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## (54) VACUUM CLEANER NOZZLE

(57) A vacuum cleaner utensil comprises a plurality of elements (Lx) flexibly mounted to a central area (C) to provide a suction opening at a side of the central area (C) corresponding to a current movement direction (MD) of the vacuum cleaner utensil out of a plurality of possible movement directions, while reducing a possibility for air to enter the central area (C) from a plurality of other directions. The central area (C) may rotate around its center. The elements (Lx) may rotate with reference to respective axes (A) provided on the central area (C). The elements may be mounted to a single axis (Ac), and have a flexible first part having a first thickness, followed by a second part having a second thickness exceeding the first thickness, wherein - when pushed together as a result of movement - the second parts of neighboring elements (Lx) reduce a possibility for air to enter the central area (C) from between the neighboring elements (Lx). The elements (Lx) may be arranged for collecting dirt from crevices (CV) over an entire operating diameter (D) of the vacuum cleaner utensil as defined by the elements (Lx). The invention also relates to a vacuum cleaner comprising such a vacuum cleaner utensil.

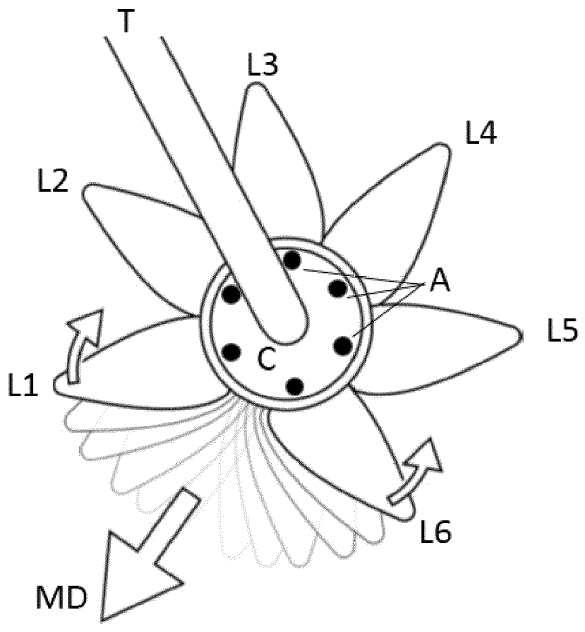


Fig. 1

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## Description

### FIELD OF THE INVENTION

**[0001]** The invention relates to a vacuum cleaner utensil (e.g. a vacuum cleaner nozzle or a robot vacuum cleaner), and to a vacuum cleaner (e.g. of the canister or stick type) provided with a nozzle formed by such a vacuum cleaner utensil.

### BACKGROUND OF THE INVENTION

**[0002]** The field of quick/flexible vacuum cleaning is gaining more and more popularity. The set of requirements for a nozzle is changing in those quick vacuum cleaners, as they are used mainly for cleaning coarse dirt particles in tight spaces, small areas and under furniture.

**[0003]** Known vacuum cleaner nozzles are usually rectangular and stiff. This is may not be the optimal shape when cleaning small spaces. Current nozzles suck up dirt through multiple openings divided evenly along the perimeter of the nozzle. There is an airflow through all of these holes, while there is only airflow necessary in the direction of movement. This is a waste of suction power and therefore not efficient.

### SUMMARY OF THE INVENTION

**[0004]** It is, inter alia, an object of the invention to provide a vacuum cleaner utensil that offers improved efficiency and omnidirectional flexibility to the user. The invention is defined by the independent claims. Advantageous embodiments are defined in the dependent claims.

**[0005]** Embodiments of the invention introduce flexible and moving parts that drag over the floor and follow the direction of movement, creating a suction hole and coarse dirt guides that are always in the current front of the nozzle, which current front is determined by what is the current movement direction.

**[0006]** 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

**[0007]**

Figs. 1-3 show behavior of an embodiment of a vacuum cleaner nozzle in accordance with the present invention;

Fig. 4 shows another view of an embodiment in accordance with the invention;

Figs. 5A and 5B show another embodiment of the invention; and

Figs. 6A - 6C show yet another embodiment of the invention.

### DESCRIPTION OF EMBODIMENTS

**[0008]** Embodiments of the invention are largely based on the insight that a traditional rectangular vacuum cleaner nozzle is designed for covering large areas, and that this requirement is not valid in the application area 'quick/flexible cleaning'. In quick/flexible cleaning it is important to be able to maneuver easily and to have a lightweight appliance (save energy).

**[0009]** In one embodiment, the vacuum cleaner nozzle comprises a plurality of elements Lx, in this embodiment six leaves or petals L1 - L6, preferably made out of flexible material, which each rotate around respective axes (●) A in the middle of the nozzle, preferably around respective axes A regularly distributed around a center of a central area C from where dirty air leaves the nozzle through a suction tube T towards the fan of a canister or stick-type vacuum cleaner. The drag force of the movement causes the leaves L1 - L6 to stay behind, creating a suction hole in a movement direction MD while closing openings at other sides of the nozzle. If the leaves L1 - L6 are hollow (as shown in Fig. 4), the suction caused by the vacuum cleaner's fan at the other end of the suction tube T will cause under-pressure in the leaves L1 - L6, which increases the drag force and thus improves the operation of the nozzle in that the leaves will move such that a suction hole will only remain in the movement direction MD. Another way to increase the drag force is the selection of the material of the leaves (or at least, the part of the leaves that touch the floor). For example, rubber provides sufficient friction with the floor, seals under-pressure on hard floors, and drags on soft floors.

**[0010]** Bigger particles are guided towards this hole by the shape of the leaves. This creates a vacuuming experience that is close to mopping, as illustrated in Figs. 1 and 2. As illustrated in the drawings, when the nozzle is moving to the left, only at the left there is an open channel, and all airflow will go to channel at the left. Airflow from other directions is blocked by the leaves L1 - L6 being forced to sit closely together. The leaves that - as a result of the movement direction MD - happen to be at the front (i.e. L1 and L6 in the movement illustrated by Fig. 1, and L4 and L5 in the movement illustrated in Fig. 2) guide coarse dirt towards the suction opening between these front leaves.

**[0011]** When encountering furniture like a table leg TL or a chair leg, the leaves L1 - L6 will bend to create suction around the object, as illustrated in Fig. 3. Preferably, to facilitate moving the nozzle in a mop-like way around objects like a table leg, the central area C of the nozzle can freely rotate around its center.

**[0012]** Under-pressure under the leaves L1 - L6 ensures that crevices CV in the floor F can be sucked empty. For this purpose, in an embodiment, the leaves L1 - L6 are hollow and suction channels are in line with the leaves L1 - L6, as illustrated in Fig. 4. In this way, the entire diameter D of the nozzle is used to suck dirt from crevices CV.

**[0013]** In an even more flexible embodiment, the axes A could be mounted to pull springs, thereby allowing the leaves L1 - L6 to be pulled out of the center. In that way, the nozzle could be positioned closer to walls, which improves its ability to clean around a corner and along a plinth. So, in normal motion, the front leaves would form a V having an opening angle of e.g. 90° guiding dirt towards the suction opening, but when pushed close to a wall, the pull springs would allow the front leaves to form an opening angle of 180°.

**[0014]** Figs. 5A and 5B show another embodiment of the invention. In this embodiment, there are 20 flexible elements L1 - L20 mounted to a single central axis Ac in the middle of the central area C. Starting from the axis Ac, each element Lx first has a relatively thin part that provides the flexible element with flexibility, followed by a relatively thick part that ensures that if the flexible elements Lx are pushed together as a result of the nozzle being moved (see e.g. Fig. 5B in which the nozzle is moved to the left, as a result of which the flexible elements are moved to the right), only at a side of the nozzle corresponding with the movement direction (in Fig. 5B, between the elements L14 and L15) it is possible for air to enter the central area C of the nozzle, while at all other sized the nozzle is substantially air-tight. Beyond its relatively thick part, each element Lx may have a relatively thin part that may help to guide dirt particles towards the central air inlet (in Fig. 5B, between the elements L14 and L15) and that may help to provide a drag force (e.g. as a result of friction with the floor) that results in the elements Lx assuming the position shown in Fig. 5B starting from the neutral positions shown in Fig. 5A. Advantageously, the elements Lx can rotate around the central axis Ac so as to allow for a mop-like flexible way of moving the nozzle around objects like table or chair legs.

**[0015]** Figs. 6A - 6C show yet another embodiment of the invention. Like in the previous embodiment of Figs. 5A and 5B, the 21 flexible elements L1 - L21 in the embodiment of Figs. 6A and 6B are mounted to a single central axis Ac, and close to that axis Ac they have relatively thin flexible parts, as shown in Fig. 6B. However, different from the previous embodiment, beyond those relatively thin flexible parts, where the elements Lx are no longer covered by the central area C, the elements Lx now have walls defining hollow bottoms, and closed roofs, so that under-pressure in the hollow parts of the elements Lx can provide an additional drag force improving the formation of a central suction opening between the elements L1 and L21 corresponding to the movement direction MD, and the closing off of other openings between the elements L1 - L2 .. L20 - L21.

**[0016]** As illustrated in Fig. 6B, to be able to get this under-pressure, the walls have heights exceeding the heights of the relatively thin flexible parts, except where the walls are covered by the central area C where the walls have a reduced height leaving a distance to the floor. The circle in Fig. 6B illustrates that when the flexible elements are pushed together as a result of the drag force, no opening is left between the walls of the flexible elements.

**[0017]** Advantageously, the roofs extend beyond the walls of the elements Lx, as this allows for a better vacuuming along plinths, as below the extended parts of the roofs there is an air flow channel to suck up dirt close to the plinths P, as schematically shown by the arrows in Fig. 6C. The elements Lx are so flexibly mounted, that - when pushed together as a result of the drag force - the roofs of neighboring elements Lx overlap each other, as illustrated in Fig. 6A.

**[0018]** Fig. 6A further shows on top of the central area C a hinge H made from a small piece of flexible tube (about 4 cm in length). Because the nozzle is attaching itself to the floor as a result of the suction and the elements Lx being hollow, it feels unnatural to push it forward like a traditional vacuum cleaner nozzle. The hinge H allows for some flexibility in every direction, allowing the user to operate the nozzle like a mop, with two hands, while the hinge H ensures that the elements Lx are not released from the floor.

**[0019]** The above embodiments provide an omnidirectional vacuum cleaner nozzle comprising a plurality of movable parts Lx that ensure that an opening is only present in the movement direction MD, e.g. as illustrated in the drawings. Embodiments provide a vacuum cleaner nozzle comprises a central area C from which dirty air can leave the vacuum cleaner nozzle; and a plurality of elements Lx flexibly mounted to the central area C to provide a suction opening at a side of the central area C currently corresponding to a current movement direction MD of the vacuum cleaner nozzle, while reducing a possibility for air to enter the central area C from other directions. Preferably, the central area C is circular, but it may have other forms, e.g. it may be square. Advantageously, the central area (C) is rotatable around its center. Preferably, the elements Lx can rotate with reference to respective axes A provided on the central area C, and preferably, the axes A are regularly distributed around a center of a central area C. Advantageously, the elements Lx are flexible. Advantageously, the elements Lx are mounted to a single axis Ac, and have a flexible first part having a first thickness, followed by a second part having a second thickness exceeding the first thickness, wherein - when pushed together as a result of movement - the second parts of neighboring elements Lx reduce a possibility for air to enter the central area C from between the neighboring elements. Preferably, the elements Lx have side walls and roofs extending beyond the side walls. Advantageously, the elements Lx are arranged for collecting dirt from crevices CV over an entire operating diameter D of the vacuum cleaner utensil as defined by the elements Lx. The invention also relates to a vacuum cleaner comprising such a vacuum cleaner nozzle.

**[0020]** Embodiments of the invention show the following characteristics: omnidirectional nozzle, with a circular central area having a suction channel, and flexible and rotating flaps that block-unblock the suction channel in

drag direction and that do not block the suction channel in a sense to create more pressure (varying the width of the channel) but just expose the correct portion of the suction channel based on the drag movement. While a conventional nozzle has to be manipulated to clean in various directions so that the suction channel is in correct orientation, in the omnidirectional nozzle provided by embodiments of this invention, the suction channel is automatically oriented based on drag. The flexible flaps or leaves are preferably hollow to create under pressure to offer optimum motion resistance/ drag so that the leaves are oriented naturally

**[0021]** In a robot vacuum cleaner embodiment, the central area C will just be a central area close to the dirty air inlet on the bottom of the robot vacuum cleaner. In this specification, the expression "flexibly mounted" covers the idea shown in Fig. 1 that an element Lx can rotate with reference to a respective axis A, the idea that the element Lx is mounted by means of a pull spring, and/or the idea shown in Figs. 5A and 6B that the elements Lx are connected to a single central axis Ac, the flexible elements each having a relatively thin part that can easily be bent. In the claims, the wording "a plurality of elements Lx flexibly mounted to a central area C" covers both the situation shown in Figs. 1-4 that the flexible elements Lx are individually mounted to the central area C, and the situation shown in Figs. 5A - 6C in which the flexible elements Lx are all connected to a central point Ac in the central area C. 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. In the device claim enumerating several means, several of these means may be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

## Claims

**1.** A vacuum cleaner utensil comprising:

a plurality of elements (Lx) flexibly mounted to a central area (C) to provide a suction opening at a side of the central area (C) corresponding to a current movement direction (MD) of the vacuum cleaner utensil out of a plurality of possible movement directions, while reducing a possibility for air to enter the central area (C) from a plurality of other directions.

**2.** A vacuum cleaner utensil as claimed in claim 1, wherein the central area (C) is circular.

**3.** A vacuum cleaner utensil as claimed in any of the preceding claims, wherein the central area (C) is rotatable around its center.

**4.** A vacuum cleaner utensil as claimed in any of the preceding claims, wherein the elements (Lx) are rotatable with reference to respective axes (A) provided on the central area (C).

**5.** A vacuum cleaner utensil as claimed in claim 4, wherein the axes (A) are regularly distributed around a center of a central area (C).

**6.** A vacuum cleaner utensil as claimed in any of the preceding claims, wherein the elements (Lx) are flexible.

**7.** A vacuum cleaning utensil as claimed in claim 6, wherein the elements (Lx) are mounted to a central point (Ac), and have a flexible first part having a first thickness, followed by a second part having a second thickness exceeding the first thickness, wherein - when pushed together as a result of movement of the vacuum cleaning utensil - the second parts of neighboring elements (Lx) reduce a possibility for air to enter the central area (C) from between the neighboring elements (Lx).

**8.** A vacuum cleaner utensil as claimed in claim 7, wherein the central point (Ac) is an axis around which the elements (Lx) can rotate.

**9.** A vacuum cleaning utensil as claimed in any of the preceding claims, wherein the elements (Lx) are hollow.

**10.** A vacuum cleaning utensil as claimed in claim 9, wherein the elements (Lx) have side walls and roofs extending beyond the side walls.

**11.** A vacuum cleaner utensil as claimed in claim 9 or 10, wherein the elements (Lx) are arranged for collecting dirt from crevices (CV) over an entire operating diameter (D) of the vacuum cleaner utensil as defined by the elements (Lx).

**12.** A vacuum cleaner comprising a vacuum cleaner utensil as claimed in any of the preceding claims.

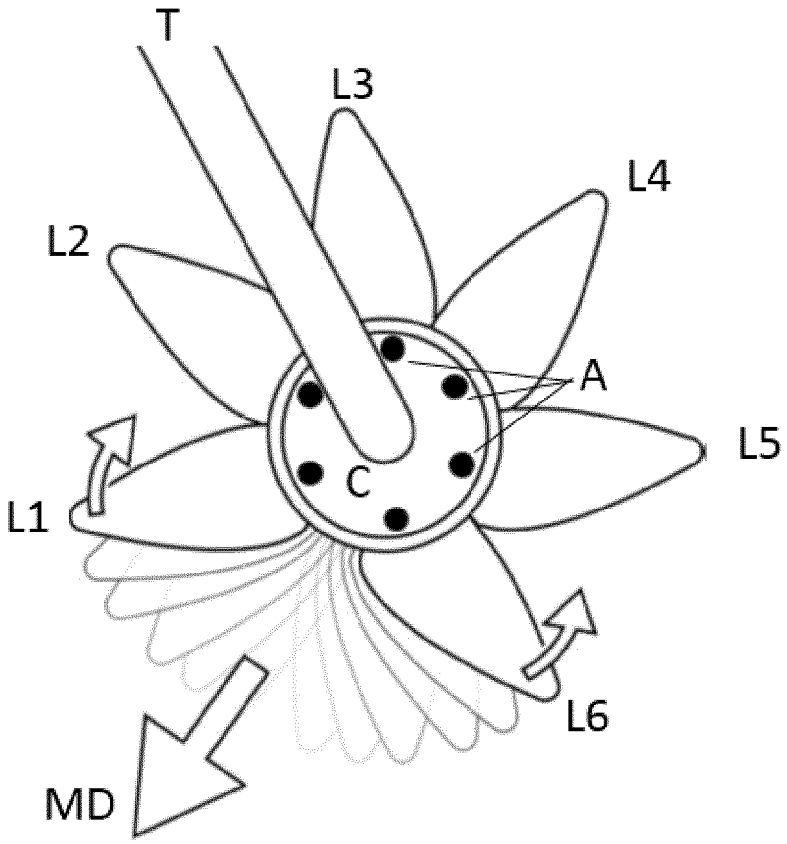


Fig. 1

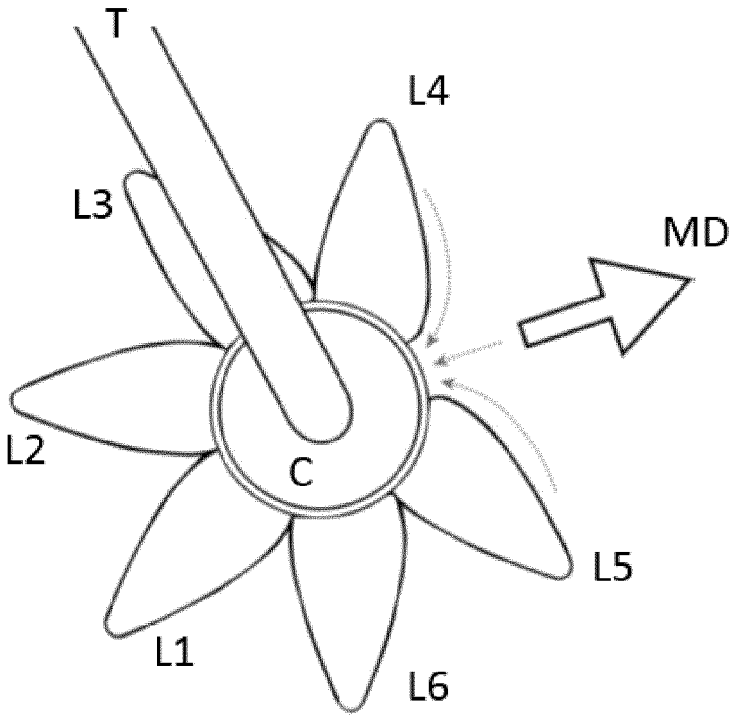


Fig. 2

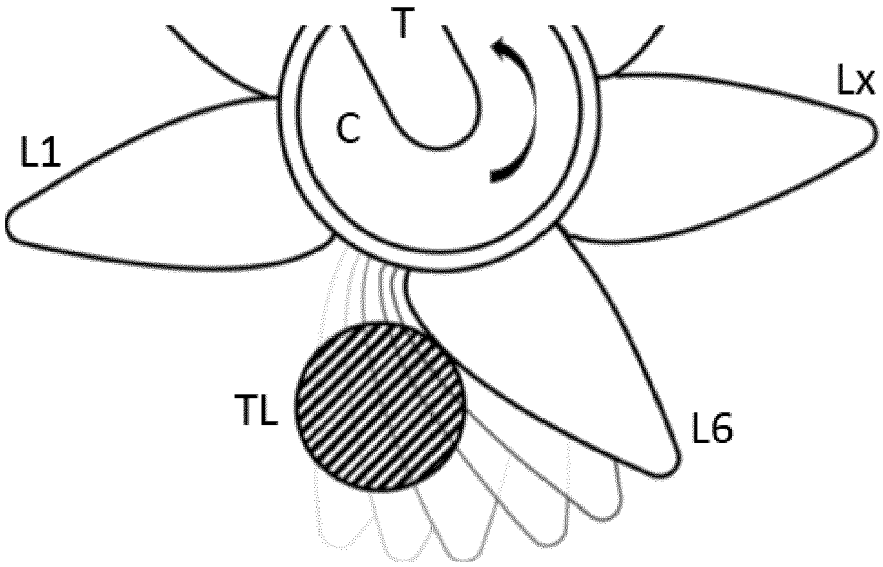


Fig. 3

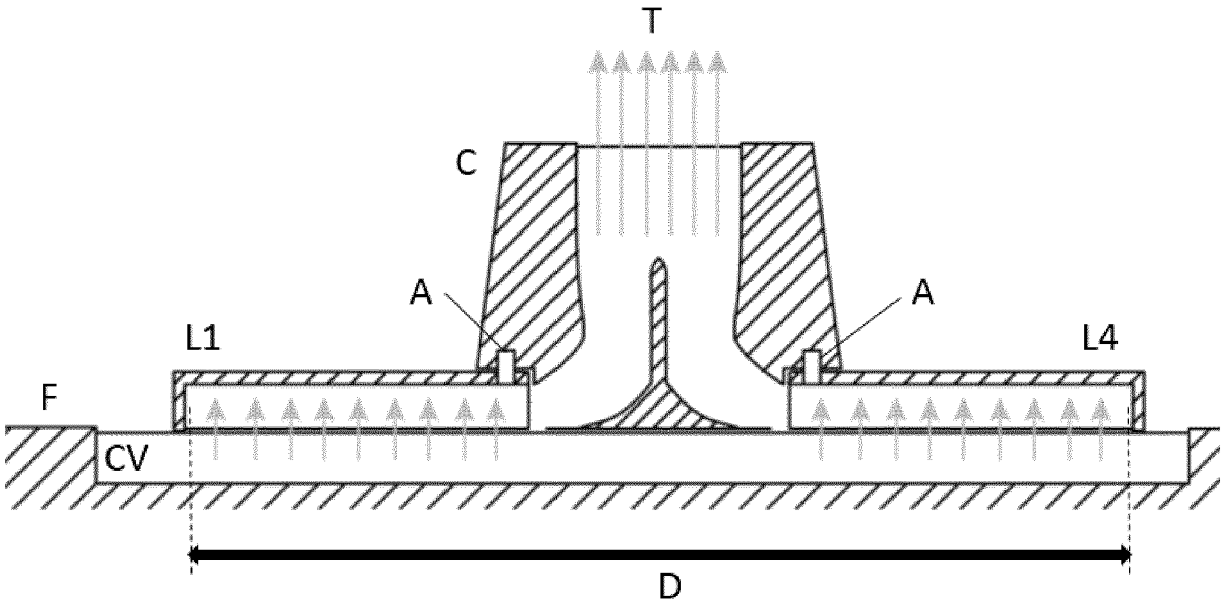


Fig. 4

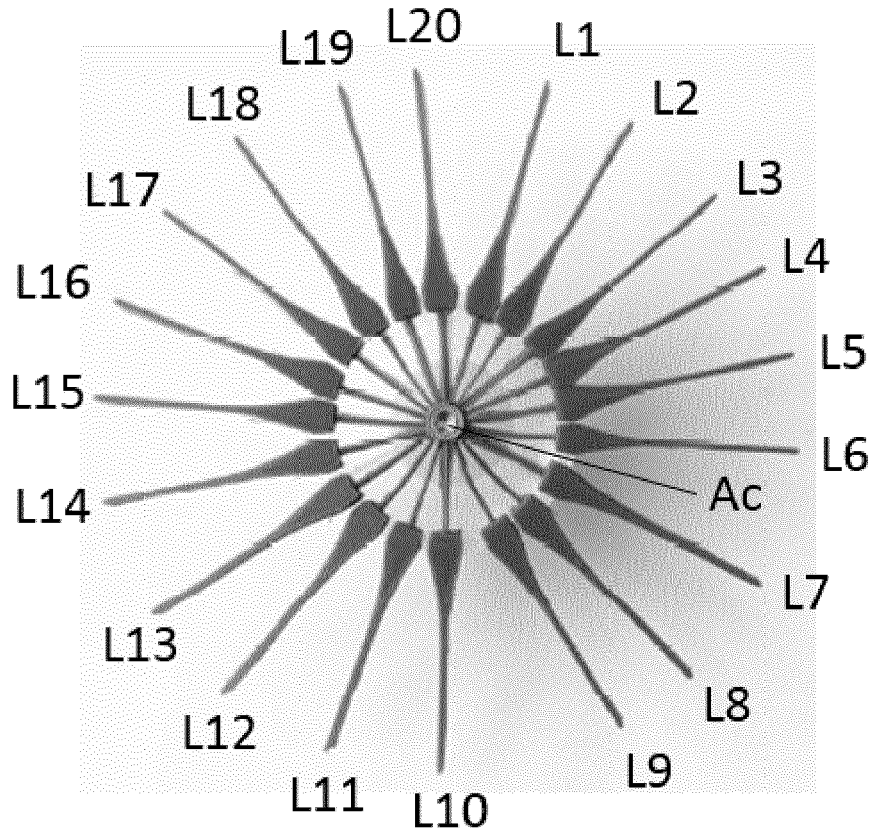
L19
L20
L1
L18
L2
L17
L3
L16
L4
L15
L5
L6
Ac
L14
L7
L13
L8
L12
L9
L11
L10

Fig. 5A

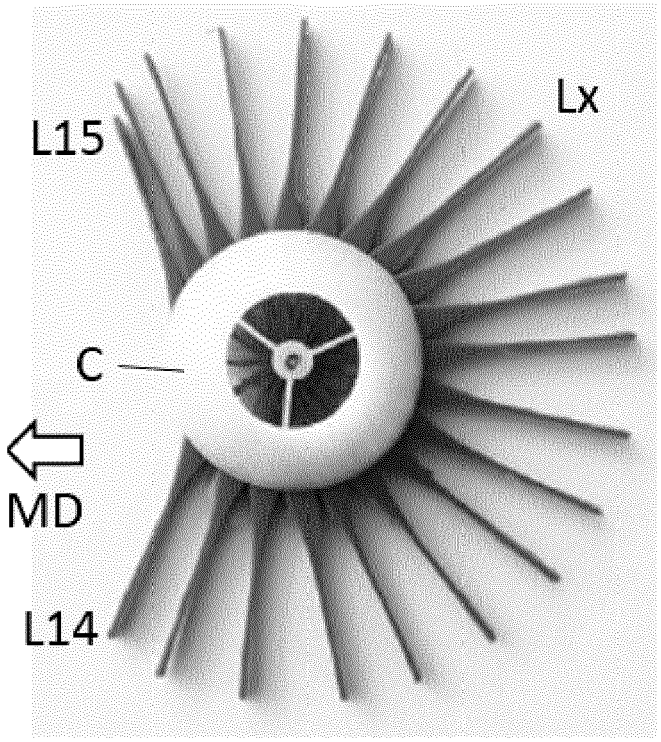
L15
Lx
C
MD
L14

Fig. 5B

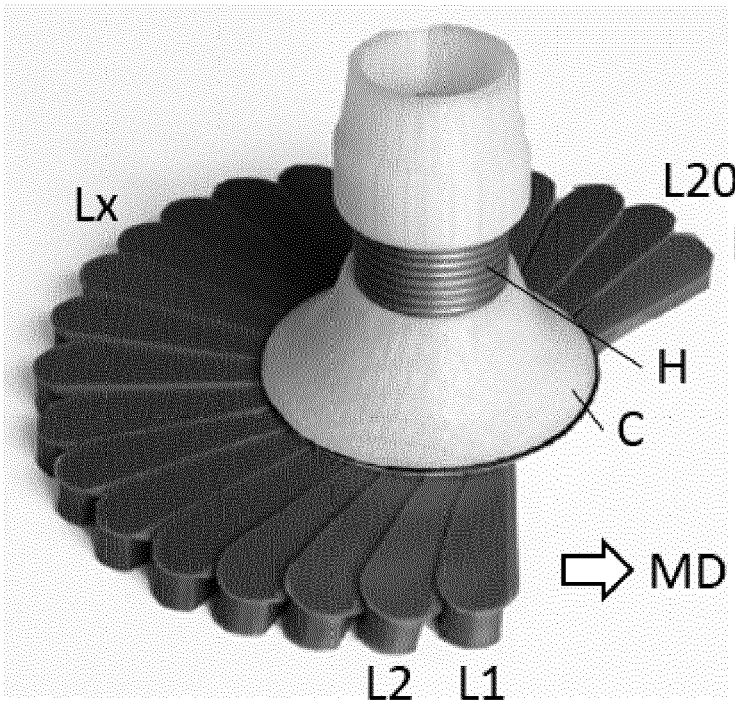


Fig. 6A

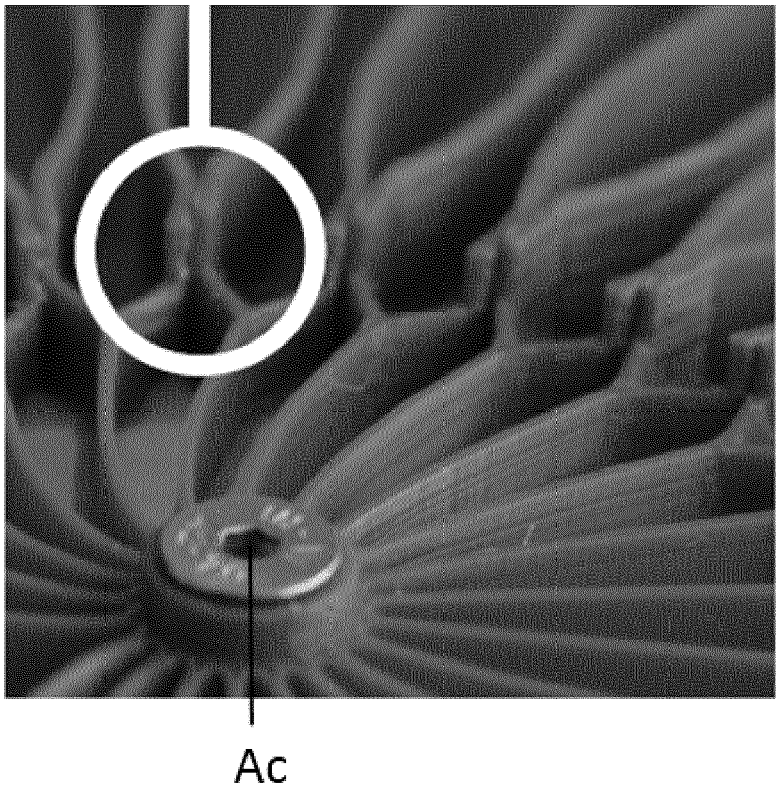


Fig. 6B

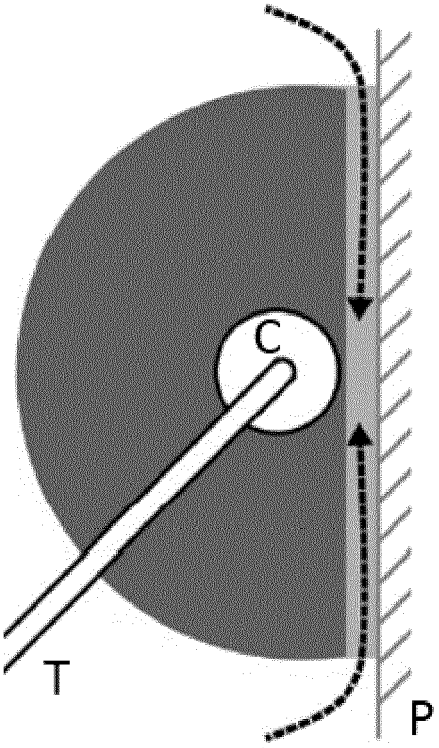


Fig. 6C

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# EUROPEAN SEARCH REPORT

Application Number
EP 17 18 1533

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| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 18 January 2018 | Redelsperger, C |

CATEGORY OF CITED DOCUMENTS

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