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(54) **SURFACE CLEANING UTENSIL**

(57) Surface cleaning utensil, comprising a wet cleaning unit (WCU) having a wetting unit (WP) and a brush unit (BU) for brushing a surface wetted by the wetting unit (WP), the brush unit (BU) having a brush (B) having a plurality of brush elements (BE) (e.g. bristles) at an angle of at least 45°, and preferably at least 70°, to a surface to be cleaned, and a driving unit for driving the brush to move in a plane at an angle of at most 45°, and preferably at most 20°, to the surface. Preferably, the brush unit (BU) comprises a plurality of rotating brushes (B) having a rotation axis at an angle of at least 45°, and preferably at least 70°, to the surface to be cleaned, wherein at least 50% of an area defined by a circumfer-

ence of each brush (B) is provided with brush elements (BE). Preferably, adjacent brushes (B) have opposite rotation directions. Preferably, the brushes (B) comprise gear-shaped elements (G). Preferably, the driving unit is arranged for causing a translational movement of the brush (B) with respect to the surface cleaning utensil. Preferably, the wet cleaning unit further comprises a drying pad (DP), the brush unit (BU) being positioned between the wetting unit (WP) and the drying pad (DP). Preferably, the surface cleaning utensil further comprises an air inlet (N) located before the wet cleaning unit (WCU) in a motion direction of the surface cleaning utensil.

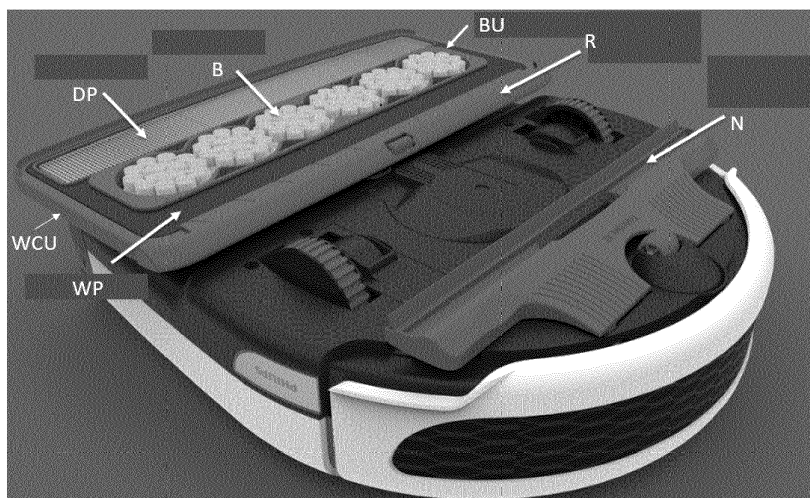


Fig. 1

## Description

### FIELD OF THE INVENTION

**[0001]** The invention relates to a surface cleaning utensil, such as a robot (vacuum) cleaner or a nozzle for a canister or stick vacuum cleaner. In case of a nozzle, the invention also relates to a vacuum cleaner provided with the nozzle.

### BACKGROUND OF THE INVENTION

**[0002]** Surface cleaning utensils having a rotating brush are known, see e.g. EP2395894 (attorneys' docket 2008PF01877). In this prior art document, the brush has a rotation axis parallel to the surface to be cleaned.

**[0003]** US9414729 discloses a robotic vacuum cleaner that 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 sub-region 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 an embodiment of a sweeping brush, the bristles are mounted on the underside of a sweeping disk.

### SUMMARY OF THE INVENTION

**[0004]** It is, inter alia, an object of the invention to provide an improved surface cleaning utensil. The invention is defined by the independent claims. Advantageous embodiments are defined in the dependent claims.

**[0005]** One aspect of the invention provides a surface cleaning utensil, comprising a wet cleaning unit having a wetting unit and a brush unit for brushing a surface wetted by the wetting unit, the brush unit having brush having a plurality of brush elements (e.g. bristles) substantially perpendicular, i.e. at an angle of at least 45°, and preferably at least 70°, to a surface to be cleaned, and a driving unit for driving the brush to move in a plane substantially parallel, i.e. at an angle of at most 45°, and preferably at most 20°, to the surface. Embodiments of such a surface cleaning utensil are particularly suitable for cleaning stains on the surface to be cleaned.

**[0006]** Preferably, the brush unit comprises a plurality of rotating brushes having a rotation axis at an angle of at least 45°, and preferably at least 70°, to the surface to be cleaned, wherein at least 50% of an area defined by a circumference of each brush is provided with brush elements. Preferably, adjacent brushes have opposite rotation directions. Preferably, the brushes comprise

gear-shaped elements. Preferably, the driving unit is arranged for causing a translational movement of the brush with respect to the surface cleaning utensil. Preferably, the wet cleaning unit further comprises a drying pad, the brush unit being positioned between the wetting unit and the drying pad. Preferably, the surface cleaning utensil further comprises an air inlet located before the wet cleaning unit in a motion direction of the surface cleaning utensil.

**[0007]** Another aspect of the invention provides a vacuum cleaner, comprising a nozzle formed by such a surface cleaning utensil, a suction unit for generating an air flow through the air inlet, and a dirt separation unit for separating dirt from the air flow.

**[0008]** 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

#### [0009]

Fig. 1 shows an embodiment of a surface cleaning utensil in accordance with the present invention;

Fig. 2 shows an embodiment of a brush unit for use in a surface cleaning utensil in accordance with the present invention; and

Fig. 3 shows adjacent brushes having gear-shaped elements.

### DESCRIPTION OF EMBODIMENTS

**[0010]** Fig. 1 shows an embodiment of a surface cleaning utensil in accordance with the present invention. The embodiment is a robot vacuum cleaner having an air inlet at the front, formed by a vacuuming nozzle N. The embodiment further comprises a brush unit BU comprising a plurality of adjacent brushes B each having multiple brush elements. Preferably, the adjacent brushes B do not leave gaps between adjacent brushes.

**[0011]** In this embodiment, the brush unit BU is part of a wet cleaning unit WCU that further comprises a wetting unit WP formed by a wetting pad. The wet cleaning unit WCU may include a drying pad DP. In this embodiment, the wetting pad WP is before the brush unit BU, while the drying pad DP is behind the brush unit BU, so that the brushes B act on a surface that has been wetted by the wetting pad WP. The surface may alternatively be wetted by a wetting unit WP that sprays a cleaning fluid on the surface and/or on the brush B.

**[0012]** The wetting pad WP and the drying pad DP are preferably made as described in WO2018/153706 (attorneys' reference 2017P01665WO), incorporated herein by reference, which also describes a single tank that can be simultaneously used for clean water and dirty water, which single tank is preferably used in the surface cleaning utensil of the present invention.

**[0013]** In this embodiment, the brushes B rotate. They

may rotate in a continuous rotation. Alternatively, they may regularly reverse the rotation direction. Adjacent brushes B may have opposite rotation directions. While each brush B may be driven by a separate motor, it is alternatively possible that only one or two motors are used for driving the brush unit BU, while the other brushes B are driven by gears, e.g. as shown in Fig. 3, which shows adjacent brushes B having gear-shaped elements G. In the embodiment of Fig. 2, it would be possible that only brushes B2 and B5 are directly driven by respective motors, while the rotation of the other brushes B1, B3, B4, B6 results from the gear-shaped elements G. The rotation speed is preferably at least 100, and more preferably at least 800, rotations per minute. In an embodiment, each brush B has at least 10,000 nylon bristles BE, e.g. at least 15,000. The length of the bristles BE is preferably between 3 and 5 mm, e.g. 4.2 mm.

**[0014]** It is additionally or alternatively possible that the brushes B are driven to carry out a translational movement compared to the surface cleaning utensil, e.g. by a laterally moving magnet. Preferably, the magnets result in an oscillation frequency of at least 100 Hz.

**[0015]** In this embodiment, the brushes B have respective rotation axes substantially vertical to the surface to be cleaned, i.e. each rotation axis is at an angle of less than 45°, and preferably less than 30°, from an angle perpendicular to a surface to be cleaned.

**[0016]** In this embodiment, each brush B has a plurality of brush elements BE substantially parallel to the rotation axis. Herein, substantially parallel allows for a small deviation of up to 30°, and preferably not more than 20°. The brush elements BE may be bristles, like shown in Fig. 3, or they may have a shape like shown in Fig. 1.

**[0017]** In this embodiment, a front end of the wet cleaning unit WCU has a ramp R for thresholds to easier cope with thresholds. For the same reason, also a front end of the vacuuming nozzle N is slanted.

**[0018]** Fig. 2 shows an embodiment of a brush unit BU for use in a surface cleaning utensil in accordance with the present invention, having 6 adjacent brushes B1, B2, B3, B4, B5 and B6 mounted at distances less than the maximum diameter of each brush.

**[0019]** Another aspect of the invention provides a vacuum cleaner, comprising a nozzle formed by a surface cleaning utensil having a wet cleaning unit with a plurality of brushes as described above, and an air inlet, a suction unit (e.g. a fan) for generating an air flow through the air inlet, and a dirt separation unit (e.g. a cyclone or dust bag) for separating dirt from the air flow.

**[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. The brush may have a rectangular shape, e.g. when it is only subject to a translation movement. If a control unit inside the robot cleaner is able to recognize the presence, and preferably also the severity of stains on the surface to be cleaned, the

driving unit can be controlled in dependence of the result of this recognition. 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.

## 15 Claims

1. Surface cleaning utensil, comprising a wet cleaning unit (WCU) having a wetting unit (WP) and a brush unit (BU) for brushing a surface wetted by the wetting unit (WP, the brush unit (BU) having
  - a brush (B) having a plurality of brush elements at an angle of at least 45°, and preferably at least 70°, to a surface to be cleaned, and
  - a driving unit for driving the brush (B) to move in a plane at an angle of at most 45°, and preferably at most 20°, to the surface.
2. Surface cleaning utensil as claimed in claim 1, wherein the brush unit (BU) comprises a plurality of rotating brushes (B) having a rotation axis at an angle of at least 45°, and preferably at least 70°, to the surface to be cleaned, wherein at least 50% of an area defined by a circumference of each brush (B) is provided with brush elements (BE).
3. Surface cleaning utensil as claimed in any of the preceding claims, wherein adjacent brushes (B) have opposite rotation directions.
4. Surface cleaning utensil as claimed in claim 3, wherein the brushes (B) comprise gear-shaped elements (G).
5. Surface cleaning utensil as claimed in any of the preceding claims, wherein the driving unit is arranged for causing a translational movement of the brush (B) with respect to the surface cleaning utensil.
6. Surface cleaning utensil as claimed in any of the preceding claims, wherein the wet cleaning unit (WCU) further comprises a drying pad (DP), the brush unit (BU) being positioned between the wetting unit (WP) and the drying pad (DP).
7. Surface cleaning utensil as claimed in any of the preceding claims, further comprising an air inlet (N) located before the wet cleaning unit (WCU) in a motion direction of the surface cleaning utensil.

8. Vacuum cleaner, comprising a nozzle formed by a surface cleaning utensil as claimed in claim 7, a suction unit for generating an air flow through the air inlet, and a dirt separation unit for separating dirt from the air flow.

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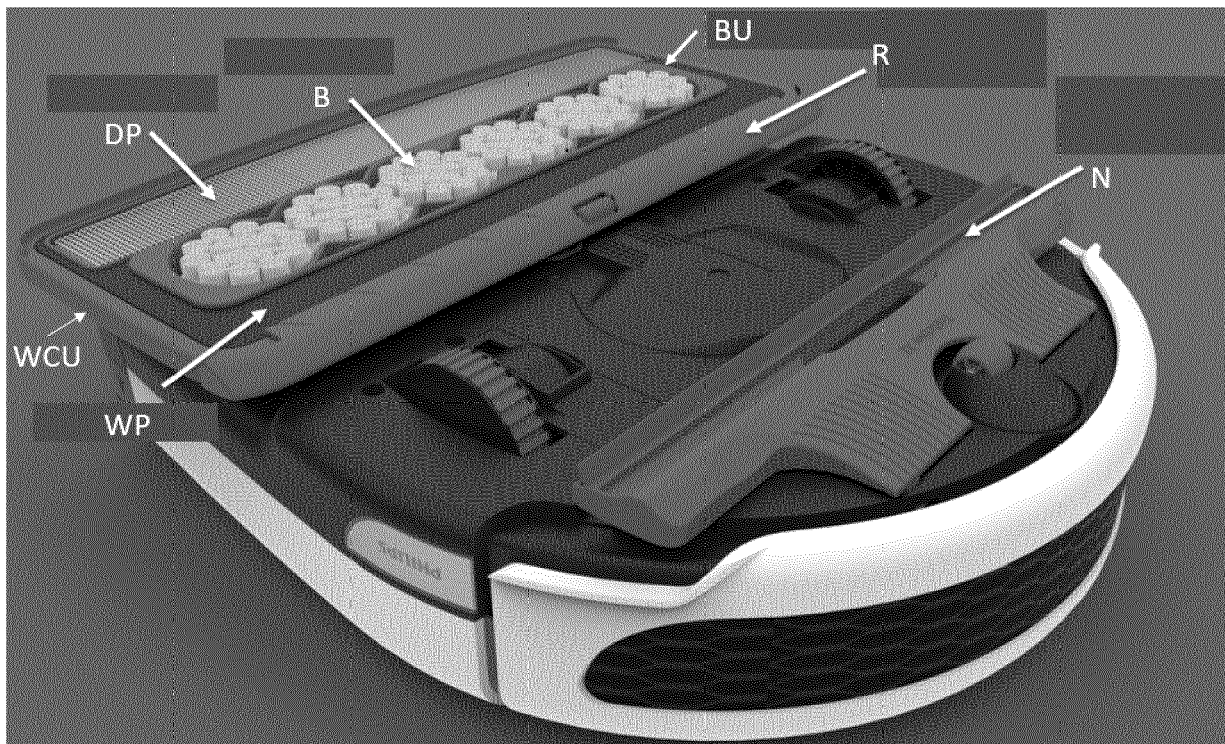


Fig. 1

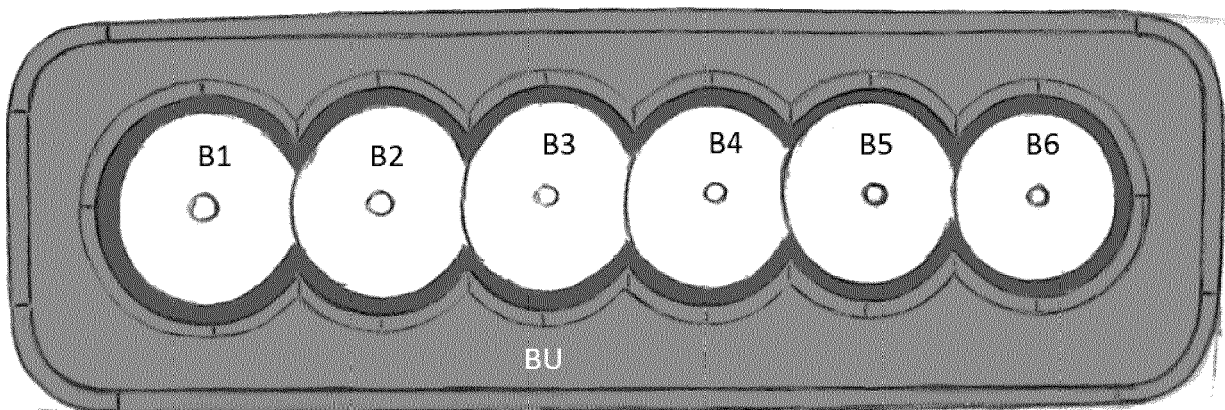


Fig. 2

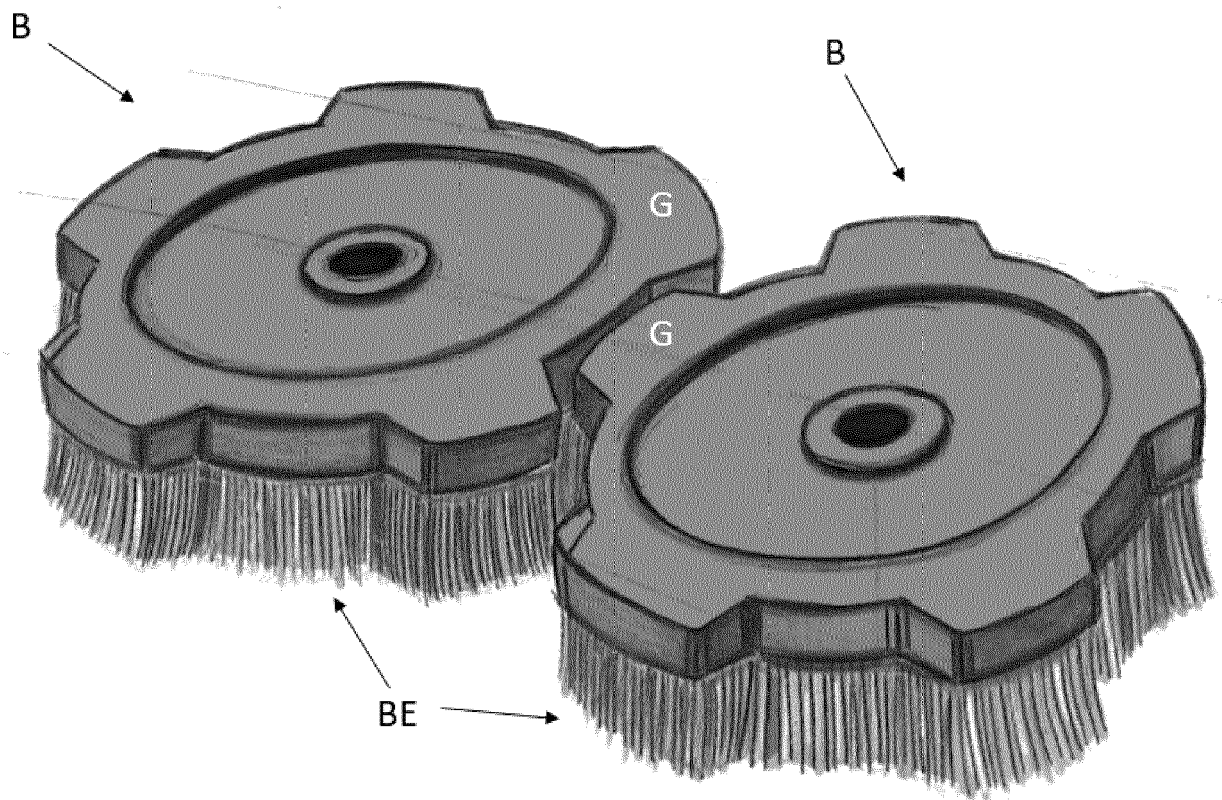


Fig. 3



## EUROPEAN SEARCH REPORT

 Application Number  
 EP 19 15 2057

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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 A	WO 2018/162091 A1 (ALFRED KAERCHER SE & CO KG [DE]) 13 September 2018 (2018-09-13) * page 12, last paragraph - page 26, line 8; figures 1-8 *	1 5,6	INV. A47L11/40
X Y A	US 4 041 567 A (BURGOON JACK L) 16 August 1977 (1977-08-16) * abstract; figures 1-10 *	1-3,7,8 4 5,6	
X Y A	US 2009/263177 A1 (JORDAN TODD A [US]) 22 October 2009 (2009-10-22) * abstract; figures 1-7 *	1-3 4 5,6	
X Y	US 3 082 451 A (SMITHSON CHARLES B) 26 March 1963 (1963-03-26) * abstract; figures 1-8 *  EP 0 254 833 A1 (IDROPLINA SRL [IT]) 3 February 1988 (1988-02-03) * abstract; figures 1-3 *	1 4	TECHNICAL FIELDS SEARCHED (IPC) A47L
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 June 2019	Examiner Hubrich, Klaus
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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 EPO FORM 1503 03.82 (P04C01)

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

EP 19 15 2057

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
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28-06-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2018162091 A1	13-09-2018	WO 2018162091 A1	13-09-2018
		WO 2018162092 A1	13-09-2018
US 4041567 A	16-08-1977	NONE	
US 2009263177 A1	22-10-2009	NONE	
US 3082451 A	26-03-1963	NONE	
EP 0254833 A1	03-02-1988	AT 66121 T	15-08-1991
		DE 3772124 D1	19-09-1991
		EP 0254833 A1	03-02-1988
		ES 2025089 B3	16-03-1992
		GR 3002499 T3	30-12-1992
		IT 207992 Z2	14-03-1988
		US 4771498 A	20-09-1988



**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- EP 2395894 A [0002]
- US 9414729 B [0003]
- WO 2018153706 A [0012]