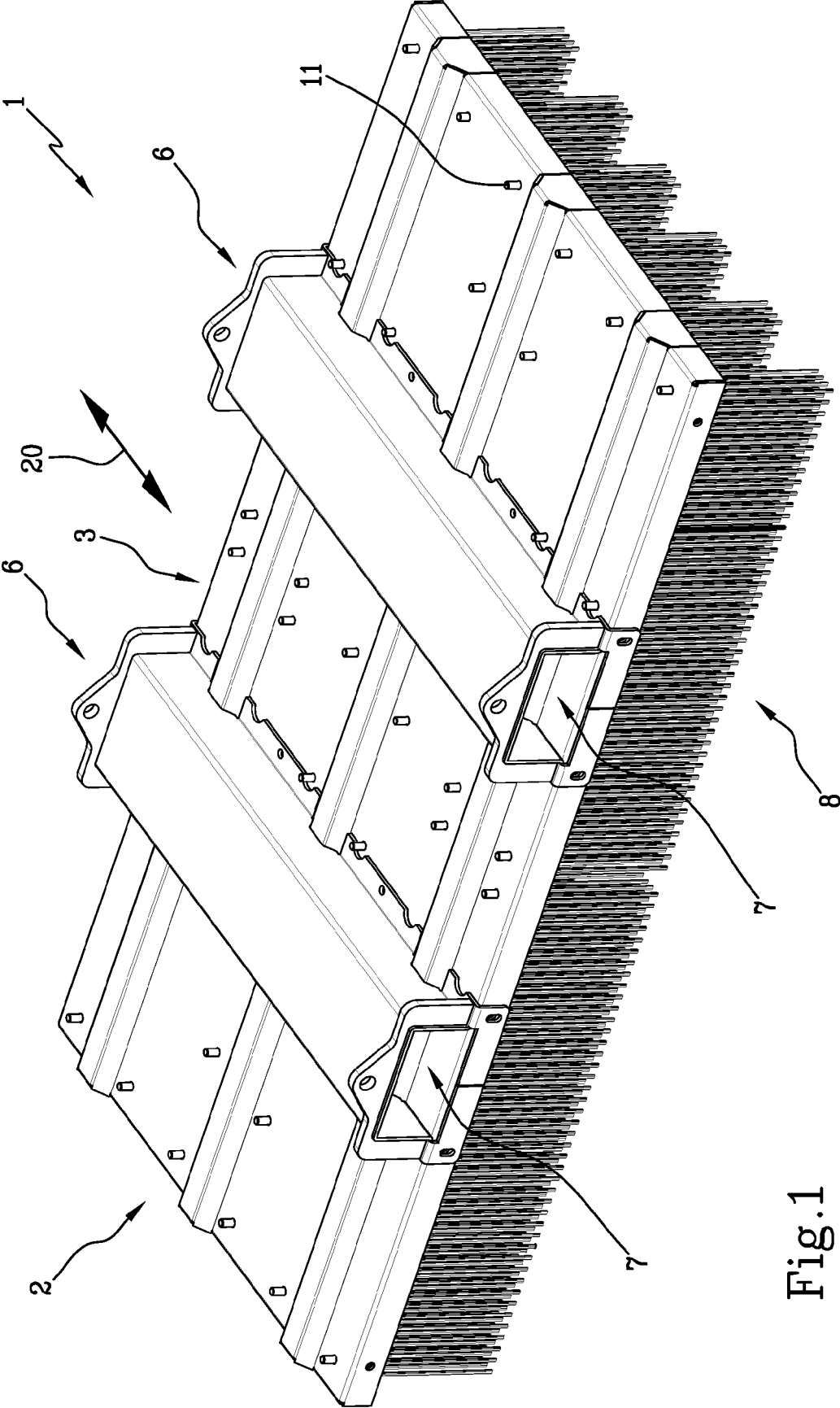


Fig.1

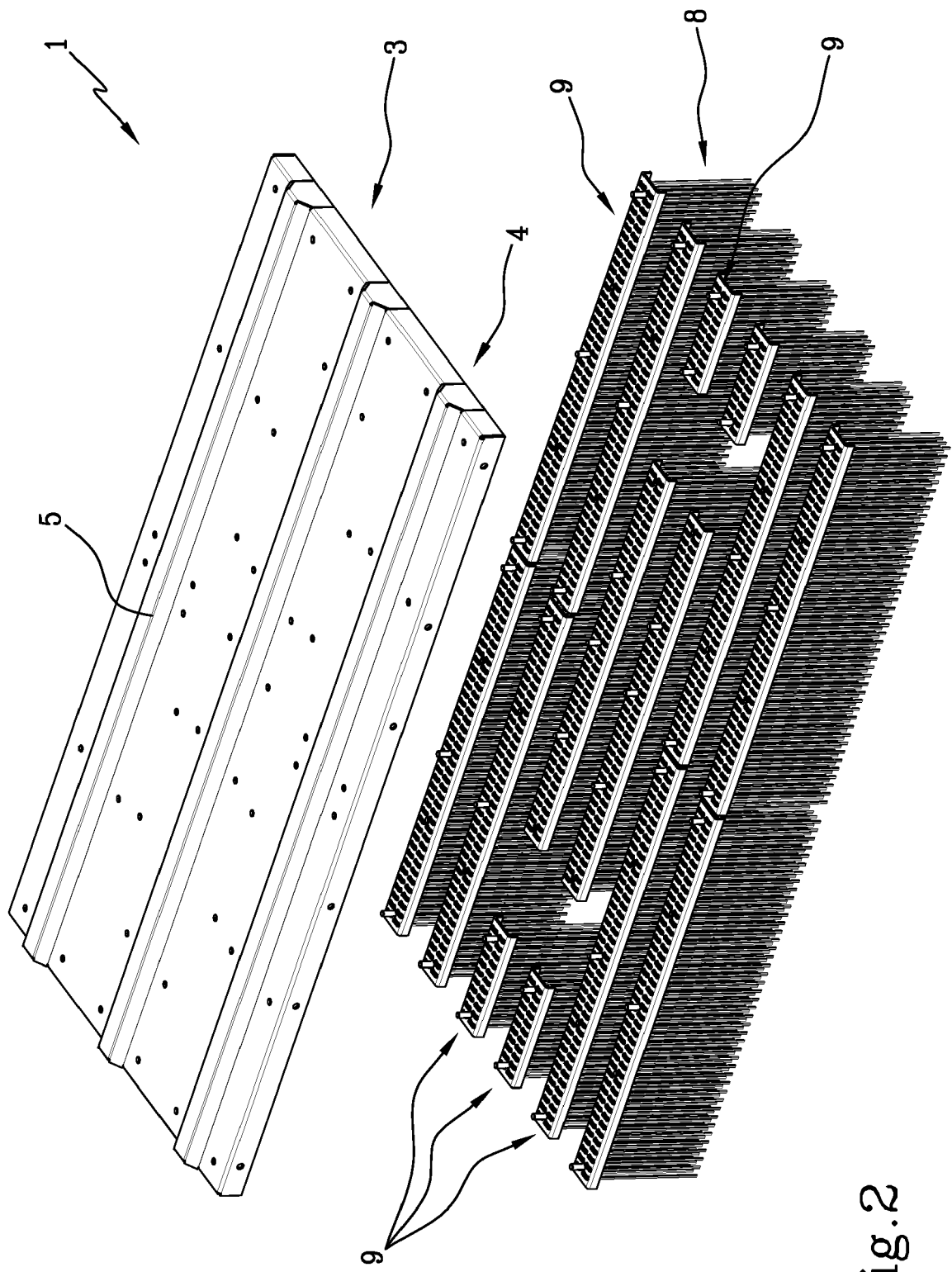


Fig.2

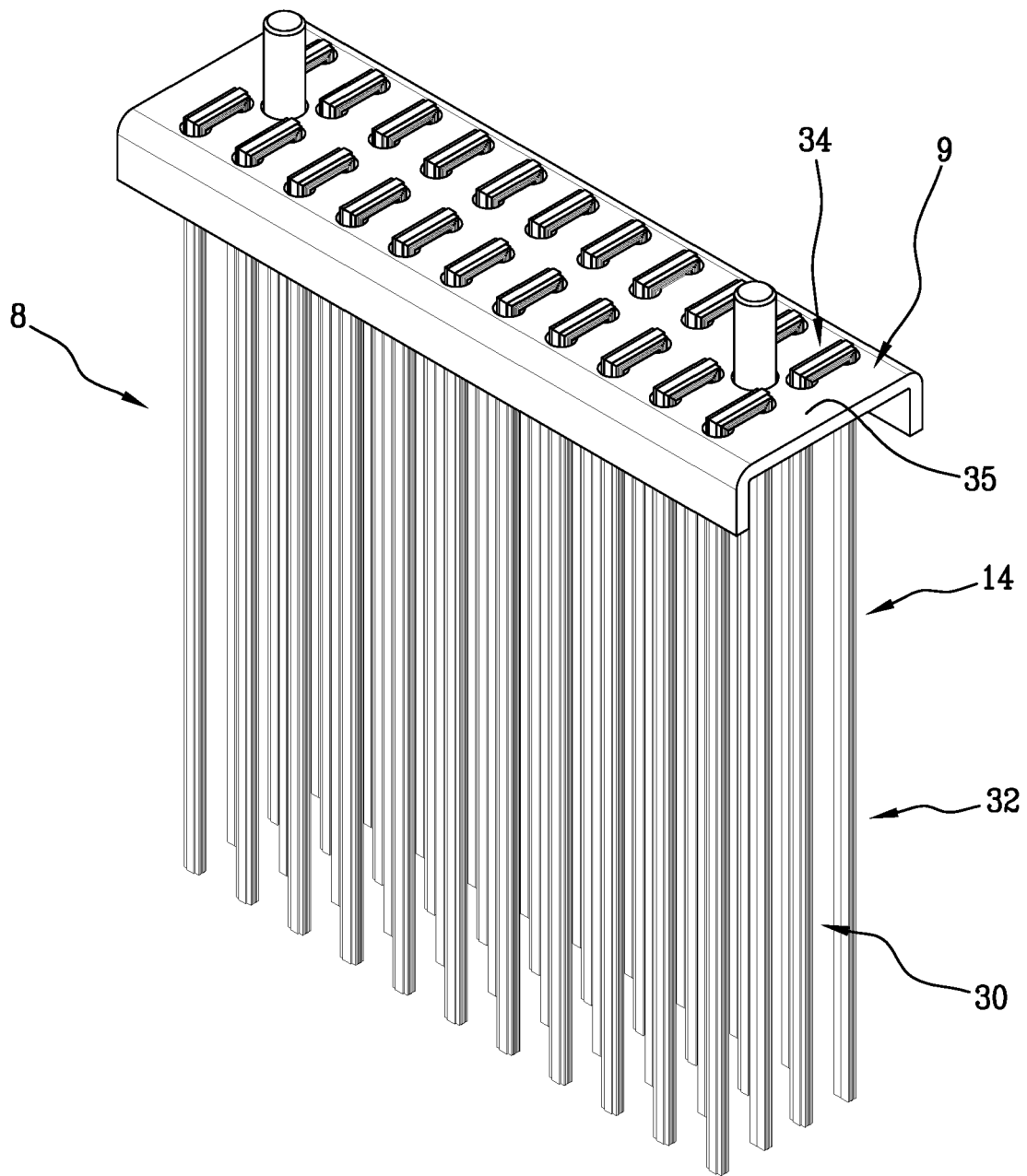


Fig.3

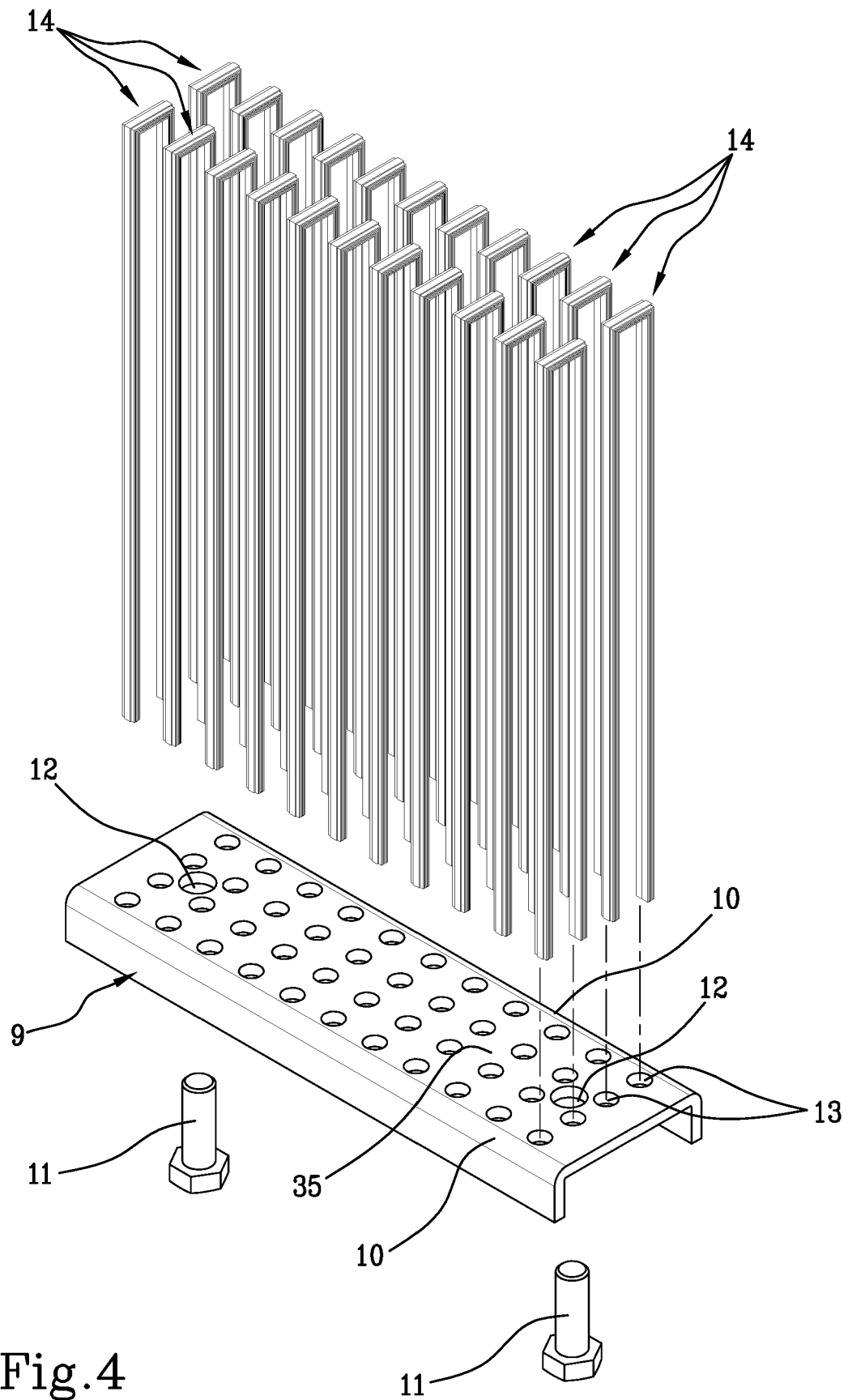


Fig.4

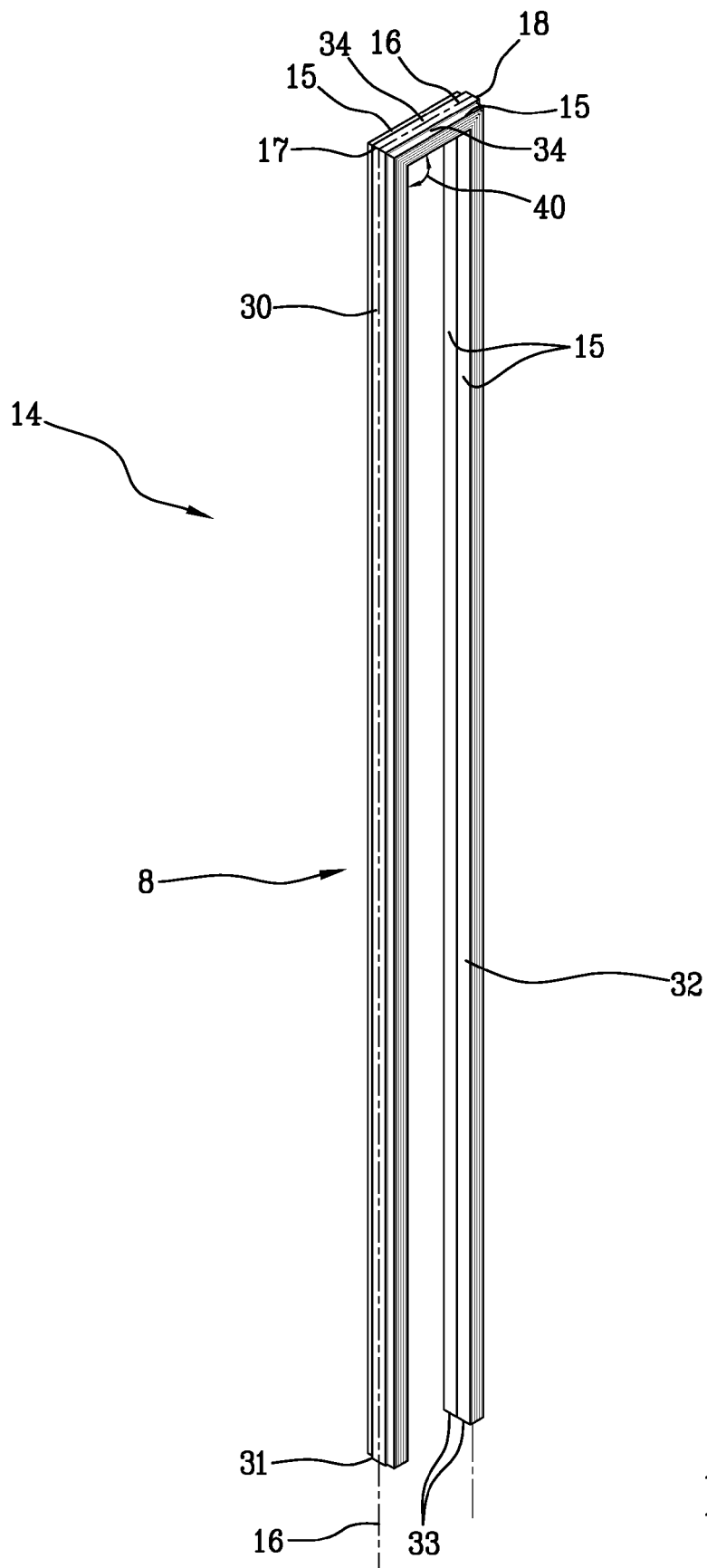
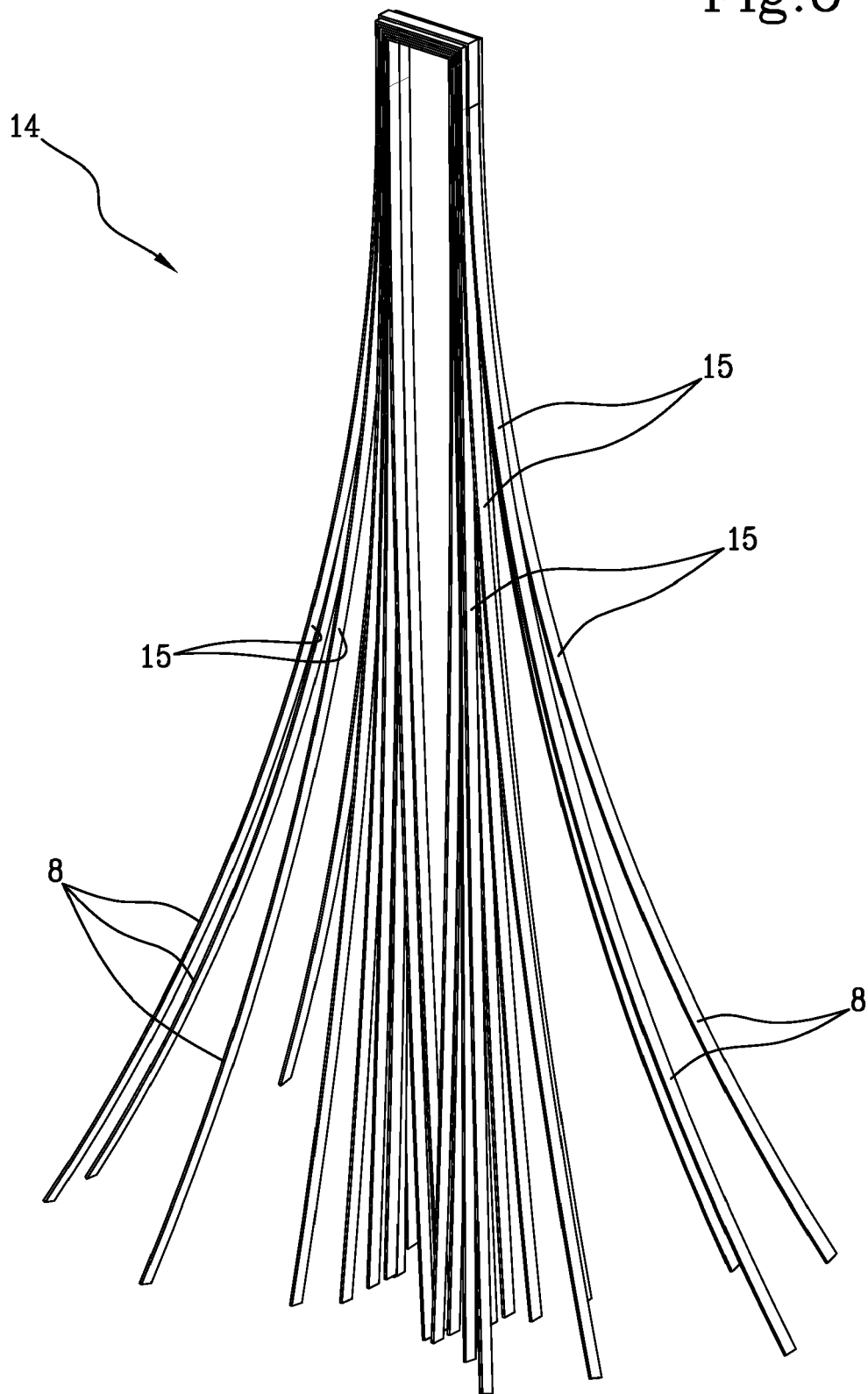


Fig.5

Fig.6



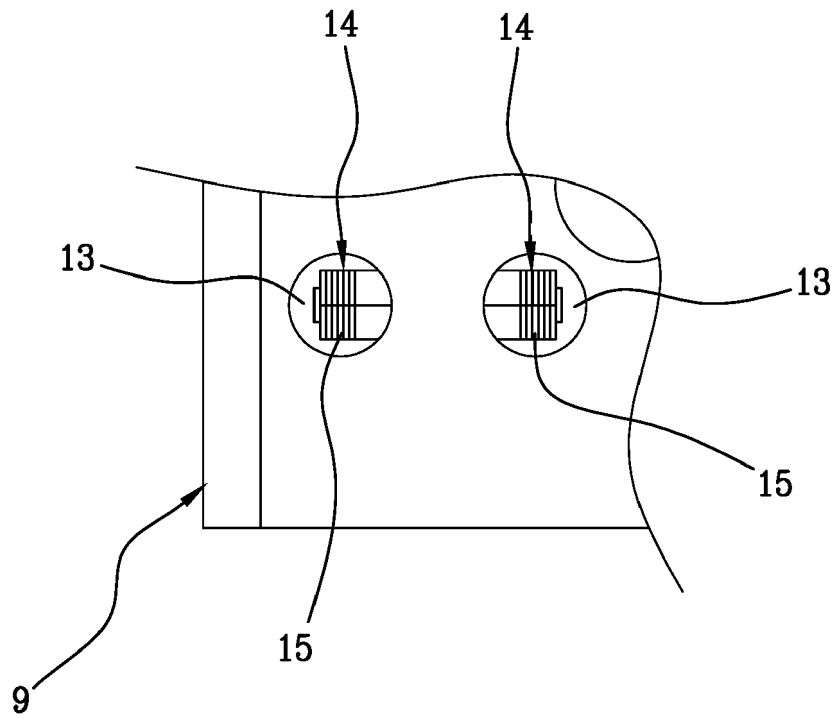


Fig.7



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