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### (54) VACUUM CLEANER UNIT

(57) In a vacuum cleaner unit (N) comprising a suction opening (O), an agitator (Ai) is provided in the suction opening (O). The agitator (Ai) has a rotation axis (RA) that is perpendicular to a surface to be cleaned, or at an angle to the surface between 90° and 45°. Preferably, there are multiple agitators. Preferably, at least one of the agitators (Ai) has a rotation direction that differs from

a rotation direction of at least another one of the agitators. Preferably, neighboring agitators (Ai) are interdigitated. Advantageously, the suction opening (O) has a front rim (FR) and a rear rim (RR), and the agitator (Ai) touches a surface to be cleaned at a position that is closer to the front rim (FR) than to the rear rim (RR).

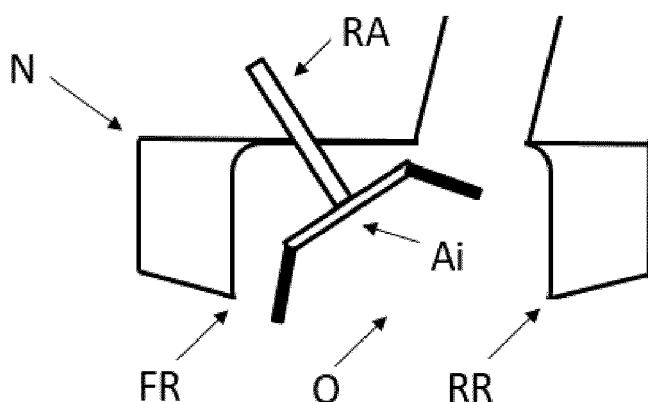


Fig. 2

**Description****FIELD OF THE INVENTION**

**[0001]** The invention relates to a vacuum cleaner unit, e.g. a vacuum cleaner nozzle or a robot vacuum cleaner.

**BACKGROUND OF THE INVENTION**

**[0002]** US9414729B2 discloses a robotic vacuum cleaner includes a driving mechanism, a fan, an electronic control, sweeping brushes and a housing with a front side extending in the transverse direction and a longitudinal direction perpendicular thereto. An underside of the housing has a suction opening that extends in the transverse direction. At least four sweeping brushes are provided, where at least two of the four sweeping brushes are disposed on each side of the suction opening such that at least one subregion of the suction opening remains free from sweeping brushes, as viewed from the front side. The at least two of the four sweeping brushes provided on each of the two sides of the suction opening are driven in an identical direction of rotation. In addition, a brush roller may be mounted in the suction opening so as to be horizontally rotatable. This brush roller is used to additionally loosen dirt from the floor so that this dirt is captured and carried along by the intake air flow.

**SUMMARY OF THE INVENTION**

**[0003]** It is, inter alia, an object of the invention to provide an improved vacuum cleaner unit. The invention is defined by the independent claims. Advantageous embodiments are defined in the dependent claims.

**[0004]** One aspect of the invention provides a nozzle developed for optimal carpet cleaning. The nozzle is provided with (substantially) vertically oriented rotating agitators. The agitators open the piles of the carpet so that dust can be sucked out and dust particles are able to become brushed out of the piles. The carpet agitators are placed directly next to the front rim of the soft floor nozzle. This is done so that pile agitators and air flow are at the same spot. This combination of pile agitators and air flow provides a thorough carpet cleaning. In a robot vacuum cleaner, the agitator(s) can be placed in the suction opening of the robot vacuum cleaner to obtain the advantages of the present invention.

**[0005]** In accordance with another aspect, the agitators (e.g. brushes) are inside the suction cavity. Thereby, the carpet is flicked where the air flow is at its best, and then due to better flicking and multi-directional flicking and better air flow, dust pick-up is improved.

**[0006]** Preferably, the agitators are close to a front rim of the suction cavity so that pile activation and air flow are at the same spot. The agitators may rotate in alternating directions. Neighboring agitators may be interdigitated. The rim may be slanted and then horizontal or sharp.

**[0007]** These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

5 **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0008]**

10 Figs. 1A and 1B show a bottom view of a floor care nozzle in accordance with an embodiment of the invention; and  
Fig. 2 shows a cross-section of a floor care nozzle in accordance with an embodiment of the invention.

15 **DESCRIPTION OF EMBODIMENTS**

**[0009]** Figs. 1A and 1B show a bottom view of a floor care nozzle N in accordance with an embodiment of the invention, and Fig. 2 shows a cross-section of that floor care nozzle. The nozzle has a suction opening O, and a plurality of agitators Ai in the suction opening O. In the example of Fig. 1A, the nozzle has 4 agitators A1 - A4; other numbers (like 1, 3 or 5) are alternatively possible. The agitators Ai have respective rotation axes RA. In one embodiment, the rotation axes RA are vertical (i.e. perpendicular to a surface to be cleaned), while in other embodiments the rotation axes RA are at an angle to the vertical between 0° and 45° (i.e. at an angle between 90° and 45° to the surface). The rotation axes RA of the agitators Ai are driven by a motor (not shown). The agitators Ai may all rotate in the same direction, but in the example of Fig. 1A, preferably at least one of the agitators Ai has a rotation direction that differs from a rotation direction of at least another one of the agitators. For example, the odd-numbered agitators A1, A3 rotate clockwise, while the even-numbered agitators A2, A4 rotate counterclockwise. Alternatively, the agitators A1, A2 to the left of the center of the suction opening O rotate clockwise, while the agitators A3, A4 to the right of the center of the suction opening O rotate counterclockwise.

**[0010]** The suction opening O has a front rim FR and a rear rim RR. The agitators Ai touch a surface to be cleaned at a position that is closer to the front rim FR than to the rear rim RR. The notions front rim FR and rear rim RR are defined with regard to a forward movement direction, to the left in Fig. 2, and away from a user in a manually operated vacuum cleaner.

**[0011]** Embodiments of the invention provide a soft-floor nozzle N for optimal carpet cleaning. A traditional passive soft-floor nozzle and a traditional turbo-brush soft-floor nozzle agitate the piles of the carpet in one direction, viz. the direction of movement. The nozzle of embodiments of this invention is provided with (substantially) vertically oriented rotating agitators Ai so that the piles of the carpet are agitated at substantially 90° compared to the movement direction.

**[0012]** The rims FR, RR in the nozzle N agitate the piles in the movement direction of the nozzle N. This

makes that the nozzle N agitates the piles in two directions at the same time, which increases the dust pick up on the soft-floor. The rim FR and the driven agitators Ai open the piles of the carpet so dust can be sucked out and dust particles are able to become brushed out of the piles. The carpet agitators Ai can e.g. be brushes or rubber.

**[0013]** In a preferred embodiment, the carpet agitators Ai are placed directly next to the front rim FR of the soft-floor nozzle N. This is done so that pile agitation and air flow are at the same spot. This combination of pile agitators and air flow provides a thorough carpet cleaning. In a conventional turbo brush, there is always a horizontal distance between the front rim FR and the ends of the rotating brush that hits the piles. In accordance with preferred embodiments of the invention, the incoming airflow enters the nozzle N at the same location where the carpet activators Ai work. This increases the dust pick up compared to the traditional turbo brush nozzle.

**[0014]** Fig. 1B shows a preferred embodiment in which neighboring agitators A1 - A5 are positioned closer to one another than in the embodiment of Fig. 1A, in such a manner that neighboring agitators are interdigitated. This allows for a higher number of agitators (e.g. 5 instead of 4) to be placed in the suction opening O, thereby improving the dirt pick-up performance.

**[0015]** 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. Measures recited in mutually different dependent claims may advantageously be used in combination.

## Claims

1. Vacuum cleaner unit (N), comprising:

a suction opening (O);  
an agitator (Ai) in the suction opening (O), the agitator (Ai) having a rotation axis (RA) that is 50 perpendicular to a surface to be cleaned, or at an angle to the surface between 90° and 45°.

2. Vacuum cleaner unit (N) as claimed in claim 1, wherein there are multiple agitators (Ai), and at least 55 one of the agitators (Ai) has a rotation direction that differs from a rotation direction of at least another one of the agitators (Ai).

3. Vacuum cleaner unit (N) as claimed in claim 1, wherein there are multiple interdigitated agitators (Ai).

5 4. Vacuum cleaner unit as claimed in any of the preceding claims, wherein the suction opening (O) has a front rim (FR) and a rear rim (RR), and the agitator (Ai) touches a surface to be cleaned at a position that is closer to the front rim (FR) than to the rear rim (RR).

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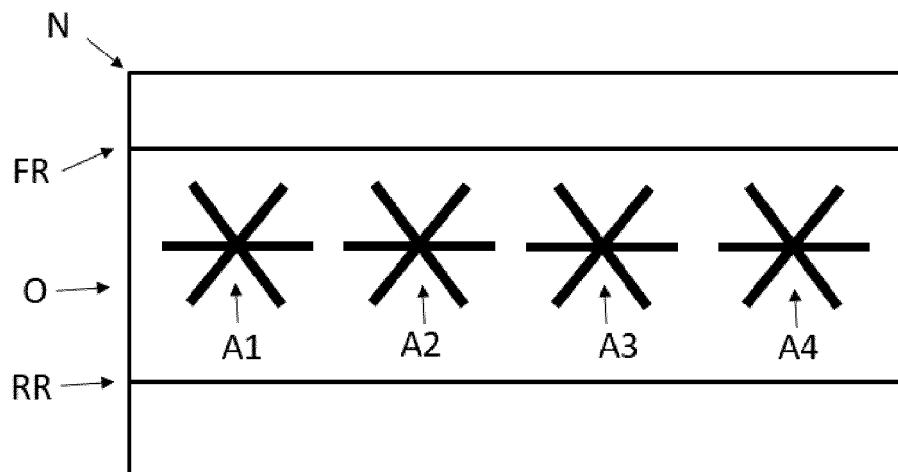


Fig. 1A

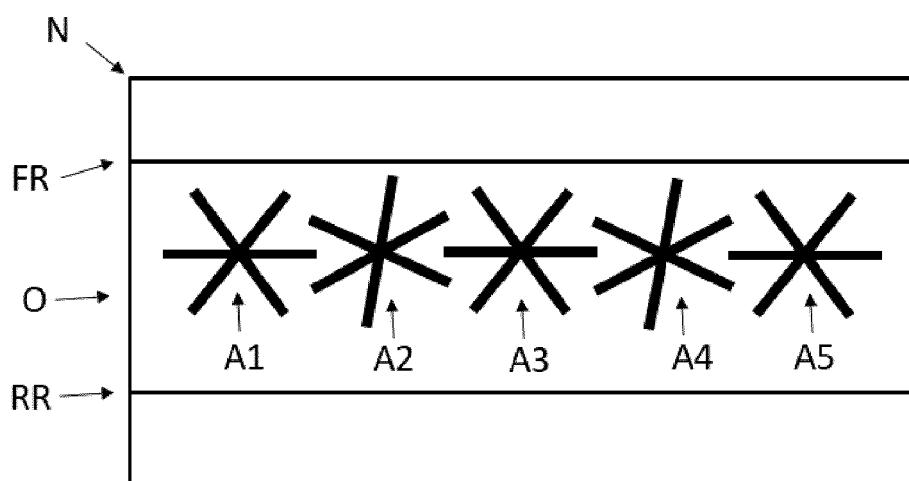


Fig. 1B

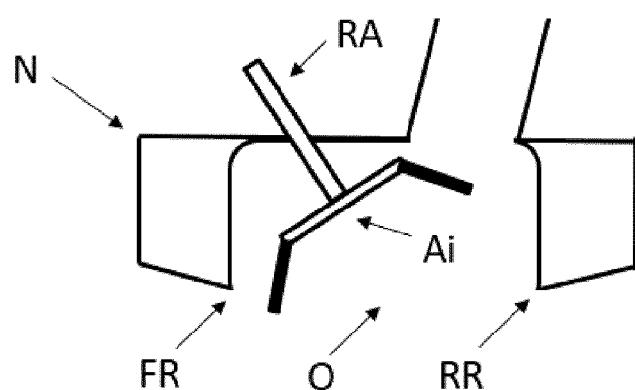


Fig. 2



## EUROPEAN SEARCH REPORT

Application Number

EP 18 18 2380

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50 1	The present search report has been drawn up for all claims		
55	Place of search Munich	Date of completion of the search 8 January 2019	Examiner Eckenschwiller, A
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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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