(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
01 December 2022 (01.12.2022)

WIPO | PCT

(10) International Publication Number
WO 2022/248257 A1

(51) International Patent Classification:
A47L 9/04 (2006.01) *A46B 17/06* (2006.01)

(21) International Application Number:
PCT/EP2022/063084

(22) International Filing Date:
13 May 2022 (13.05.2022)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
21175995.6 26 May 2021 (26.05.2021) EP

(71) Applicant: **KONINKLIJKE PHILIPS N.V.** [NL/NL]; High Tech Campus 52, 5656 AG Eindhoven (NL).

(72) Inventors: **FERMÍN ESPÍN, Franco**; High Tech Campus 42, 5656 AE Eindhoven (NL). **BRADA, IJpe Bernardus**; High Tech Campus 42, 5656 AE Eindhoven (NL).

(74) Agent: **DE VRIES, Janna**; High Tech Campus 42, 5656 AE Eindhoven (NL).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,

(54) **Title:** WET VACUUM CLEANER, A CLEANING TRAY AND A CLEANING METHOD

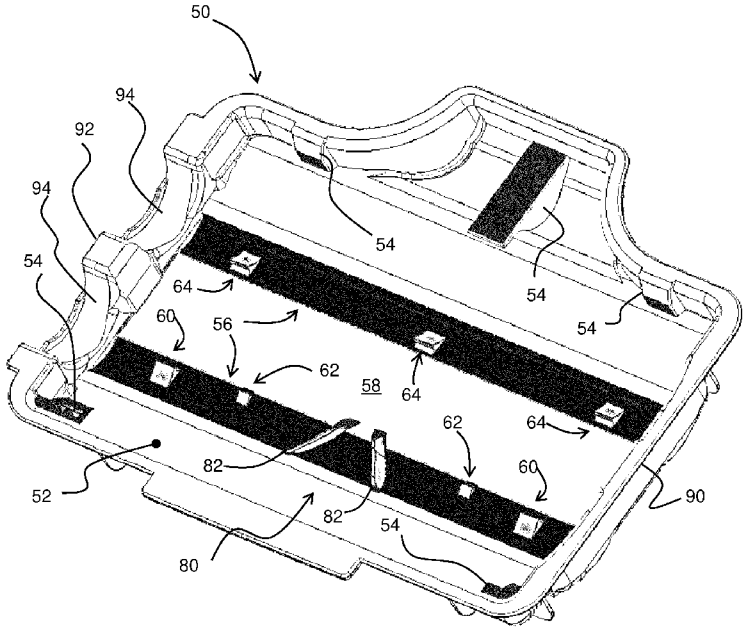


FIG. 4

(57) **Abstract:** The invention provides a cleaning tray for a wet floor cleaner, for receiving a head of the wet floor cleaner. The cleaning tray has at least one brush channels for receiving a bottom portion of an outer circumference of a roller brush. At least one raised projection is positioned along the brush channel having an upstream ramp surface and a steeper downstream ramp surface. The projection adds turbulence for improving the cleaning results as well as enabling control of the flow of cleaning liquid around the brush and the cleaning tray, to ensure full soaking of the brush as well as cleaning of all of the area of the cleaning tray itself. The invention also provides a cleaning method which may use the cleaning tray.

WO 2022/248257 A1

[Continued on next page]

EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

— *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

WET VACUUM CLEANER, A CLEANING TRAY AND A CLEANING METHOD

FIELD OF THE INVENTION

This invention relates to a wet vacuum cleaner, in particular it relates to the cleaning of roller brushes used in the head of a wet vacuum cleaner.

BACKGROUND OF THE INVENTION

Wet vacuum cleaners are known in which the cleaning head (often known as the "nozzle") has two counter-rotating brushes. Suction is applied at least to the space between the brushes to draw up liquid from the floor that has been delivered to the floor by the vacuum cleaner. The brushes contact the floor to perform a scrubbing action.

Wet vacuum cleaners are hard to clean after use. Cleaning after use is a prerequisite to avoid bacterial growth and unpleasant odors after use. The user perceives both as unhygienic.

To overcome this problem some wet vacuum cleaners are equipped with a cleaning tray that is used to rinse the appliance after use. For example, EP2672872 discloses a tray to clean the roller brush of a wet vacuum cleaner.

Most known wet vacuum cleaners are connected to mains power. In battery driven appliances, the known use of a tray would not work well because the available suction power is not sufficient to achieve an acceptable cleaning result.

There is therefore a need for an improved wet vacuum cleaning tray, in particular that can be used for a battery-driven appliance. There is also a need for an improved cleaning result of the appliance as well as from the tray.

SUMMARY OF THE INVENTION

The invention is defined by the claims.

According to examples in accordance with an aspect of the invention, there is provided a cleaning tray of a wet floor cleaner, adapted to receive a head of the wet floor cleaner, the head comprising a roller brush, the cleaning tray comprising:

a base for supporting the head;

a brush channel formed in the base for receiving a bottom portion of an outer circumference of the roller brush;

at least one raised projection positioned along the brush channel which is for projecting into the roller brush when the cleaning tray is used, wherein the raised projection comprises an upstream ramp surface positioned such that the outer circumference of the roller brush rides up the upstream ramp surface when rotated and a downstream ramp surface, wherein the downstream ramp surface is steeper than the upstream ramp surface; and

a suction area faced by the downstream ramp surface.

This cleaning tray has at least one brush channel to receive a roller brush. There is at least one projection which functions as a turbulence introducing element. The turbulence provides improved mixing of debris with cleaning liquid so that debris can be more effectively removed during a cleaning cycle when using the cleaning tray. The rotation of the roller brush creates an under pressure at the location of the downstream ramp surface, thereby drawing cleaning liquid towards it. This enables the efficient transport of the cleaning liquid within the tray, in particular so that the whole of the roller brush (as well as the whole area of the cleaning tray) is subjected to a cleaning liquid flow in use. The under pressure is enhanced because the outer circumference of the roller brush may not make contact with the downstream ramp surface due to the rotational speed, and the inertia of the tufts, preventing them from immediately deforming radially outwardly to the location of the downstream ramp surface. Thus, a cavity is formed behind the downstream ramp surface, creating under pressure.

Note that "upstream" and "downstream" relate to the rotation of the roller brush, i.e. a rotating roller brush circumference meets the upstream surface first.

The upstream ramp surface is preferably a smooth ramp. It may be straight or concave or convex, or may have multiple sections each of different convex, concave or straight shape. It does not present a barrier to cleaning liquid flow and hence does not block the passage of cleaning liquid being carried by the roller brush, but provides a guide surface. The transition between the upstream and downstream ramp surfaces in particular introduces the turbulence.

The cleaning tray for example comprises a set of raised projections each having an upstream ramp surface and a downstream ramp surface.

The use of multiple raised projections enables the cleaning liquid flow around the roller brush and the cleaning tray to be controlled to ensure cleaning of the entire surface of the roller brush, by preventing the collection of cleaning liquid (which is for example delivered by the head of the wet floor cleaner) only in localized areas of the roller brush.

By way of example, there may be a projection near each end of the brush channel, hence near the four corners of the cleaning tray if there are two brush channels. There may additionally be projections at intermediate positions along the brush channels.

The, or each, raised projection for example has:

a height in the range 1mm to 10mm; and/or

a length, parallel to a length of the brush channels, in the range 1mm to 50mm.

This height is measured from the bottom of the brush channel. Even a relatively small projection is able to create sufficient turbulence to improve the collection of debris from the roller brush during cleaning.

The, or each, raised projection for example has an apex at the junction between the upstream and downstream ramp surfaces, with an angle of 90 degrees or more.

This rapid change in direction of a surface over which the roller brush is driven, creates the desired turbulence and under pressure.

The apex for example has a radius of curvature of less than 2mm.

A sharp corner creates a sudden change in the flow area, thereby introducing significant turbulence to the flow.

The brush channel may comprise a set of two or more raised projections. The projections may be distributed along the length of the roller brush, for example including near the ends, to provide a turbulent cleaning effect along their length.

The brush channel for example comprises a set of two or more raised projections, wherein there are at least two different shapes of raised projection within the set. Using different designs of projection enables the desired flow patterns to be controlled more accurately. Different shapes of projections may have different width and/or height.

The cleaning tray may further comprise, in the brush channel, a flow guide which provides a flow path across the brush channel to the suction area.

The flow guide provides additional control of the cleaning liquid flow around the tray and in particular it assists in steering the cleaning liquid to the corners of the tray when there is a large amount of cleaning liquid present. At the end of a cleaning cycle, when there is a small amount of cleaning liquid, it also assists in directing the remaining amount of cleaning liquid to the center of the tray where the cleaning liquid will be picked up by a suction airflow. Thus, the flow guide further assists in obtaining a clean and dry tray.

The flow guide for example comprises two lateral side projections which become closer together along the flow path.

Thus, the flow guide defines a narrowing channel towards the suction area. The side projections for example have a height in the range 1mm to 6mm.

The two lateral side projections for example form part of a V-shape with an apex angle in the range 40 to 120 degrees.

The cleaning tray may comprise opposite side walls, wherein one of the side walls has an openings (or pair of openings) through which the roller brush (or both roller brushes) may be received laterally parallel to their axes of rotation.

This enables removal of the brush or brushes from the cleaning head and then from the cleaning tray, after cleaning has finished, with the cleaning head remaining in the cleaning tray. The roller

brush (or brushes) may then be exposed to ambient air to dry fully, and the openings also allow air flow around the cleaning head to dry fully.

The cleaning tray is for example adapted to receive a head of a wet floor cleaner which comprises a pair of roller brushes, wherein the cleaning tray comprises a pair of brush channels, and the suction areas is between the pair of brush channels.

The invention also provides a wet floor cleaner comprising:

a cleaning head comprising:

a housing;

at least one rotary brush extending across a width of the housing; and

a suction channel for delivering suction to at least a space adjacent the at least one rotary brush;

a pump for delivering suction to the suction channel of the cleaning head;

a delivery system for delivering cleaning liquid to the cleaning head; and

the cleaning tray as defined above

The delivery system may be a second pump which is part of the cleaner, or there may be a separate external fluid supply. In the latter case, the delivery system is a conduit for receiving cleaning liquid from the external fluid supply and routing it to the cleaning head.

The cleaning head for example further comprises a support wheel arrangement for mounting the housing at a minimum spacing over the floor to be cleaned. For a system with two rotary brushes, a drive arrangement is also provided for driving the first and second rotary brushes in opposite rotation directions.

The invention also provides a method of cleaning a roller brush of a cleaning head of a wet floor cleaner, when the cleaning head is fitted to a cleaning tray, the cleaning head comprising at least one rotary brush and suction channel for delivering suction to at least a space adjacent the at least one rotary brush, the method comprising:

in a start cycle:

delivering a relatively large volume of cleaning liquid to the cleaning head and driving the roller brush at a relatively slow rotational speed with no delivered suction; and

delivering a relatively small volume of cleaning liquid to the cleaning head and driving the roller brush at a relatively fast rotational speed and applying a first level of suction;

in a middle cycle:

delivering a relatively large volume of cleaning liquid to the cleaning head and driving the roller brush at a relatively slow rotational speed with no delivered suction;

delivering a relatively small volume of cleaning liquid to the cleaning head and driving the roller brush at a relatively fast rotational speed with no delivered suction; and

delivering a relatively small volume of cleaning liquid to the cleaning head and driving the roller brush at a relatively fast rotational speed and applying a second level of suction lower than the first level of suction; and

in an end cycle:

delivering a maximum volume of cleaning liquid to the cleaning head and driving the roller brush at a relatively slow rotational speed with no delivered suction; and

driving the roller brush at a relatively fast rotational speed and applying the suction with no delivered cleaning liquid.

Note that the terms "relatively large", "relatively small", "relatively slow" and "relatively fast" refer to the individual cycles. For example, the "relatively large volume" in the middle cycle does not have to be the same "relatively large volume" as used in the start cycle. It only needs to be larger than the "relatively small volume" of the middle cycle.

This method provides a three cycle cleaning method. The first cycle uses low speed rotation and a large amount of cleaning liquid (e.g. water) to soak the brush. A large suction and high roller drive speed is used to remove the residue without spreading dirt in the tray. This may be thought of as a pre-wash which removes coarse dirt.

The middle cycle has a spinning period with no suction and only a small amount of cleaning liquid, to spin dirt out from the brush.

The end cycle delivers the most cleaning liquid to provide soaking and to reach every area of the cleaning tray at low brush speed. This may be thought of as a rinse cycle. The cleaning liquid is then removed by applying suction.

This cleaning method has been found to be particularly effective and enables operation with low power.

The middle cycle may be applied twice or even more than twice.

The last step of the end cycle may comprise driving the roller brush at a relatively fast rotational speed and applying the second level of suction and then the first level of suction with no delivered cleaning liquid.

Thus, when there is still a lot of cleaning liquid, a lower level of suction is first used to prevent spillage, and the suction is then increased to remove almost all of the remaining water and residue.

The method is for example applied with the cleaning head fitted to a cleaning tray as defined above.

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiment(s) described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention, and to show more clearly how it may be carried into effect, reference will now be made, by way of example only, to the accompanying drawings, in which:

Figure 1 shows a known layout for a wet floor cleaner head;

Figure 2 shows another known layout to achieve a smaller and more compact cleaning head;

Figure 3 shows a cross section through one of the rear support wheels of the cleaning head of Figure 2;

Figure 4 shows an example of a cleaning tray;

Figure 5 shows a projection in more detail; and

Figure 6 shows a flow guide in more detail.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The invention will be described with reference to the Figures.

It should be understood that the detailed description and specific examples, while indicating exemplary embodiments of the apparatus, systems and methods, are intended for purposes of illustration only and are not intended to limit the scope of the invention. These and other features, aspects, and advantages of the apparatus, systems and methods of the present invention will become better understood from the following description, appended claims, and accompanying drawings. It should be understood that the Figures are merely schematic and are not drawn to scale. It should also be understood that the same reference numerals are used throughout the Figures to indicate the same or similar parts.

The invention provides a cleaning tray for a wet floor cleaner, for receiving a head of the wet floor cleaner. The cleaning tray has at least one brush channel for receiving a bottom portion of an outer circumference of a roller brush. At least one raised projection is positioned along the brush channel having an upstream ramp surface and a steeper downstream ramp surface. The projection adds turbulence for improving the cleaning results as well as enabling control of the flow of cleaning liquid around the brush and the cleaning tray, to ensure full soaking of the brush as well as cleaning of all of the area of the cleaning tray itself. The invention also provides a cleaning method which may use the cleaning tray.

The invention thus relates to a cleaning tray for cleaning the head of a wet floor cleaner. The general configuration of the cleaner head will first be explained, for a particular example with a pair of parallel roller brushes.

Figure 1 shows a known layout for a wet floor cleaner head 10, viewed from the underside. The head comprises a housing 12 which supports a first, front brush 14 and a second, rear

brush 16. A set of four support wheels 18 is arranged in a rectangular configuration behind the rear brush 16.

A main direction of motion of the cleaning head in use is parallel to a length direction of the cleaning head, perpendicular to the width direction of the housing as defined above. The main direction of movement is shown by the large arrow. This motion tends to roll the brushes over the floor.

Figure 2 shows another known layout to achieve a smaller and more compact cleaning head, for example more suitable for a battery-operated device.

The head 10 again comprises a housing 12 which supports a first, front brush 14 and a second, rear, brush 16.

The housing 12 has width W between first and second side walls 20, 22 and a length L, the length being parallel to the intended main direction of movement of the cleaning head over a floor to be cleaned.

The first and second rotary brushes 14, 16, each extend across the width of the housing between the first and second side walls 20, 22, with parallel rotation axes, and side by side in the length direction. A suction channel is provided for delivering suction to at least a space 24 between the first and second rotary brushes 14, 16. The suction is applied to the general volume of the housing.

This definition of the width direction and length direction of the cleaning head is applicable throughout this text.

The support wheel arrangement in this design comprises a first support wheel 30 in the space 24 between the first and second rotary brushes and a second support wheel 32 in the space 24 between the first and second rotary brushes. The outer faces of the wheels are approximately flush with the side walls.

Mounting the first and second support wheels between the rotary brushes saves space. There is a third support wheel 34 behind the first and second rotary brushes (it could instead be in front) in the length direction, and a fourth support wheel 36 side-by-side with the third support wheel 34.

Figure 3 shows a cross section though one 34 of the rear support wheels 34,36 of the cleaning head of Figure 2, and shows the support wheel 30 further back (behind the plane of the cross section). It shows that the first and second rotary brushes 14, 16 are driven in opposite rotation directions, so that they move upwardly where they face each other, in the space 24. A suction channel 40 delivers suction to at least the space 24 between the first and second rotary brushes.

The rotary brushes are driven by a drive arrangement which may comprise a single motor and a belt drive for driving the two rotary brushes. Alternatively, each rotary brush may have its own respective motor mounted in the core of the respective rotary brush.

The cleaning head also has a fluid delivery arrangement (not shown) for delivering cleaning liquid (i.e. water and optionally cleaning agents) to the first and/or second rotary brushes.

Cleaning liquid may for example be delivered to the rotary brush 16 at the back of the cleaning head from a reservoir formed in a main housing of the vacuum cleaner.

The vacuum cleaner itself has a first pump (fan) for delivering suction to the cleaning head and a second pump for delivering the cleaning liquid.

The mounting of the support wheels by the housing defines a minimum spacing S between a bottom surface of the housing and the floor surface. This minimum spacing is for example in the range 1.5 mm to 3 mm. The rotary brushes project below the level of the floor (when the floor is not present) so that the tufts are deformed by the presence of the floor. This defines a floor indentation and it is part of the water gathering and cleaning function as well as providing brush torque control.

Figure 3 also shows front and rear spoilers 42 which keep air pressure inside the housing to prevent air and water blowing out of the system, making it hard to pick up dirt from the floor. They also guide water which has been sprayed against the housing back to the brushes.

After use, it is known to fit the cleaning head to a cleaning tray, and to apply a cleaning program. This invention relates in particular to a design of the cleaning tray to achieve optimum cleaning of the brushes, as well as to a cleaning cycle. By making the cleaning cycle more effective, it can be performed with lower power, which is of particular interest for a battery-operated vacuum cleaner.

Figure 4 shows a cleaning tray 50 for a wet floor cleaner, for receiving a head 10 of the wet floor cleaner.

The cleaning tray comprises a base 52 for supporting the head. Mounting areas 54 are provided for engaging with the cleaning head to provide a reliable positioning of the cleaning head in the cleaning tray.

The cleaning tray 50 comprises a pair of brush channels 56 formed in the base. These comprise an arcuate indentation (with a cylindrical shape corresponding almost to the cylindrical shape of the outer circumference of the roller brushes). In use, the outer circumference of the roller brushes contacts the brush channels to provide deformation of the tufts and hence promote cleaning. The radius of the brush channel is for example smaller than the outer radius of the roller brush by an amount in the range 1mm to 3mm.

Thus, each brush channel is for receiving a bottom portion of an outer circumference of a respective roller brush.

There is a suction area 58 between the brush channels 56, and a suction nozzle of the cleaning head, when positioned in the cleaning tray, is located over this suction area.

The invention provides a raised projection in one or both of the brush channels. One raised projection is sufficient to have a significant effect on the cleaning liquid flow during cleaning. However, Figure 4 shows an example with six projections, of two different designs.

A front brush channel has two larger projections 60 near the ends and two smaller projections 62 located more centrally.

A rear brush channel has two larger projections 64 near the ends as well as one in the middle.

The projections at the ends of the brush channels have more effect when the cleaning tray is full of water. As water is removed, the projections at the ends of the brush channels have a reduced function as there is no longer any water away from the center. Thus, the more central projections then continue to introduce turbulence (as explained below) until all the water has been removed.

Figure 5 shows one projection 60 in more detail in cross section perpendicular to the length axis of the brush channel 56. The depth of the brush channel is for example 3mm or less. The projection 60 is for projecting into the tufts of roller brush when the cleaning tray is used, as can be seen by the brush 14 in Figure 5. The raised projection comprises an upstream ramp surface 70 positioned such that the outer circumference of the roller brush 14 rides up the upstream ramp surface when rotated. The upstream ramp surface is smooth so presents a gradual decrease in available radius for the roller brush rather than an abrupt face. However, it may be straight, concave or convex or have different sections with different curvature. A downstream ramp surface 72 is steeper than the upstream ramp surface. The downstream ramp surface faces the suction area 58. There is an apex 74 at the junction between the ramp surfaces 70, 72.

The upstream ramp surface for example has an angle in the range 20 to 40 degrees (relative to a straight line between the back and front of the projection where is meets the brush channel) and the downstream ramp surface for example has an angle in the range 60 to 90 degrees. Each ramp surface may be approximated as a straight plane between the apex and the front or back, for this purposes of this angle definition.

The projections function as turbulence introducing elements. The turbulence provides improves mixing of debris with liquid so that debris can be more effectively removed during a cleaning cycle. The rotation of the roller brushes creates an under pressure at the location of (downstream of) the downstream ramp surface, thereby drawing cleaning liquid towards it. This enables the efficient transport of the cleaning liquid within the tray, in particular so that the whole of the roller brush is subjected to a cleaning liquid flow in use. The under pressure is enhanced as the outer circumference of the roller brush may not make contact with the downstream ramp surface due to the rotational speed, and the inertia of the tufts preventing them from immediately deforming radially outwardly to meet the downstream ramp surface.

The turbulence and under pressure create a flow of water borne particles circulating in the tray.

The projections for example have a height (in a radial direction of the roller brushes) in the range 1mm to 10mm; and/or a length, parallel to a length of the brush channels, in the range 1mm to 50mm. A relatively small projection is able to create sufficient turbulence to improve the collection of debris from the roller brushes during cleaning.

The apex 74 for example has an angle of 90 degrees or more. This gives a rapid change in direction of the surface over which the roller brushes are driven and thereby creates the desired turbulence and under pressure. The apex 74 for example has a radius of curvature of less than 2mm.

The projections are for example formed as an integral part of the tray. The pressure differences created by the ramp surfaces are designed to control the cleaning liquid flow to spread the cleaning liquid along the length of the brushes.

The projections near the corners of the tray are positioned on the two sides of the wheels, and in this way they provide protection for the area near the wheels. This area is very sensitive to pollution of mainly fibrous material that easily raps around the shafts of the wheels. The projections reduce this pollution by providing a barrier function and creating turbulence near the wheels.

Returning to Figure 4, the front brush channel 56 additionally has a flow guide 80 which provides a flow path across the brush channel 56 to the suction area 58.

The flow guide provides additional control of the cleaning liquid flow around the tray. In particular, it assists in steering the cleaning liquid to the corners of the tray when there is a large amount of cleaning liquid present. At the end of a cleaning cycle it also assists in directing the reduced amount of cleaning liquid to the center of the tray where the cleaning liquid will be picked up by the suction flow. Thus, the flow guide further 80 assists in obtaining a clean and almost dry tray.

The flow guide 80 comprises two lateral side projections 82 which become closer together along the flow path towards the suction area 58. The side projections 82 for example have a height in the range 1mm to 6mm. They form part of a V-shape with an apex angle in the range 40 to 120 degrees.

Figure 6 shows the flow guide 80 more clearly.

Figure 4 also shows that the cleaning tray has opposite side walls 90, 92. One of the side walls 92 has a pair of openings 94 through which the roller brushes may be received laterally parallel to their axes of rotation.

This enables removal of the brushes from the cleaning head and then from the cleaning tray, after cleaning has finished but with the cleaning head remaining in the cleaning tray. The roller brushes may then be exposed to ambient air to dry fully, and the openings then also allow air flow around the cleaning head to dry fully.

The invention also provides a method of using the cleaning tray.

The method comprises three types of cycle. The cycle characteristics are shown in the table below. Cycle 1 is a start cycle, cycles 2 and 3 are middle cycles and cycle 4 is an end cycle. Each cycle has multiple steps.

Each step involves a rotational speed for the roller brushes ("RPM"), a suction power ("Fan Power"), a cleaning liquid delivery rate ("Pump rate"), and a duration ("Time"). The product of the duration and cleaning liquid delivery rate gives the amount of cleaning liquid used ("Water vol.").

Step	Cycle	Time [s]	RPM	Fan Power [W]	Pump rate [ml/min]	Water vol. [ml]
1	1	47	2500	0	67	52
2		8	4500	100	67	9
3	2	45	2500	0	67	50
4		10	4500	0	67	11
5		4	4500	60	67	4
6	3	37	2500	0	67	41
7		10	4500	0	67	11
8		4	4500	60	67	4
9	4	55	2500	0	67	61
10		10	4500	60	0	0
11		5	4500	100	0	0

As shown, the start cycle involves:

delivering a relatively large volume of cleaning liquid (52 ml) to the cleaning head and driving the roller brushes at a relatively slow rotational speed (2500 rpm) with no delivered suction; and subsequently

delivering a relatively small volume of cleaning liquid (9 ml) to the cleaning head and driving the roller brushes at a relatively fast rotational speed (4500 rpm) and applying a first level of suction (100 W).

The middle cycle involves:

delivering a relatively large volume of cleaning liquid (50 ml then 41 ml in a second repetition of the middle cycle) to the cleaning head and driving the roller brushes at a relatively slow rotational speed (2500 rpm) with no delivered suction;

subsequently delivering a relatively small volume of cleaning liquid (11 ml) to the cleaning head and driving the roller brushes at a relatively fast rotational speed (4500 rpm) with no delivered suction; and

subsequently delivering a relatively small volume of cleaning liquid (4 ml) to the cleaning head and driving the roller brushes at a relatively fast rotational speed (4500 rpm) and applying a second level of suction (60 W) lower than the first level of suction.

The end cycle involves:

delivering a maximum volume of cleaning liquid (61 ml, i.e. the most that is delivered in any of the steps) to the cleaning head and driving the roller brushes at a relatively slow rotational speed (2500 rpm) with no delivered suction; and

subsequently driving the roller brushes at a relatively fast rotational speed (4500 rpm) and applying the suction (at 60 W then at 100 W) with no delivered cleaning liquid.

The purpose of each of the 11 steps is explained below.

Step 1

This step fills the tray with enough cleaning liquid to soak at a low RPM but without water spitting out to sides and front.

Step 2

A vacuum is applied for a high airflow and the brushes spin at a high RPM at the same time, to remove all course dirt without spreading dirt in tray.

Step 3

The tray is filled with enough water to soak at low brush RPM and create turbulence releasing dirt from the corners and edges.

Step 4

The brushes are spun at high RPM thereby spinning out dirt from the brushes and rising the tray (and a viewing window).

Step 5

Dirty water is removed from the tray with a low airflow. There is no need to reach good dryness or cleanliness yet.

Step 6

This is a repetition of step 3, to fill with enough water to soak the brushes and at a low brush RPM, thereby creating turbulence releasing dirt from the corners and edges.

Step 7

This is a repetition of step 4, to spin at high brush RPM thereby spinning out dirt from the brush and rinsing the tray and window.

Step 8

This is a repetition of step 5, to vacuum dirty water from the tray with low airflow.

Step 9

This step involves over-filling the tray with water to soak at low RPM. Turbulence is created in every corner of the tray and nozzle to release any remaining dirt.

Step 10

A vacuum is applied at low airflow with a high roller brush RPM to remove most water and dirt, without spitting the additional filled water out of the tray by the raised RPM.

Step 11

A vacuum is applied for a high airflow with a high roller brush RPM to remove all remaining water and dirt.

It can be seen that the method provides a three cycle cleaning method (with the middle cycle repeated with slightly different timing). The first cycle uses low speed rotation and a large amount of cleaning liquid to soak the brushes. A large suction and high roller drive speed is used to remove the residue without spreading dirt in the tray. This may be thought of as a pre-wash which removes coarse dirt.

The middle cycle has a spinning period with no suction and only a small amount of cleaning liquid, to spin dirt out from the brushes.

The end cycle delivers the most cleaning liquid to provide soaking and to reach every area of the cleaning tray at low brush speed. This may be thought of as a rinse cycle. The cleaning liquid is then removed by applying suction and with a high brush rotation speed.

The housing of the cleaning head is shown as generally rectangular so that the side walls 20, 22 are parallel, but the side walls may be non-parallel for example with a triangular or trapezium shaped housing. The first and second brushes may have the same length (in the width direction of the head) or they may have different lengths. The cleaning tray is designed to match the cleaning head.

The example above has a pair of roller brushes. However, the invention may be applied to a cleaning head with a single roller brush, for example a roller brush in front of a squeegee. The function of the projection or projections in spreading water along the length of the roller brush as well as the flow control achieved is applicable also to cleaning of a cleaning head with a single roller brush.

Variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality.

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.

If the term "adapted to" is used in the claims or description, it is noted the term "adapted to" is intended to be equivalent to the term "configured to".

Any reference signs in the claims should not be construed as limiting the scope.

CLAIMS:

1. A cleaning tray (50) of a wet floor cleaner, adapted to receive a head (10) of the wet floor cleaner, the head comprising a roller brush, the cleaning tray comprising:

a base (52) for supporting the head;

a brush channel (56) formed in the base for receiving a bottom portion of an outer circumference of the roller brush;

at least one raised projection (60;62;64) positioned along the brush channel which is for projecting into the roller brush when the cleaning tray is used, wherein the raised projection comprises an upstream ramp surface (70) positioned such that the outer circumference of the roller brush rides up the upstream ramp surface when rotated and a downstream ramp surface (72), wherein the downstream ramp surface is steeper than the upstream ramp surface; and

a suction area faced by the downstream ramp surface.

2. The cleaning tray of claim 1, comprising a set of raised projections (60; 62; 64) each having an upstream ramp surface and a downstream ramp surface.

3. The cleaning tray of claim 1 or 2, wherein the, or each, raised projection has:

a height in the range 1mm to 10mm; and/or

a length, parallel to a length of the brush channels, in the range 1mm to 50mm.

4. The cleaning tray of any one of claims 1 to 3, wherein the, or each, raised projection has an apex (74) at the junction between the upstream and downstream ramp surfaces, which an angle of 90 degrees or more.

5. The cleaning tray of claim 4, wherein the apex has a radius of curvature of less than 2mm.

6. The cleaning tray of any one of claims 1 to 5, wherein the brush channel (56) comprises a set of two or more raised projections, and wherein there are at least two different shapes of raised projection within the set.

7. The cleaning tray of any one of claims 1 to 6, further comprising, in the brush channels, a flow guide (80) which provides a flow path across the brush channel to the suction area.

8. The cleaning tray of claim 7, wherein the flow guide comprises two lateral side projections (82) which become closer together along the flow path.

9. The cleaning tray of claim 8, wherein the two lateral side projections (82) form part of a V-shape with an apex angle in the range 40 to 120 degrees.

10. The cleaning tray of any one of claims 1 to 9, comprising opposite side walls (90,92), wherein one of the side walls has an opening (94) through which the roller brush may be received laterally parallel to its axes of rotation.

11. The cleaning tray of any one of claims 1 to 10, adapted to receive a head (10) of a wet floor cleaner which comprises a pair of roller brushes, wherein the cleaning tray comprises a pair of brush channels, and the suction area is between the pair of brush channels.

12. A wet floor cleaner comprising:
a cleaning head comprising:
a housing (12);
at least one rotary brush (14, 16) extending across a width of the housing (12); and
a suction channel (40) for delivering suction to at least a space (24) adjacent the at least one rotary brush (14, 16);
a pump for delivering suction to the suction channel of the cleaning head;
a delivery system for delivering cleaning liquid to the cleaning head; and
the cleaning tray (50) of any one of claims 1 to 11.

13. A method of cleaning a roller brush of a cleaning head of a wet floor cleaner, when the cleaning head is fitted to a cleaning tray, the cleaning head comprising at least one rotary brush and suction channel for delivering suction to at least a space adjacent the at least one rotary brush, the method comprising:
in a start cycle:
delivering a relatively large volume of cleaning liquid to the cleaning head and driving the roller brush at a relatively slow rotational speed with no delivered suction; and
delivering a relatively small volume of cleaning liquid to the cleaning head and driving the roller brush at a relatively fast rotational speed and applying a first level of suction;
in a middle cycle:
delivering a relatively large volume of cleaning liquid to the cleaning head and driving the roller brush at a relatively slow rotational speed with no delivered suction;

delivering a relatively small volume of cleaning liquid to the cleaning head and driving the roller brush at a relatively fast rotational speed with no delivered suction; and

delivering a relatively small volume of cleaning liquid to the cleaning head and driving the roller brush at a relatively fast rotational speed and applying a second level of suction lower than the first level of suction; and

in an end cycle:

delivering a maximum volume of cleaning liquid to the cleaning head and driving the roller brush at a relatively slow rotational speed with no delivered suction; and

driving the roller brush at a relatively fast rotational speed and applying the suction with no delivered cleaning liquid.

14. The method of claim 13, wherein the last step of the end cycle comprises driving the roller brush at a relatively fast rotational speed and applying the second level of suction and then the first level of suction with no delivered cleaning liquid.

15. The method of any one of claims 12 to 14 applied with the cleaning head fitted to a cleaning tray as claimed in any one of claims 1 to 11.

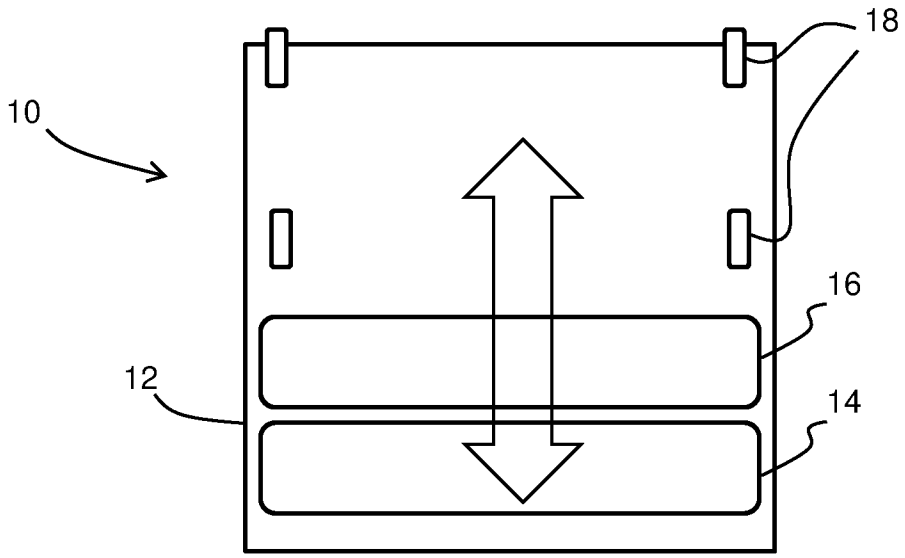


FIG. 1

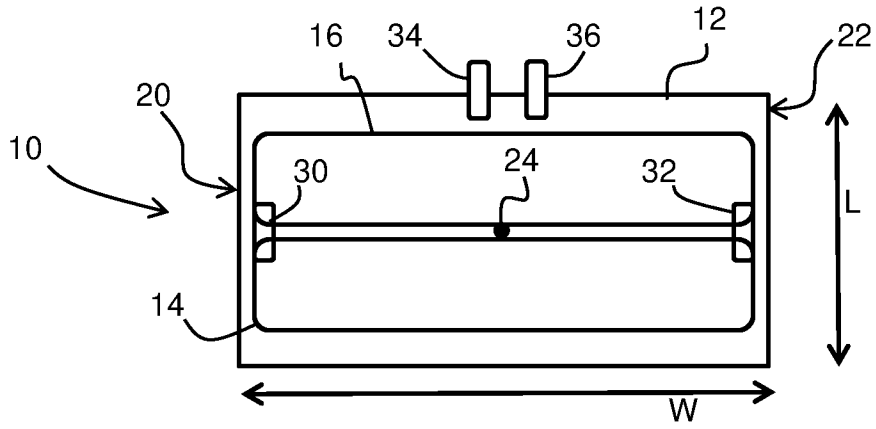


FIG. 2

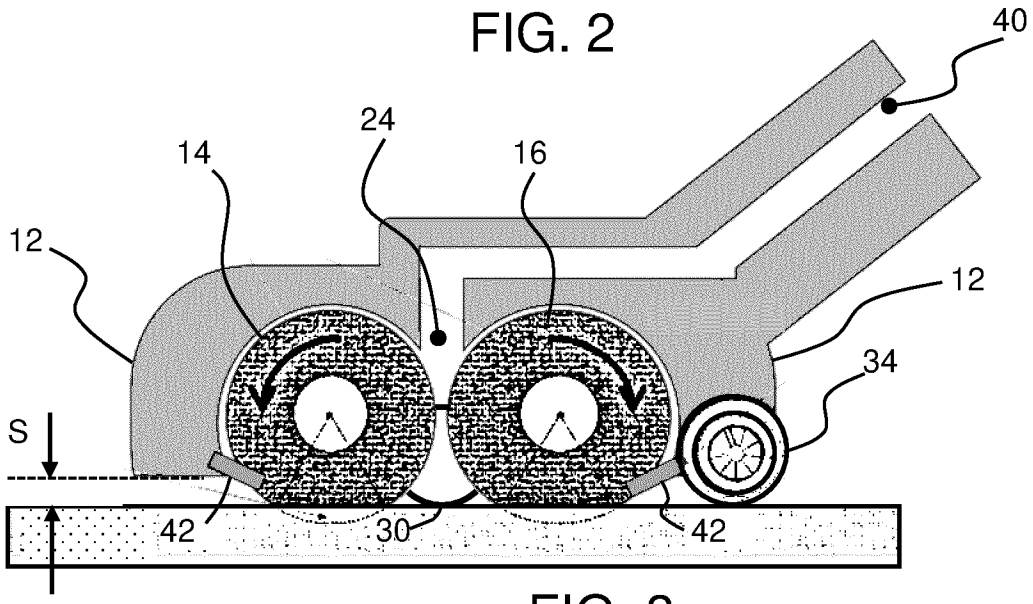


FIG. 3

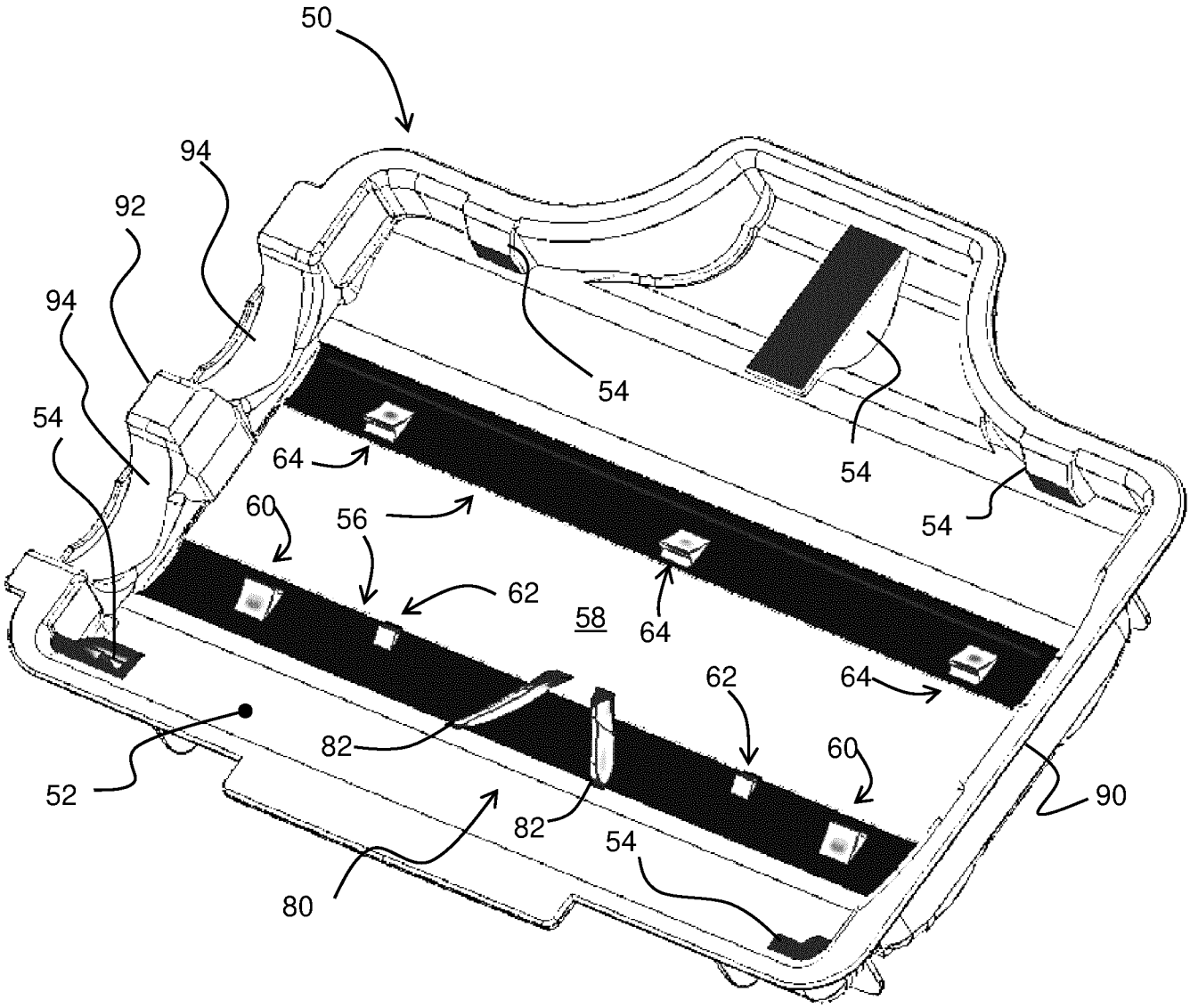

50
94
92
94
54
54
64
60
56
62
58
64
54
54
62
64
82
60
52
82
90
54
80

FIG. 4

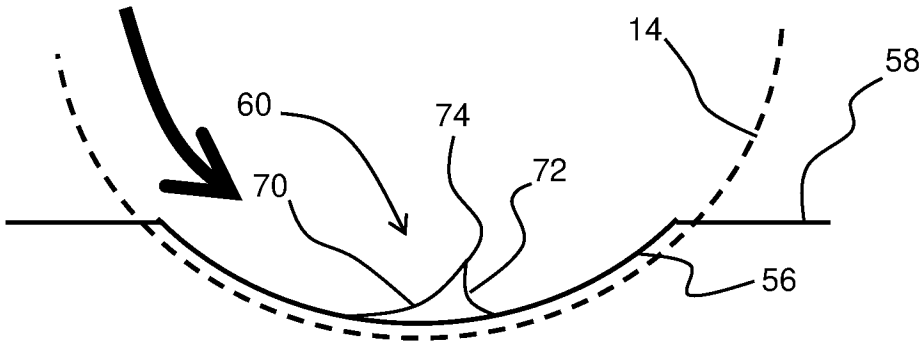

14
58
60
74
70
72
56

FIG. 5

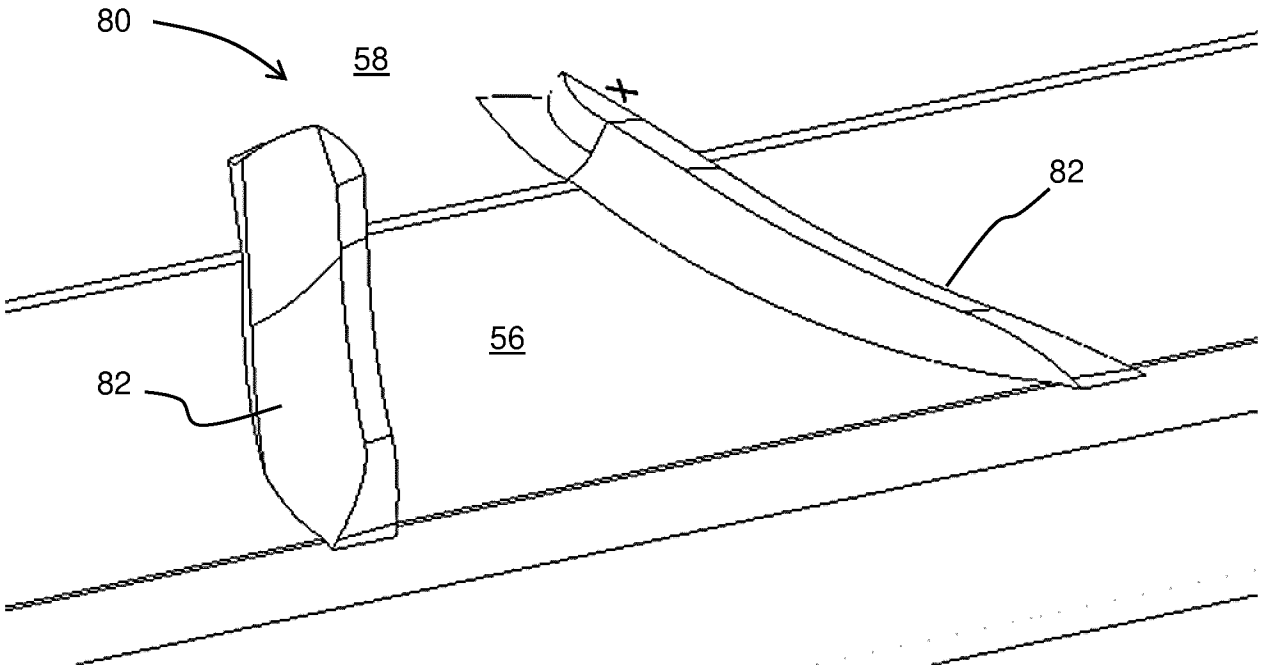


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2022/063084

A. CLASSIFICATION OF SUBJECT MATTER
INV. A47L9/04 A46B17/06
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47L A61D A46B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2 672 872 A1 (KONINKL PHILIPS NV [NL]) 18 December 2013 (2013-12-18) cited in the application paragraphs [0031] - [0049] paragraphs [0009] - [0010]	1-15
A	EP 3 409 167 A1 (BISSELL HOMECARE INC [US]) 5 December 2018 (2018-12-05) paragraphs [0041] - [0044] paragraphs [0053] - [0056]	1-15
A	CN 112 617 684 A (JIANGSU MIDEA CLEAN ELECTRIC APPLIANCE CO LTD; MIDEA GROUP CO LTD) 9 April 2021 (2021-04-09) figures	1-15

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 September 2022	16/09/2022

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Eckenschwiller, A

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2022/063084

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2672872 A1	18-12-2013	BR 112013019894 A2	11-10-2016
		CN 103369996 A	23-10-2013
		EP 2484261 A1	08-08-2012
		EP 2672872 A1	18-12-2013
		JP 6084578 B2	22-02-2017
		JP 2014507218 A	27-03-2014
		PL 2672872 T3	31-10-2019
		RU 2013141168 A	20-03-2015
		TR 201908946 T4	22-07-2019
		US 2013305468 A1	21-11-2013
		WO 2012107876 A1	16-08-2012
EP 3409167 A1	05-12-2018	AU 2018203547 A1	20-12-2018
		CN 108968835 A	11-12-2018
		EP 3409167 A1	05-12-2018
		US 2018344112 A1	06-12-2018
CN 112617684 A	09-04-2021	NONE	