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(54) **FLOOR CARE NOZZLE**

(57) In a floor care nozzle comprising a nozzle housing (HS), a mass (m) is vertically movable within the nozzle housing (HS). Preferably, the nozzle housing (HS) is provided with a damping element (DE) at a place where the mass (m) collides with the nozzle housing (HS), or the mass (m) is provided with a damping element (DE). Preferably, a total weight of the mass (m) is at least about 10% of a weight of the nozzle. Preferably, the mass (m) comprises a plurality of masses (m) distributed over a width of the nozzle housing (HS), wherein the number of masses (m) could be at least 3 and at most 6. Preferably, the nozzle housing (HS) comprises a plurality of containers (C) in which respective masses (m) can move, which are advantageously placed at a front end of the nozzle housing (HS).

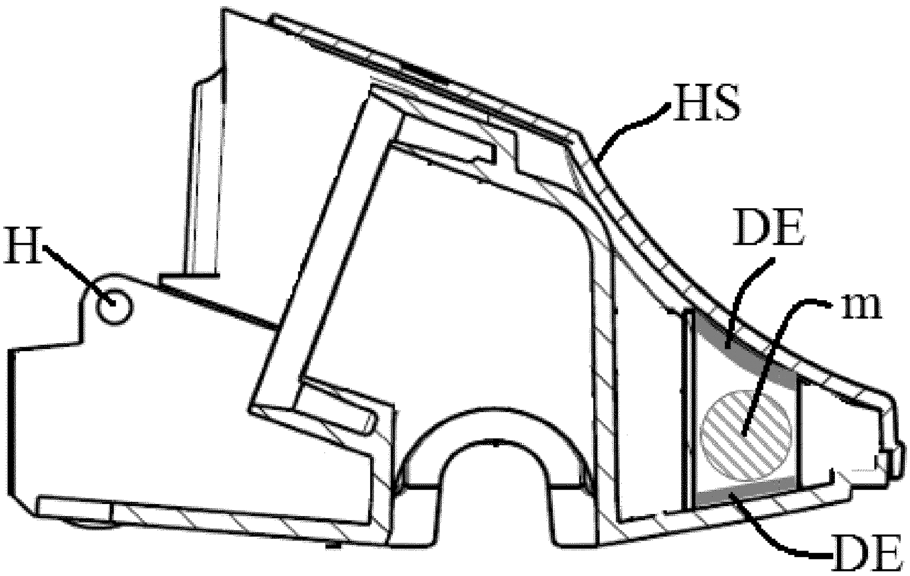

Fig. 3A

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a floor care nozzle, and to a vacuum cleaner provided with such a floor care nozzle.

BACKGROUND OF THE INVENTION

[0002] Some floor care nozzles appear to produce an audible rattle when used on certain carpets.

SUMMARY OF THE INVENTION

[0003] It is, inter alia, an object of the invention to provide an improved floor care nozzle. The invention is defined by the independent claims. Advantageous embodiments are defined in the dependent claims.

[0004] The invention is based on the following insights. The disturbing phenomenon when using prior art nozzles exposes itself as a vertical oscillation of the nozzle head during backwards stroke in a single hinge nozzle, or a hopping behavior in double-hinge nozzles. Merely adding mass to the nozzle appeared to have no effect in the disturbing phenomenon. A further study revealed that the oscillation starts when an impulse (in this case a starting velocity given by the carpet) is put onto the nozzle. The nozzle starts to move away from the carpet at this velocity, but is slowed down by gravitational pull and vacuum generated by the vacuum cleaner fan. These forces create a negative vertical acceleration, with which the time to land can be calculated. When landed, the nozzle will get another vertical push from the carpet, and start on its next jump. With every landing, the nozzle is pushed into the carpet harder, creating more force on the front rim, giving it more frictional force to create an even higher starting velocity with the net jump. It appeared that the mass of the nozzle itself does have no effect on this phenomenon, and that the frequency of the nozzle is dependent on the height of the jumps (or starting vertical velocity). It also appeared that (in combination with the increasing vertical impulse with every jump) the nozzle will tend to start out with a high frequency jump with just small jumping height, but will quickly move to high jumps with a low frequency. Based on these considerations, the invention is based on the insight that by counteracting the high frequency, low amplitude jumps at the beginning of the movement of the nozzle, it becomes possible to prevent the high jumps, low frequency motion from occurring later on. The main element to prevent this high frequency motion from occurring is a free mass within the nozzle.

[0005] 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

[0006]

Fig. 1 illustrates the phenomenon addressed by the invention;
Fig. 2 illustrates the principle underlying the invention; and
Figs. 3A-3C and 4 show embodiments of the invention.

DESCRIPTION OF EMBODIMENTS

[0007] Fig. 1 illustrates the phenomenon addressed by the invention, by showing 4 sequential phases in the movement of a nozzle when dragged backwards (dragging force F_{drag}) on a carpet. The first picture shows an impulse force F_{imp} (e.g. caused by an unevenness in the carpet), which results in an upwards movement of the nozzle that is shown in the second picture. When the nozzle has fallen down into the carpet, so that the nozzle experiences more resistance than in the first picture, the increased impulse force F_{imp} shown in the third picture will result in an ever higher jump as shown in the last picture.

[0008] Fig. 2 illustrates the principle underlying the invention. The following steps can be identified.

[0009] Step 1: The vacuum force F_{vac} and gravity force F_{grav} want to keep the nozzle to the ground. The nozzle mass M and the free mass m are launched into the air by an unevenness in the carpet (impulse Imp), while the nozzle is dragged over the carpet.

[0010] Step 2: Nozzle & free mass fly through the air together, and experience mainly the gravitational force F_{grav}.

[0011] Step 3: When the nozzle gets closer to the ground, it will experience the vacuum force F_{vac} again, which pulls it down faster. The free mass m inside the nozzle does not experience this vacuum, hence it starts lagging behind in motion, creating a gap between the nozzle and the free mass m.

[0012] Step 4: After touchdown of the nozzle, the nozzle is launched back into the air again by the carpet force Imp, but quite early meets the free mass m, which was still on its way down.

[0013] Step 5: The collision between the nozzle and the free mass m will send the nozzle back to the ground again. In this way, the amplitude of the nozzle movement is kept small, hence the kinetic energy the free mass needs to have can remain quite small (since it only has to dampen out small oscillations of the nozzle).

[0014] The main advantages of this solution are:

1. The free masses m can be incorporated in the nozzle, without the user ever having to see them (invisible).
2. The free masses m can be relatively cheap.
3. The free masses m are relatively simple to build

into the nozzle.

4. The free masses m do not interact with the use of the nozzle.

5. The mass can be very small in comparison with the nozzle.

[0015] As to the type of the free mass, the mass can a solid or liquid form. In case of a liquid form the containment of the liquid should be secured. The main advantage is that the element size is rather small and best reacts on impulses. When applying a liquid, the viscosity can be of influence. In a preferred embodiment of the nozzle, steel spheres or rods are used as free mass m, which have a solid structure that is easier to contain in position within a nozzle housing construction.

[0016] As to the size of the free mass m, when investigating the principle, the element size does not seem to be very relevant. The dynamic behavior is approximately the same in large or small members. Tests have been performed with 4 relatively big steel spheres (diameter 12 mm, and total weight 27 g), and with about 90 small steel spheres (diameter 3 mm, and same total weight 27 g). Both have equal performance. Therefore, from a logistic and assembly point of view, the preference is to use a relatively low number (e.g. 3 or 4) of relatively large free masses m.

[0017] As to the total weight of the free masses, it appeared that good results were obtained if the total weight m of the free masses was at least about 10% of the weight M of the nozzle, e.g. m = 27 g and M = 280 g.

[0018] As to the location of the free mass, preferably it should most far away from the hinge point, since the movement of the free mass is then the largest. After experiments it shows that the same weight is more effective when placed away from the hinge H, as shown in Fig. 3A. Fig. 3A shows an embodiment of a nozzle in accordance with the invention, in which HS indicates a nozzle housing HS.

[0019] A disadvantage of the free masses is that these can rattle when they move within their containers. By making a container structure with the right dimensioning the mass object can mostly move in one direction. By adding a small damping element DE at the bottom or the top of this place it can cancel out the sounds, as shown in Fig. 3A. Another solution could be to encapsulate the mass objects themselves in a damping layer such as rubber, as shown in Fig. 3B. The most optimal and economic execution could be to use a steel cylinder as mass m. The benefit of this steel cylinder is that the top and bottom surfaces are flat, and these surfaces can be equipped with a very thin layer of absorbing material DE to reduce the audible effect of the free masses m colliding with the plastic nozzle housing parts, as shown in Fig. 3C.

[0020] As shown in Fig. 4, in the soleplate of the nozzle, containers C are provided, within which a free mass m can be positioned. In the embodiment of Fig. 4, the containers C have a cylinder shape. The shape of the free masses m to be put into cylindrical mass containers C can be a cylinder or a sphere. The top cover can seal the compartment, securing that the free mass m will always stay in place. The number of containers C may vary between 3 and 6, depending on the applied masses or total weight.

[0021] In summary, the invention provides a floor care nozzle comprising a nozzle housing HS, in which a mass m is vertically movable. Preferably, the nozzle housing HS is provided with a damping element DE at a place where the mass m collides with the nozzle housing HS, or the mass m is provided with a damping element DE. Preferably, a total weight of the mass m is at least about 10% of a weight of the nozzle. Preferably, the mass m comprises a plurality of masses m distributed over a width of the nozzle housing HS, wherein the number of masses m could be at least 3 and at most 6. Preferably, the nozzle housing HS comprises a plurality of containers C in which respective masses m can move, which are advantageously placed at a front end of the nozzle housing HS. A vacuum cleaner is advantageously provided with the nozzle of the present invention.

[0022] 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. For example, instead of cylindrical containers C, other containment structure shapes are alternatively possible, such as square, hexagon, etc. with contact ribs defining the degrees of freedom for this mass. Any such containers contain the mass inside a pre-defined space, giving it much less room to move around compared to a mass that is free to move inside the nozzle. Additionally, if the masses are not spheres, but cylinders (or the like), they will not be able to roll along the walls of the container when the side of the container is close to horizontal, but they will then tend to slide. This sliding makes the masses significantly less mobile when the nozzle is moved, hence this results in much less rattling when the nozzle is handled off the floor.

[0023] The mass m should be allowed to move with a vertical motion component. In a straightforward embodiment, the mass m moves vertically. However, deviations from a purely vertical movement are perfectly possible (and even desired if this results in making the container C better fit in within a desired overall outer shape of the nozzle design), as long as it is ensured that the mass m is able to counteract undesired movements of the nozzle, i.e. the movement of the mass m has a sufficiently large component in a direction of an undesired movement of the nozzle. In an alternative embodiment, the mass m could be mounted to an arm that may rotate around e.g. the hinge H: this will still result in that the mass m can move with a vertical motion component so as to counteract undesired movements of the nozzle. A rotating movement of the mass m may be the best way to counteract a hopping undesired movement of a double-hinge nozzle.

[0024] The drawings are drafted so as to illustrate the essential features of the present invention. In reality, the nozzle will have various ribs and other structures to ensure that it is strong enough.

[0025] 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 floor care nozzle comprising a nozzle housing (HS) provided with a mass (m) that is movable with a vertical motion component within the nozzle housing (HS).

2. A floor care nozzle as claimed in claim 1, wherein the nozzle housing (HS) is provided with a damping element (DE) at a place where the mass (m) collides with the nozzle housing (HS).

3. A floor care nozzle as claimed in claim 1, wherein the mass (m) is provided with a damping element (DE).

4. A floor care nozzle as claimed in any of the preceding claims, wherein a total weight of the mass (m) is at least about 10% of a weight of the nozzle.

5. A floor care nozzle as claimed in any of the preceding claims, wherein the mass (m) comprises a plurality of masses (m) distributed over a width of the nozzle housing (HS).

6. A floor care nozzle as claimed in claim 5, wherein the number of masses (m) is at least 3 and at most 6.

7. A floor care nozzle as claimed in any of the preceding claims, wherein the nozzle housing (HS) comprises a plurality of containers (C) in which respective masses (m) can move.

8. A floor care nozzle as claimed in claim 7, wherein the containers (C) are placed at a front end of the nozzle housing (HS).

9. A vacuum cleaner comprising a floor care nozzle as claimed in any of the preceding claims.

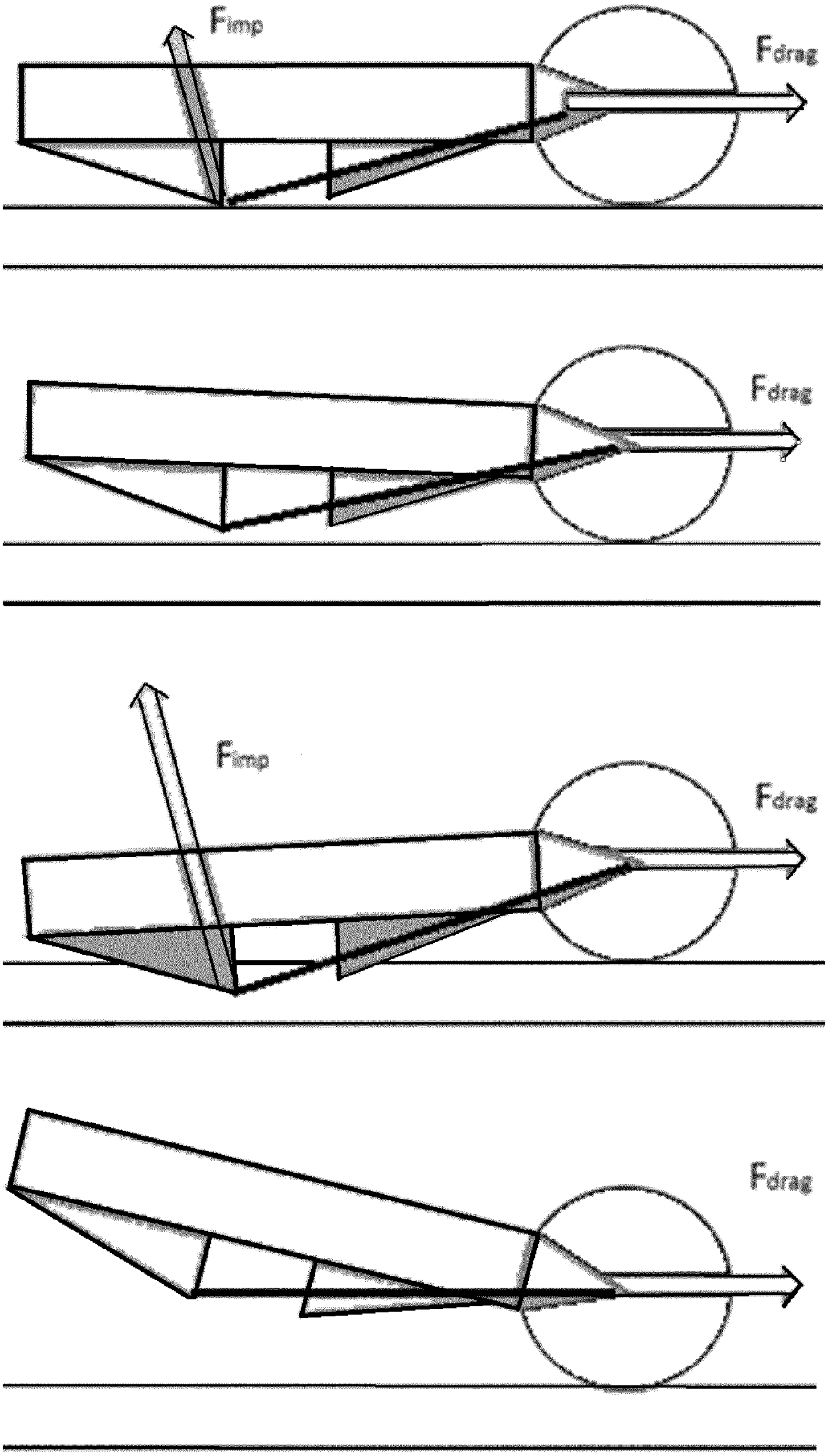

Fig. 1

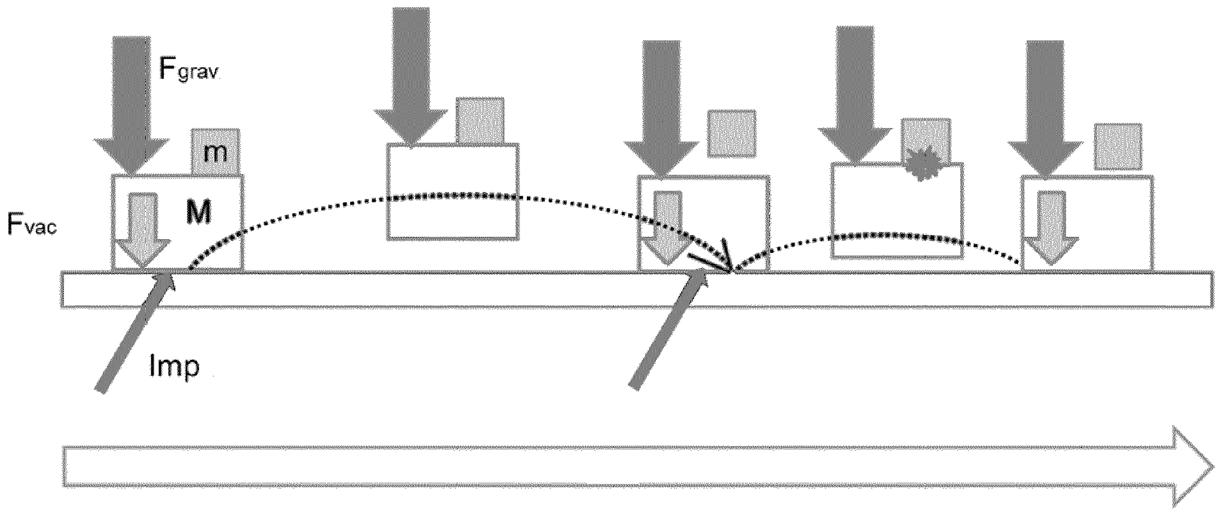

Fig. 2

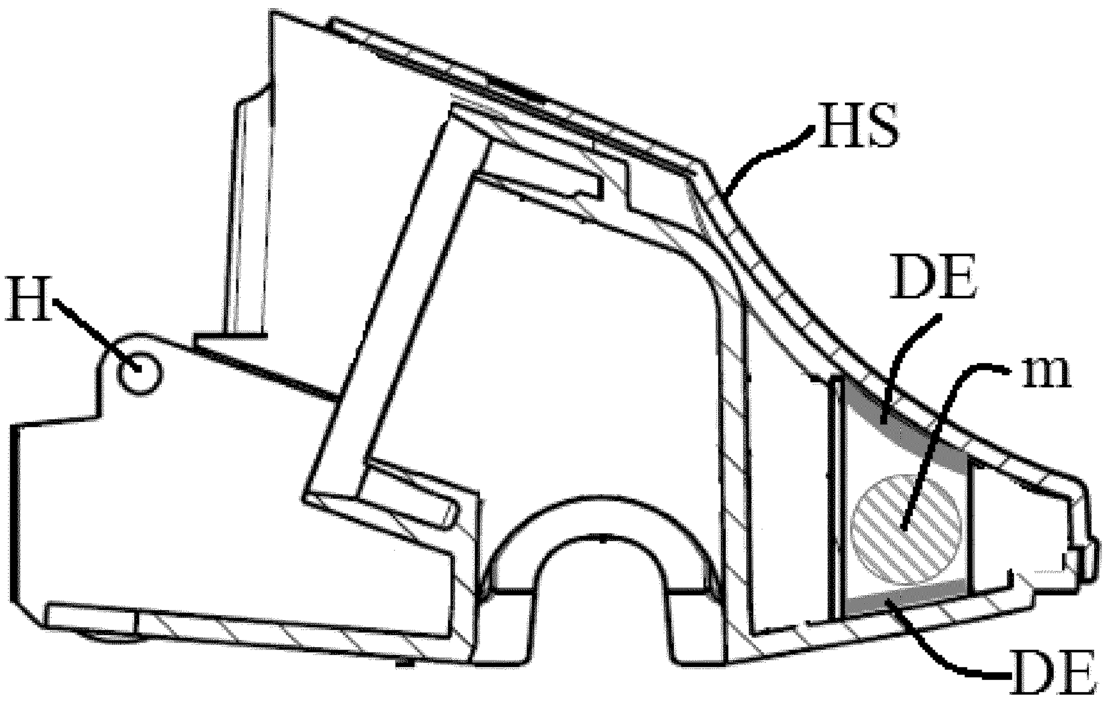

Fig. 3A

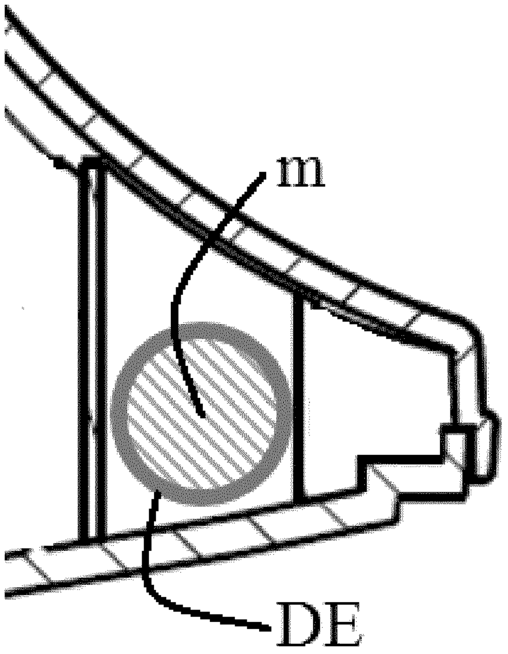

Fig. 3B

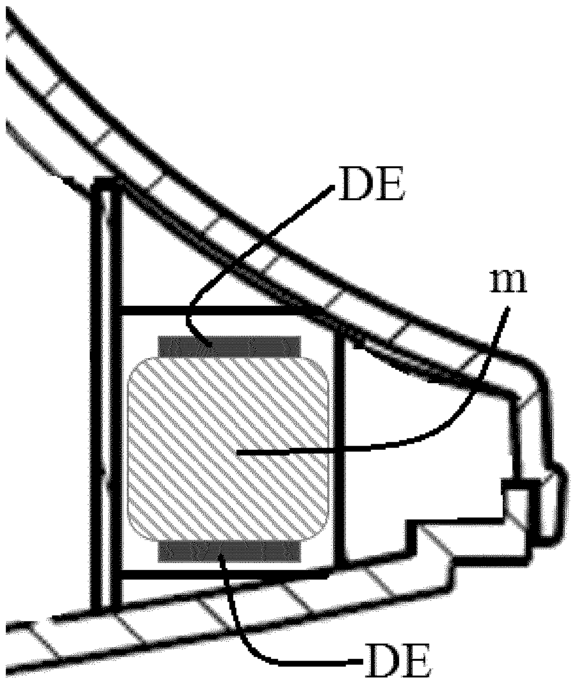

Fig. 3C

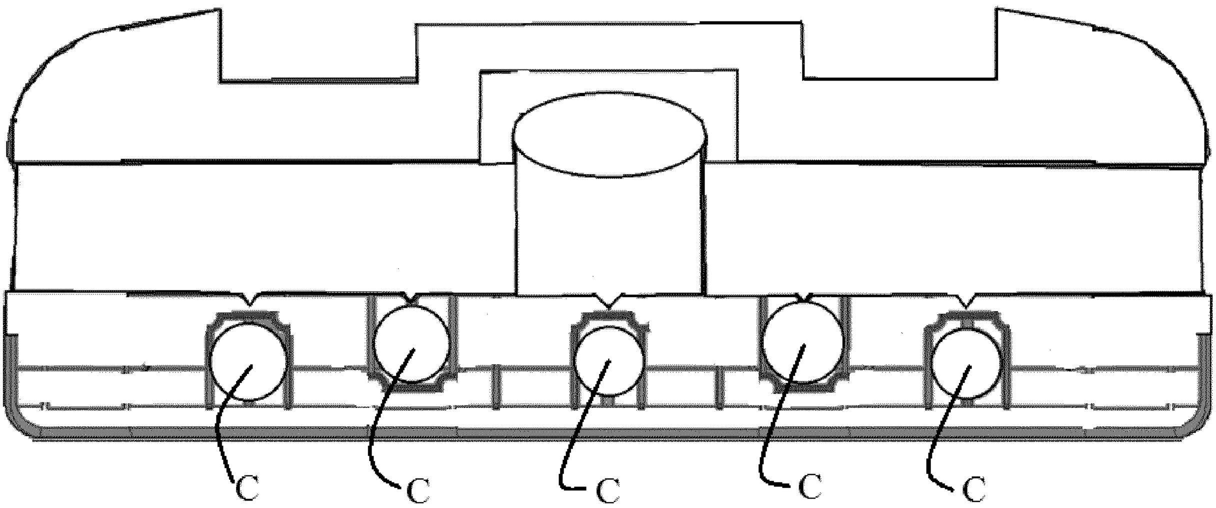

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 16 16 2190

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 A	GB 910 697 A (SIEMENS ELEKTROGERAETE GMBH) 14 November 1962 (1962-11-14) * page 1, line 57 - page 2, line 56; figures 1-4 *	1,5,6,9 2-4,7,8	INV. A47L9/02
X A	US 2 858 560 A (BODINE JR ALBERT G) 4 November 1958 (1958-11-04) * column 2, line 13 - column 3, line 51; figure 4 *	1-3,9 4-8	
X A	DE 15 03 919 A1 (WESSEL HANS [DE]) 5 November 1970 (1970-11-05) * page 3, line 13 - page 8, line 25; figures 1-7,10,11 *	1,5,6,9 2-4,7,8	

TECHNICAL FIELDS SEARCHED (IPC)

A47L

The present search report has been drawn up for all claims

2

Place of search	Date of completion of the search	Examiner
Munich	2 September 2016	Blumenberg, Claus

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 16 2190

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02-09-2016

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