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(54) A WET CLEANING NOZZLE COMPRISING TWO ROTATABLE BRUSHES AND AN INTERMEDIATE BODY

(57) In the context of cleaning of surfaces (10) by using cleaning liquid, a wet cleaning nozzle (101) comprising two fast rotating brushes (20) and a rotatable intermediate body (40) positioned between the brushes (20) is provided. The intermediate body (40) may be at a position for interacting with the brushes (20). Various options exist in respect of supplying the cleaning liquid, such as supplying the liquid directly to the intermediate body (40) and/or at least one of the brushes (20). In such cases, the intermediate body (40) is allowed to function as a liquid exchanger between the brushes (20) and also as a liquid applicator when the intermediate body (40) rolls over the surface (10). The intermediate body 40 also functions to reduce a residue amount of liquid on the surface (10) since rotation of the intermediate body (40) creates a constantly moving line of contact to the surface (10).

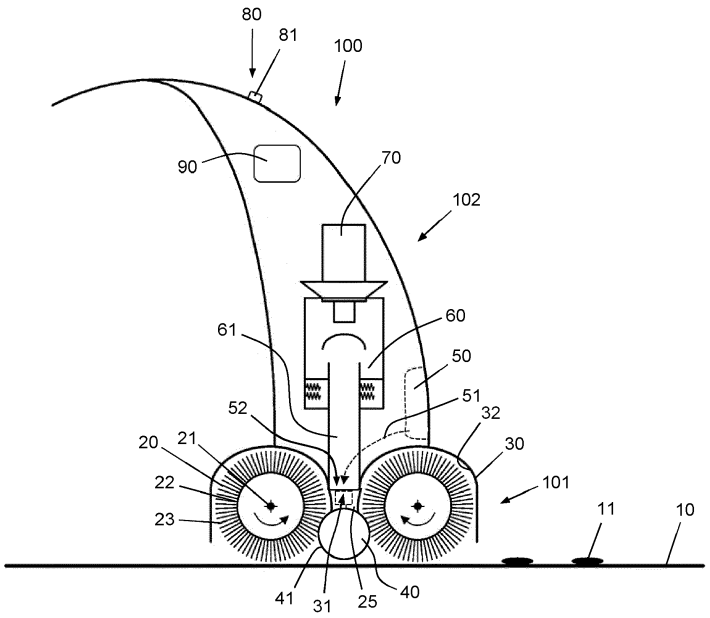

Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a wet cleaning nozzle configured to be applied in a cleaning device and to perform a cleaning action on a surface.

[0002] Further, the invention relates to a cordless cleaning device comprising a wet cleaning nozzle as mentioned and a body portion which is couplable or coupled to the wet cleaning nozzle and which is configured to be taken hold of by a user of the cleaning device.

BACKGROUND OF THE INVENTION

[0003] Generally speaking, cleaning a surface involves removes dirt from the surface. The term "dirt" as used in the present text is to be understood so as to cover any contamination as may be present on a surface and which is of such type and size that well-known cleaning actions such as vacuum cleaning and mopping are applicable to remove the contamination from the surface. Practical examples in this respect include dust and small particles of any kind, and also wet types of contamination such as spilled drinks. A practical example of the surface to be cleaned is a floor, wherein the floor may be of any kind, such as a wooden floor, a carpet floor, a tile floor, etc.

[0004] A well-known example of a cleaning device which is suitable to be used for cleaning a surface is a vacuum cleaner. Generally, a vacuum cleaner has a cleaning nozzle, also known as cleaning head, which is the part of the vacuum cleaner where the actual process of picking up dirt from a surface to be cleaned is to take place and which is therefore to be put on or at least close to the surface. Further, a vacuum cleaner normally comprises a body portion including a dirt accumulating area, and an arrangement configured to act on the cleaning nozzle so that a suction force is prevailing in the cleaning nozzle during operation of the vacuum cleaner. The suction force serves to facilitate transport of dirt which is picked up from the surface during operation of the vacuum cleaner towards the dirt accumulating area, wherein the dirt is made to pass an outlet opening in a housing of the cleaning nozzle. The suction force may also be an important factor in the actual process of picking up the dirt from the surface. On the other hand, the cleaning nozzle may be equipped with at least one movable component for interacting with the surface in order to pick up the dirt, such as at least one rotatable brush that may serve as an agitator of the dirt and that may particularly be configured to help dislodge dirt from the surface and direct it towards the outlet opening.

[0005] WO 2012/107876 A1 discloses a cleaning device comprising a nozzle having an open side for facing surfaces to be cleaned, and at least one brush for contacting surfaces to be cleaned, which is rotatably arranged in the nozzle. The at least one brush is provided with a plurality of brush hairs, wherein it is possible that these brush hairs are extremely soft and flexible. In such a case, a cleaning action of a surface is not performed by scrubbing the surface but by putting the brush hairs alternately in and out of contact with the surface during rotation of the brush. In particular, during one revolution of the brush, the brush hairs remove particles and/or liquid droplets from a soiled surface and fling away the particles and/or the droplets when they reach a position in which they are free from contact to the surface and in which they can be fully outstretched. In the nozzle of the cleaning device, in which the brush is arranged, there are means for receiving the particles and/or the droplets, and for possibly transporting the particles and/or the droplets towards a space where they are collected. The cleaning device may be equipped with means for realizing a suction force at the nozzle in order to direct the particles and/or the droplets in a desired direction once they are released from the brush hairs. Further, it is possible that the cleaning device is configured to supply a cleaning liquid to the rotating brush in order to promote the adherence of particles to the brush hairs and/or to realize an additional cleaning effect on a surface to be cleaned. The cleaning device comprises wheels for supporting the nozzle and allowing the nozzle to roll along surfaces to be cleaned.

[0006] In the context of the invention, it is acknowledged that in the field of wet cleaning by using brushes, it is advantageous to take measures aimed at realizing a distribution of cleaning liquid such that an equal cleaning performance over a length of the brushes can be obtained. Further, it is important to not create liquid marks on the surface after the cleaning liquid on the surface has dried up. Known measures involve applying one or more rubber squeegees for scraping dirt from the surface and also leaving an even thin layer of liquid on the surface. However, it appears that at the position of a squeegee, dirt and liquid accumulates, so that additional cleaning effects of applying the squeegee are limited and may even be lost after a while.

SUMMARY OF THE INVENTION

[0007] It is an object of the invention to provide a practical way of improving evenness of the result of a wet cleaning action performed on a surface by means of a wet cleaning nozzle, avoiding formation of liquid marks on the surface in the process.

[0008] In view of the foregoing, the invention provides a wet cleaning nozzle configured to be applied in a cleaning device and to perform a cleaning action on a surface, the wet cleaning nozzle comprising: a housing; two brushes which are rotatably arranged in the housing and extend substantially parallel to each other, and which are configured to interact with the surface to be cleaned; an intermediate body which is generally shaped like a cylinder and has a curved main surface, which is rotatably arranged on the housing, at a position between the brushes, which is configured to interact with the surface

to be cleaned through the curved main surface, and which extends substantially parallel with the two brushes, along at least a substantial portion of the two brushes as seen in a longitudinal direction of the brushes and the intermediate body; and a wetting arrangement which is arranged and configured to enable a supply of liquid to at least one of the intermediate body, the brushes and the surface to be cleaned.

[0009] In the wet cleaning nozzle according to the invention, the intermediate body acts to evenly spread cleaning liquid over a surface subjected to a cleaning action by means of the wet cleaning nozzle. Due to the rotatable arrangement of the intermediate body on the housing and the interaction of the intermediate body with the surface at the position of the curved main surface, the intermediate body rolls over the surface as the wet cleaning nozzle is moved over the surface. Compared to the conventional use of a squeegee, there is no static interaction line, and the film of liquid on the surface can be thinner. Advantages of putting to practice the invention are many, including the following. In the first place, distribution of cleaning liquid is improved. The intermediate body acts like an applicator of liquid when the wet curved main surface rolls on the surface, so that a very even layer of liquid is created on the surface, which translates to equal cleaning performance over the pair of brushes in the longitudinal direction. In the second place, due to the effect of having a roller on a surface, which results in obtaining the relatively thin layer of liquid as mentioned, the risk of the creation of liquid marks when the liquid dries up is drastically reduced and may probably even be eliminated.

[0010] The invention covers any suitable cross-sectional shape of the intermediate body. In one practical embodiment, the cross-section of the intermediate body is substantially circular, so that the intermediate body has a substantially circular periphery about a central longitudinal axis of the intermediate body, whereas in another practical embodiment, the cross-section of the intermediate body is non-circular, so that the intermediate body has a substantially non-circular periphery about a central longitudinal axis of the intermediate body, particularly near-circular such as decagonal or dodecagonal. An alternative to the definition of the intermediate body as being generally shaped like a cylinder and having a curved main surface is a definition of the intermediate body as being generally shaped like a roller and having a curved main surface. In any case, the indication that the main surface is curved does not necessarily mean that the main surface has a generally circular outline as seen in cross-section of the intermediate body. As explained, also non-circular, particularly near-circular shapes as possible in this respect.

[0011] According to an interesting option, the intermediate body is configured to also interact with at least one of the brushes. When this option is put to practice, a further improvement of the cleaning results is obtained on the basis of the fact that the intermediate body is constantly brushed and remains clean in that way without a need for any separate cleaning measures.

[0012] It is practical if each of the brushes comprises a core element and flexible, string-like brush elements extending outwardly relative to the core element. In that case, realizing the option of having constant interaction of the intermediate body with at least one of the brushes does not need to involve more than having a configuration in which at least one of the brushes overlaps with the intermediate body at the position of the brush elements. In the context of the invention, the brushes may be of any type that is suitable to be used for picking up dirt from a surface to be cleaned. The brushes may especially be designed to serve as an agitator, for example, agitating dirt particles as may be present on the surface. The flexible, string-like brush elements may be microfiber elements having a linear mass density lower than 150 g per 10 km, at least at tip portions, so that the brush elements really can be highly flexible. The linear mass density as mentioned may even be lower than 10 g per 10 km, 5 g per 10 km or 1 g per 10 km. Such brush elements can be placed on the core element in a dense arrangement so as to very effectively interact with a surface to be cleaned during operation of the wet nozzle arrangement. Further, it may be practical if such brush elements are arranged on the core element in tufts. A practical example of a length of the microfiber elements is 10 mm, and a practical example of a thickness of the microfiber elements is 8 μm.

[0013] In the context of the invention, it is advantageous if the intermediate body is designed to promote even spreading of the liquid over the surface and at the same time to not hinder movement of the wet cleaning nozzle over the surface. In this respect, it is advantageous if the curved main surface of the intermediate body is a generally smooth surface. For example, the intermediate body may be made of a plastic material, in which case it is very well possible to have the smooth appearance of the curved main surface, although use of other types of material in the intermediate body are not excluded. The intermediate body may be generally shaped like a roller, and may be hollow.

[0014] In an advantageous embodiment of the wet cleaning nozzle according to the invention, the intermediate body is positioned on the housing to have an additional function as a rolling support of the wet cleaning nozzle on the surface to be cleaned during a cleaning action. In the embodiment, interaction of the intermediate body with the surface is realized with force following from reaction forces to the weight of the wet cleaning nozzle acting at the interface of the intermediate body and the surface, which is advantageous for obtaining the desired even and thin spreading of the cleaning liquid. In case the intermediate body is used as a single and only rolling support of the wet cleaning nozzle, there is no risk of contamination of the surface at the position of additional wheels or other additional elements for supporting the wet cleaning nozzle on the surface. This is an interesting

aspect because wheels, like squeegees, are known to be susceptible to accumulation of dirt over time. On the other hand, it is to be noted that the invention also covers embodiments of the wet cleaning nozzle in which one or more wheels or other components for supporting the wet cleaning nozzle on the surface are present, which has advantages of stability and manoeuvrability, for example.

[0015] It is practical if the brushes of the wet cleaning nozzle are designed such that an operational shape of each of the brushes is generally the shape of a cylinder having a circular cross-section. In such a practical case, the assembly of the brushes and the intermediate body is an assembly of three roller-like components in a substantially parallel side-by-side arrangement, wherein the brushes and the intermediate body may be of similar or comparable size in the longitudinal direction. Further, it is possible that a diameter of the intermediate body is considerably smaller than a diameter of the operational shape of each of the brushes, optionally at least 3 times smaller. In that way, it is avoided that the addition of the intermediate body to a conventional design of the wet cleaning nozzle results in increased bulkiness of the wet cleaning nozzle. A practical example of the respective diameters involves 55 mm in respect of the diameter of the brushes and 15 mm in respect of the diameter of the intermediate body.

[0016] In the context of the invention, it is possible that the wetting arrangement is arranged and configured to enable a direct supply of liquid to the intermediate body. The rotating movement of the intermediate body can be used to advantage when it comes to spreading the liquid over the periphery of the intermediate body. With the direct supply of liquid to the intermediate body, it can be ensured that the intermediate body receives a continuous supply of liquid and that right from the start of the operation of the wet cleaning nozzle, accumulation of dirt on the intermediate body cannot occur, which does not mean that having a continuous supply of liquid throughout operation is essential in the context of the invention, as it is also possible to have a supply of liquid only from time to time. It is practical if the direct supply of liquid involves a continuous or intermittent flow of liquid, or spray of liquid, directed towards the intermediate body. In general, the wetting arrangement may be configured to supply the liquid solely under the influence of gravity, i.e. to allow the liquid to simply fall down from one or more appropriate supply positions, but it is also possible that measures are taken to realize a pressurized liquid supply. The wetting arrangement can be provided more or less as an add-on to an existing design of a wet cleaning nozzle, but it is also possible that the wetting arrangement is provided in a more integrated fashion. A practical example of the liquid is water or a mixture of water and a cleaning agent.

[0017] A notable option in respect of the wetting arrangement is an option according to which the wetting arrangement is designed so as to enable supply of cleaning liquid from inside one or both of the brushes, i.e. to enable supply of cleaning liquid to the brush elements from a position at the core element.

[0018] In the case that the intermediate body is wetted directly by means of the wetting arrangement, it may further be so that the brushes are wetted only indirectly, namely through interaction with the intermediate body, in the case that the intermediate body is configured to interact with the brushes, and also through interaction with the surface as wetted by the intermediate body. In particular, it may be so that the wetting arrangement is arranged and configured to enable the direct supply of liquid to the intermediate body at the position of the curved main surface of the intermediate body, from outside of the intermediate body. It is practical if in that case, the wetting arrangement is configured to let out liquid to the intermediate body at a position which in a normal, operational orientation of the wet cleaning nozzle is a position right above the intermediate body. An interesting fact is that the brushes are best rotated in opposite directions, rotating towards each other at a level closest to the surface and rotating away from each other at a level farthest from the surface. This means that when the wet cleaning nozzle is moved over the surface and the intermediate body is made to rotate in the process, the brush which is at the front in the direction of the movement is wetted first by the intermediate body, so that it is ensured that the fresh liquid is always provided at a front position. In view of the desire to evenly spread the liquid over the surface, it is advantageous if the wetting arrangement is arranged and configured to enable to the direct supply of liquid to the intermediate body at a number of supply positions along the intermediate body in the longitudinal direction, and not just at a single, central supply position, for example, although this is not excluded in the context of the invention.

[0019] In any case, it may be practical if the wetting arrangement comprises a conduit system configured to transport liquid and to let out liquid at least to the intermediate body. In conformity with the above remarks about the wetting arrangement, it is noted that such a conduit system may be integrated as much as possible in the housing of the wet cleaning nozzle, but may also comprise conduits arranged on the housing.

[0020] The invention further relates to a cleaning device, particularly a cordless cleaning device, comprising a wet cleaning nozzle as defined and described in the foregoing and a body portion which is couplable or coupled to the wet cleaning nozzle and which is configured to be taken hold of by a user of the cleaning device. It is practical if either the wet cleaning nozzle or the larger entirety of the cleaning device comprises a reservoir which is configured to receive liquid, to contain liquid, and to let out liquid to the wetting arrangement of the wet cleaning nozzle. Advantageously, the reservoir is removably arranged on the wet cleaning nozzle or the larger entity of the cleaning device so that it is easy for a user to take the reservoir to a place where the reservoir can be

filled with liquid.

[0021] It is to be noted that in general, the invention covers numerous types of cleaning device, including vacuum cleaner robots.

[0022] The above-described and other aspects of the invention will be apparent from and elucidated with reference to the following detailed description of a practical embodiment of a wet cleaning nozzle comprising a housing and two brushes and an intermediate body arranged in the housing, and further comprising a wetting arrangement which is arranged and configured to enable a direct supply of liquid to the intermediate body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The invention will now be explained in greater detail with reference to the figures, in which equal or similar parts are indicated by the same reference signs, and in which:

Figure 1 diagrammatically shows a portion of a floor having a surface to be cleaned and components of a wet vacuum cleaner comprising a wet cleaning nozzle according to an embodiment of the invention;

Figure 2 diagrammatically shows a view of a longitudinal section of the wet cleaning nozzle, taken at a position of an intermediate body included in the wet cleaning nozzle;

Figure 3 diagrammatically shows a bottom view of the wet cleaning nozzle; and

Figure 4 diagrammatically shows a view of a cross-section of the wet cleaning nozzle.

DETAILED DESCRIPTION OF EMBODIMENTS

[0024] Figure 1 illustrates the design of a wet vacuum cleaner 100 comprising a wet cleaning nozzle 101 according to an embodiment of the invention. The particular vacuum cleaner represented in figure 1 and described in the following is just one example of many types of cleaning devices which are feasible in the framework of the invention. In this respect, it is noted that the invention does not only relate to wet vacuum cleaners, but also to other types of vacuum cleaners such as wet/dry vacuum cleaners having a dry cleaning function besides a wet cleaning function.

[0025] The wet vacuum cleaner 100 is configured to be used for the purpose of subjecting a surface 10 such as a floor surface to a wet cleaning action. Figure 1 shows the vacuum cleaner 100 in a normal, operational orientation relative to the surface 10 to be cleaned. The use in the present text of a term having an orientation aspect is to be understood in relation to this normal, operational orientation of the vacuum cleaner 100 relative to the surface 10 to be cleaned, wherein it is assumed that the surface 10 is at a bottom position and the vacuum cleaner 100 is placed on the surface 10.

[0026] The wet cleaning nozzle 101 is present in the vacuum cleaner 100 at a side of the vacuum cleaner 100 which is supposed to face the surface 10 during operation of the vacuum cleaner 100. The wet cleaning nozzle 101 accommodates two brushes 20 which are configured to interact with the surface 10 during operation of the vacuum cleaner 100. In the following, it is assumed that each of the brushes 20 is provided in the form of a roller which is rotatable about a rotation axis 21 which is defined by a central longitudinal axis of the roller, and that each of the brushes 20 comprises a core element 22 and flexible microfiber elements 23 arranged on the core element 22, which does not alter the fact that other embodiments of the brushes 20 are possible as well. The brushes 20 are oriented such that their rotation axes 21 extend substantially parallel to the surface 10. The brushes 20 may be identical, but this is not necessary in the context of the invention. As indicated in figure 1 by means of curved arrows depicted at the position of the brushes 20, the brushes 20 are arranged so as to be rotatable in opposite directions with respect to each other about their respective rotation axes 21. The wet cleaning nozzle 101 comprises a housing 30 which is configured to partially cover the brushes 20. The housing 30 can be made of a plastic material, for example.

[0027] Besides the wet cleaning nozzle 101, the vacuum cleaner 100 comprises a body portion 102 which is configured to be taken hold of by a user of the vacuum cleaner 100. Preferably, the wet cleaning nozzle 101 and the body portion 102 are removably couplable to each other. The body portion 102 can be shaped in any appropriate way. The outline of the body portion 102 as shown in figure 1 is of a diagrammatical nature only. It is practical if the body portion 102 comprises a handle so that a user can easily take hold of the body portion 102 and move the vacuum cleaner 100 over the surface 10 to be cleaned as desired. The wet cleaning nozzle 101 comprises an intermediate body 40 which is generally shaped like a cylinder, which is rotatably arranged on the housing 30, at a position between the brushes 20. In the present example, the intermediate body 40 has a substantially circular cross-sectional shape. Further, in the present example, the intermediate body 40 enables the wet cleaning nozzle 101 to be supported on the surface 10 to be cleaned and to be moved back and forth on the surface 10, in additional to a number of wheels 90, which may be two wheels 90 at a trailing position on the wet cleaning nozzle 101 to support most of the weight of the wet cleaning nozzle 101, as shown in figure 3.

[0028] For the purpose of driving the brushes 20 during operation of the vacuum cleaner 100, the vacuum cleaner 100 is equipped with a suitable electric drive mechanism (not shown). For the purpose of powering the drive mechanism and probably also other components of the vacuum cleaner 100, the vacuum cleaner 100 may be connectable to the mains and/or may be equipped with a suitable battery arrangement. Preferably, the vacuum cleaner 100 is a cordless device comprising a rechargeable battery arrangement, in which case it may further be

practical if the vacuum cleaner 100 is part of a set including a charging dock besides the vacuum cleaner 100. Such a set may also include a flushing tray that can be used for the purpose of cleaning the brushes 20 and the intermediate body 40. In case the vacuum cleaner 100 is not equipped with a battery, a simple dock which is without charging ability may be provided for receiving and holding the vacuum cleaner 100 while the vacuum cleaner 100 is not being operated.

[0029] The body portion 102 of the vacuum cleaner 100 includes a liquid reservoir 50 which serves for containing a liquid such as water or a mixture of water and a cleaning agent, and a liquid supply mechanism 51 which serves for supplying the liquid to a wetting arrangement 52 of the wet cleaning nozzle 101 during operation of the vacuum cleaner 100. The liquid supply mechanism 51 may comprise any suitable type of pump arrangement, for example, or may be configured to enable displacement of the liquid as desired under the influence of gravity. In the present example, the wetting arrangement 52 of the wet cleaning nozzle 101 is arranged and configured to enable a direct supply of liquid to the intermediate body 40 of the wet cleaning nozzle 101. Additional and other options in respect of the supply of liquid are covered by the invention as well, which include options of directly supplying liquid to the surface 10 and to one or both of the brushes 20. Generally speaking, the wetting arrangement 52 may be realized in any suitable way. For instance, it is possible to design the wetting arrangement 52 with a functionality to temporarily stop the supply of liquid to the intermediate body 40 if so desired. This may be useful in view of a situation in which a type of surface 10 to be cleaned requires more than an average amount of liquid, this may allow a user to manually initiate a cleaning action of the intermediate body 40 from time to time, etc.

[0030] Further, in the present example, the wet cleaning nozzle 101 comprises an elongated intermediate component 25 which is located in an area between the brushes 20, and, as can be seen in figure 2, the wetting arrangement 52 comprises a conduit system 53 which is partially arranged in the elongated intermediate component 25 and which is configured to transport the liquid and to let out the liquid to the intermediate body 40 at four supply positions P. In figure 1, the liquid reservoir 50, the liquid supply mechanism 51 and the wetting arrangement 52 of the wet cleaning nozzle 101 are indicated by means of dotted lines. It is practical if the liquid reservoir 50 is removably coupled to the body portion 102 so that a user is enabled to separate the liquid reservoir 50 from the body portion 102 when it is desired to take the liquid reservoir 50 to a place where the liquid reservoir 50 is to be filled with liquid.

[0031] The body portion 102 of the vacuum cleaner 100 further includes a dirt reservoir 60 which serves for receiving and accumulating wet dirt 11 which is picked up from the surface 10 by the brushes 20 during operation of the vacuum cleaner 100. The dirt reservoir 60 can be configured in numerous ways as conventionally available for accumulating wet dirt from the incoming dirt 11 which is picked up from the surface 10 such as for instance a cyclonic arrangement or a tube-in-cup arrangement. The body portion 102 includes a vacuum mechanism 70 configured to create underpressure that is functional to enable transport of the dirt 11 from the area where the brushes 20 are located to the dirt reservoir 60 in the body portion 102, through an outlet opening 31 in a surface 32 of the housing 30 facing the brushes 20 and a suction channel 61 extending from the outlet opening 31 to the dirt reservoir 60. The housing 30 is coupled to the assembly of the suction channel 51, the dirt reservoir 50 and the vacuum mechanism 60 in the body portion 102 of the vacuum cleaner 100 through a coupling area of the housing 30 which is in fluid communication with the outlet opening 31.

[0032] The intermediate body 40 extends substantially parallel with the two brushes 20, along at least a substantial portion of the two brushes 20 as seen in the longitudinal direction *l*, and is generally shaped like a roller. As explained in the foregoing, the intermediate body 40 has a function in supporting the wet cleaning nozzle 101 on the surface 10 to be cleaned. This function is practical but not essential, meaning that embodiments of the wet cleaning nozzle 101 are feasible in which additional supporting elements are present. In any case, the intermediate body 40 is intended to interact with the surface 10 at the position of a curved main surface 41 of the intermediate body 40 so as to perform a function of spreading out liquid over the surface 10 and ensuring that when the wet cleaning nozzle 101 is moved from one area of the surface 10 to another, only a thin film of the liquid remains on the one area, so that a subsequent drying process only takes a minimum of time and formation of liquid marks on the surface 10 is prevented. A suitable material for use in the intermediate body 40, especially at the position of the curved main surface 41, is plastic.

[0033] It is advantageous yet not essential if the intermediate body 40 and the brushes 20 are positioned such that interaction between the intermediate body 40 and the brushes 20 is enabled. This can easily be realized when the intermediate body 40 is in an area where the intermediate body 40 can be reached by the microfiber elements 23 of the respective brushes 20. In such a case, the intermediate body 40 has a function of wetting the brushes 20 along their length, i.e. their dimension in the longitudinal direction *l*, while the brushes 20 have a function of keeping the intermediate body 40 clean. In view of the directions of rotation of the respective brushes 20, and also of the direction of the rotation of the intermediate body 40 which is invoked as the wet cleaning nozzle 101 is moved over the surface 10, the brush 20 which has a front position is under the influence of a freshly wetted portion of the curved main surface 41 of the intermediate body 40 first, almost immediately, which is advantageous for obtaining the best possible cleaning results.

[0034] Basic aspects of the way in which the wet vacuum cleaner 100 is operated are as follows. During operation, the brushes 20 are driven so as to rotate and the liquid supply mechanism 51 is activated so as to supply liquid to the wetting arrangement 52 of the wet cleaning nozzle 101 so that liquid may be let out to the intermediate body 40. A practical example of the speed at which the brushes 20 are rotated is 4,800 rpm. Any stains as may be present on an area of the surface 10 which is within reach of the brushes 20 are detached under the influence of the liquid and agitation by the brushes 20, and dirt particles and dust as may be present on the area of the surface 10 are removed along with the liquid and conveyed to the dirt reservoir 60, passing through the outlet opening 31 and the suction channel 61 in the process. The dirt 11 is picked up from the surface 10 by tip portions of the microfiber elements 23 of the brushes 20 and is flung away from the tip portions as the brushes 20 rotate, at a position where the tip portions move out of contact to the surface 10. In the process, as explained in the foregoing, the intermediate body 40 is useful to promote spreading of the liquid over the surface 10 and to realize excellent cleaning results without liquid marks on the surface 10. Due to the fact that the intermediate body 40 is arranged and configured to rotate as the wet cleaning nozzle 101 is displaced over the surface 10, there is practically no risk that dirt 11 accumulates on the intermediate body 40, so that the advantageous spread of liquid over the surface 10 is obtained without a risk of stains caused by residue dirt 11.

[0035] Letting out liquid to the intermediate body 40 during operation of the wet cleaning nozzle 101 is another factor in keeping the intermediate body 40 clean, so that any negative influences on the results of the action of cleaning the surface 10 following from the fact that the surface 10 is contacted by the intermediate body 40 are avoided. It can be seen in figure 2 that the position at which the liquid is let out to the intermediate body 40 is a position right above the intermediate body 40, such that the liquid can be received by the intermediate body 40 at the position of the curved main surface 41 thereof. Letting out liquid to the surface 10 at supply positions P which are distributed along the intermediate body 40 in the longitudinal direction *l* is a factor in achieving that eventually the brushes 20 are sufficiently wetted, without any dry or nearly-dry areas which might render the cleaning action less effective.

[0036] As illustrated in figure 1, the vacuum cleaner 100 may be equipped with a user interface 80, which user interface 80 may include an on/off button 81, for example. The vacuum cleaner 100 may further comprise a controlling system 90 including a microcontroller which is programmed to put the brushes 20 in motion and to activate both the liquid supply mechanism 51 and the vacuum mechanism 70 in reaction to input received from the user through the user interface 80 to that end.

[0037] It will be clear to a person skilled in the art that the scope of the invention is not limited to the examples discussed in the foregoing, but that several amendments and modifications thereof are possible without deviating from the scope of the invention as defined in the attached claims. It is intended that the invention be construed as including all such amendments and modifications insofar they come within the scope of the claims or the equivalents thereof. While the invention has been illustrated and described in detail in the figures and the description, such illustration and description are to be considered illustrative or exemplary only, and not restrictive. The invention is not limited to the disclosed embodiments. The drawings are schematic, wherein details which are not required for understanding the invention may have been omitted, and not necessarily to scale.

[0038] Variations to the disclosed embodiments can be understood and effected by a person skilled in the art in practicing the claimed invention, from a study of the figures, the description and the attached claims. In the claims, the word "comprising" does not exclude other steps or elements, and the indefinite article "a" or "an" does not exclude a plurality. Any reference signs in the claims should not be construed as limiting the scope of the invention.

[0039] Elements and aspects discussed for or in relation with a particular embodiment may be suitably combined with elements and aspects of other embodiments, unless explicitly stated otherwise. Thus, 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.

[0040] The terms "comprise" and "include" as used in this text will be understood by a person skilled in the art as covering the term "consist of'. Hence, the term "comprise" or "include" may in respect of an embodiment mean "consist of', but may in another embodiment mean "contain/have/be equipped with at least the defined species and optionally one or more other species".

[0041] Notable aspects of the invention are summarized as follows. In the context of cleaning of surfaces 10 by using cleaning liquid, a wet cleaning nozzle 101 comprising two fast rotating brushes 20 and a rotatable intermediate body 40 positioned between the brushes 20 is provided, wherein the intermediate body 40 may be at a position for interacting with the brushes 20. Various options exist in respect of supplying the cleaning liquid, such as supplying the liquid directly to the intermediate body 40 and/or at least one of the brushes 20. In such cases, the intermediate body 40 is allowed to function as a liquid exchanger between the brushes 20 and also as a liquid applicator when the intermediate body 40 rolls over the surface 10. The intermediate body 40 also functions to reduce the amount of liquid that will remain on the surface 10 as residue since the rotation of the intermediate body 40 invoked as the wet cleaning nozzle 101 is moved over the surface 10 creates a constantly moving line of contact to the surface 10, on the basis of which it can be avoided that liquid remains stationary in dead spaces. A design of the wet cleaning nozzle 101 is

feasible in which the intermediate body 40 also functions as a wheel support of the wet cleaning nozzle 101.

[0042] Compared to a conventional application of squeegees, a more even distribution of cleaning liquid over the surface 10 can be obtained. Also, due to the continuous and moving interaction of the intermediate body 40 with the surface 10, better cleaning results can be obtained due to the absence of polluted spots, wherein the formation of liquid marks on the surface 10 is prevented.

Claims

1. Wet cleaning nozzle (101) configured to be applied in a cleaning device (100) and to perform a cleaning action on a surface (10), the wet cleaning nozzle (101) comprising:

   a housing (30);
   two brushes (20) which are rotatably arranged in the housing (30) and extend substantially parallel to each other, and which are configured to interact with the surface (10) to be cleaned;
   an intermediate body (40) which is generally shaped like a cylinder and has a curved main surface (41), which is rotatably arranged on the housing (30), at a position between the brushes (20), which is configured to interact with the surface (10) to be cleaned through the curved main surface (41), and which extends substantially parallel with the two brushes (20), along at least a substantial portion of the two brushes (20) as seen in a longitudinal direction (*l*) of the brushes (20) and the intermediate body (40); and
   a wetting arrangement (52) which is arranged and configured to enable a supply of liquid to at least one of the intermediate body (40), the brushes (20) and the surface (10) to be cleaned.

2. Wet cleaning nozzle (101) as claimed in claim 1, wherein the intermediate body (40) is configured to also interact with at least one of the brushes (20).

3. Wet cleaning nozzle (101) as claimed in claim 1 or 2, wherein each of the brushes (20) comprises a core element (22) and flexible, string-like brush elements (23) extending outwardly relative to the core element (22).

4. Wet cleaning nozzle (101) as claimed in claim 3, wherein at least one of the brushes (20) overlaps with the intermediate body (40) at the position of the brush elements (23).

5. Wet cleaning nozzle (101) as claimed in any of claims 1-4, wherein the curved main surface (41) of the intermediate body (40) is a generally smooth surface.

6. Wet cleaning nozzle (101) as claimed in any of claims 1-5, wherein the intermediate body (40) is made of a plastic material.

7. Wet cleaning nozzle (101) as claimed in any of claims 1-6, wherein the intermediate body (40) is positioned on the housing (30) to have a function as a rolling support of the wet cleaning nozzle (101) on the surface (10) to be cleaned during a cleaning action.

8. Wet cleaning nozzle (101) as claimed in any of claims 1-7, wherein an operational shape of each of the brushes (20) is generally the shape of a cylinder having a circular cross-section.

9. Wet cleaning nozzle (101) as claimed in claim 8, wherein a diameter of the intermediate body (40) is considerably smaller than a diameter of the operational shape of each of the brushes (20), optionally at least 3 times smaller.

10. Wet cleaning nozzle (101) as claimed in any of claims 1-9, wherein the wetting arrangement (52) is arranged and configured to enable a direct supply of liquid to the intermediate body (40).

11. Wet cleaning nozzle (101) as claimed in claim 10, wherein the wetting arrangement (52) is arranged and configured to enable the direct supply of liquid to the intermediate body (40) at the position of the curved main surface (41) of the intermediate body (40), from outside of the intermediate body (40).

12. Wet cleaning nozzle (101) as claimed in claim 11, wherein the wetting arrangement (52) is configured to let out liquid to the intermediate body (40) at a position which in a normal, operational orientation of the wet cleaning nozzle (101) is a position right above the intermediate body (40).

13. Wet cleaning nozzle (101) as claimed in any of claims 10-12, wherein the wetting arrangement (52) is arranged and configured to enable to the direct supply of liquid to the intermediate body (40) at a number of supply positions (P) along the intermediate body (40) in the longitudinal direction (*l*).

14. Wet cleaning nozzle (101) as claimed in any of claims 1-13, wherein the wetting arrangement (52) comprises a conduit system (53) configured to transport liquid and to let out liquid at least to the intermediate body (40).

15. Cordless cleaning device (100), comprising a wet cleaning nozzle (101) as claimed in any of claims

1-14 and a body portion (102) which is couplable or coupled to the wet cleaning nozzle (101) and which is configured to be taken hold of by a user of the cleaning device (100).

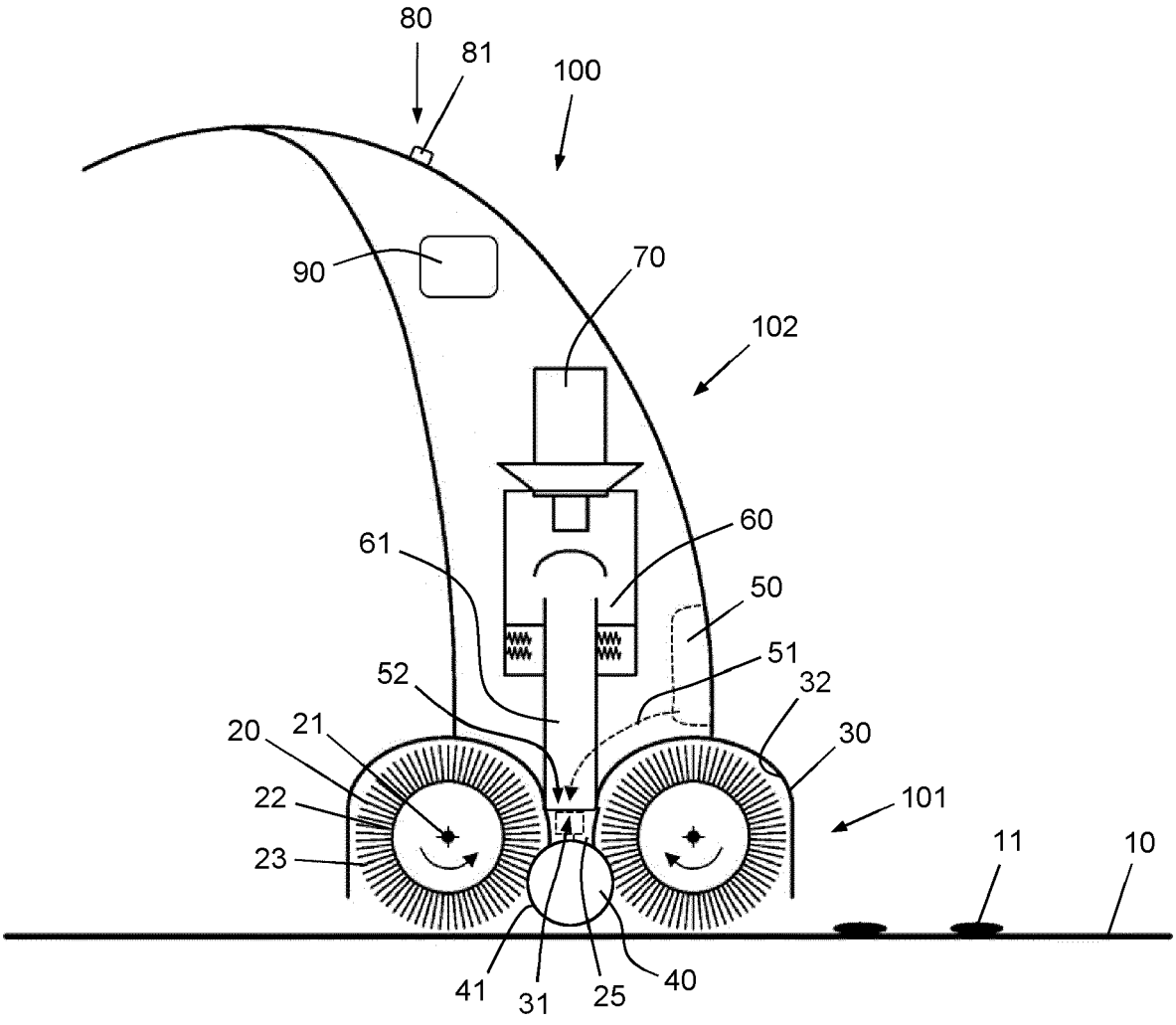
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Fig. 1

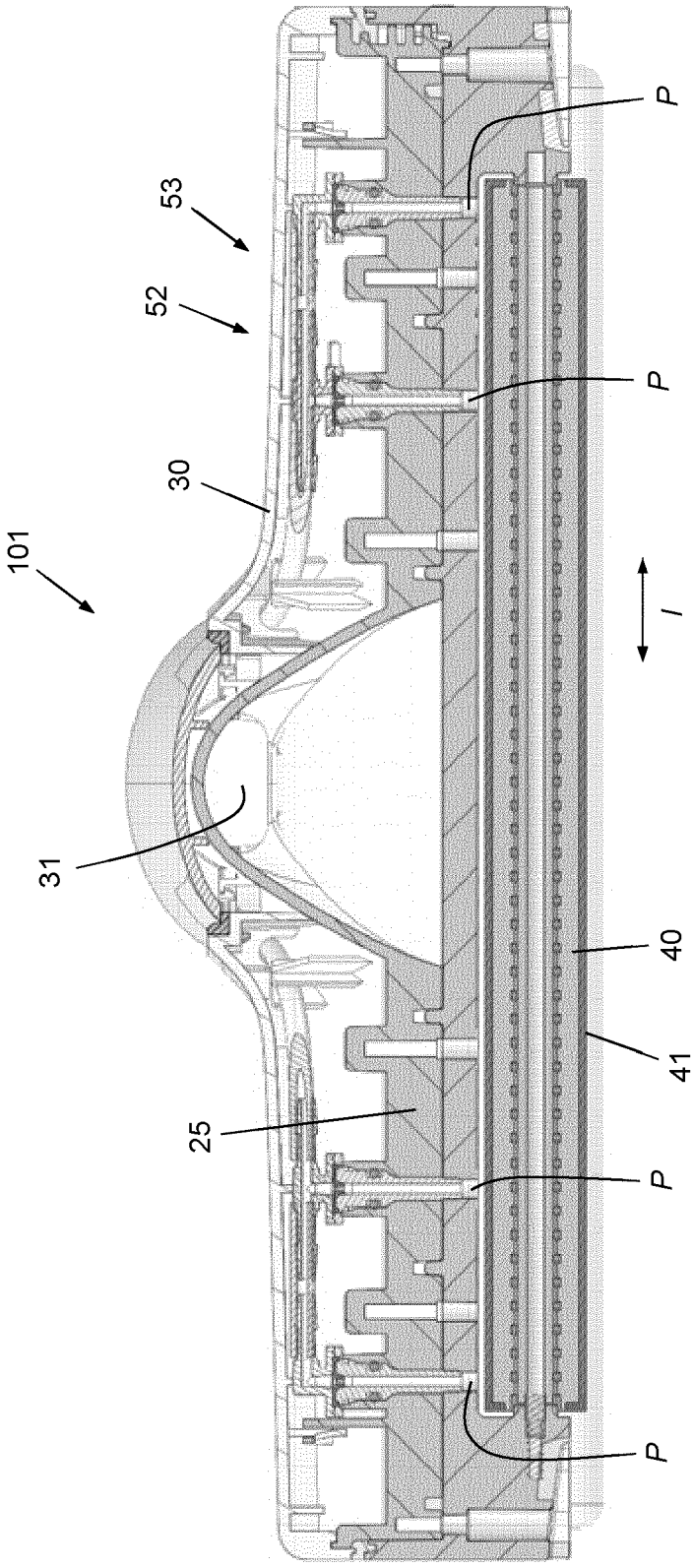


Fig. 2

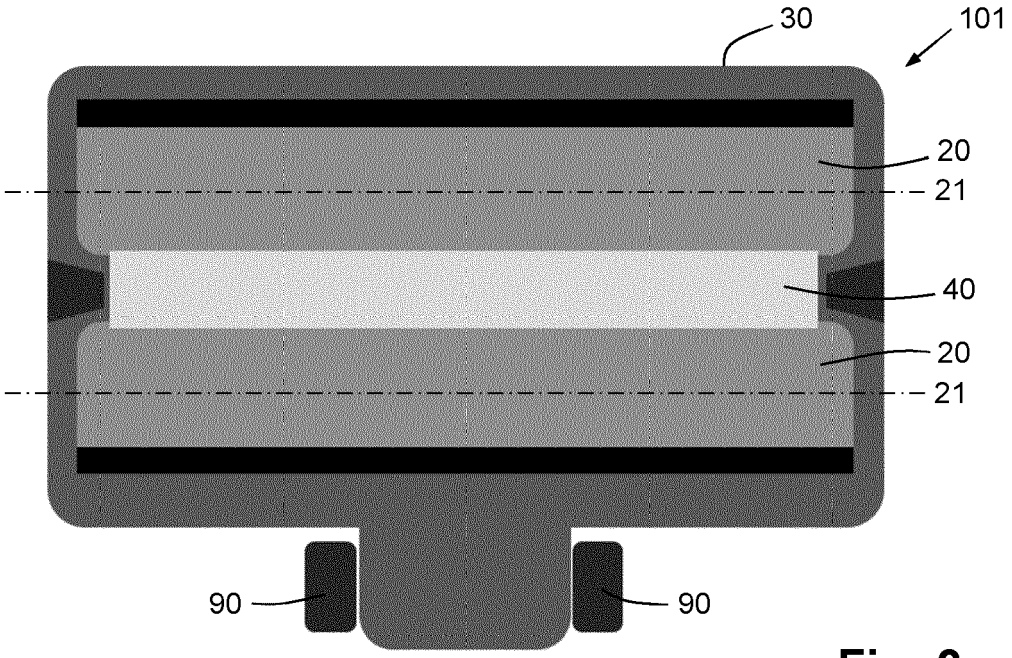
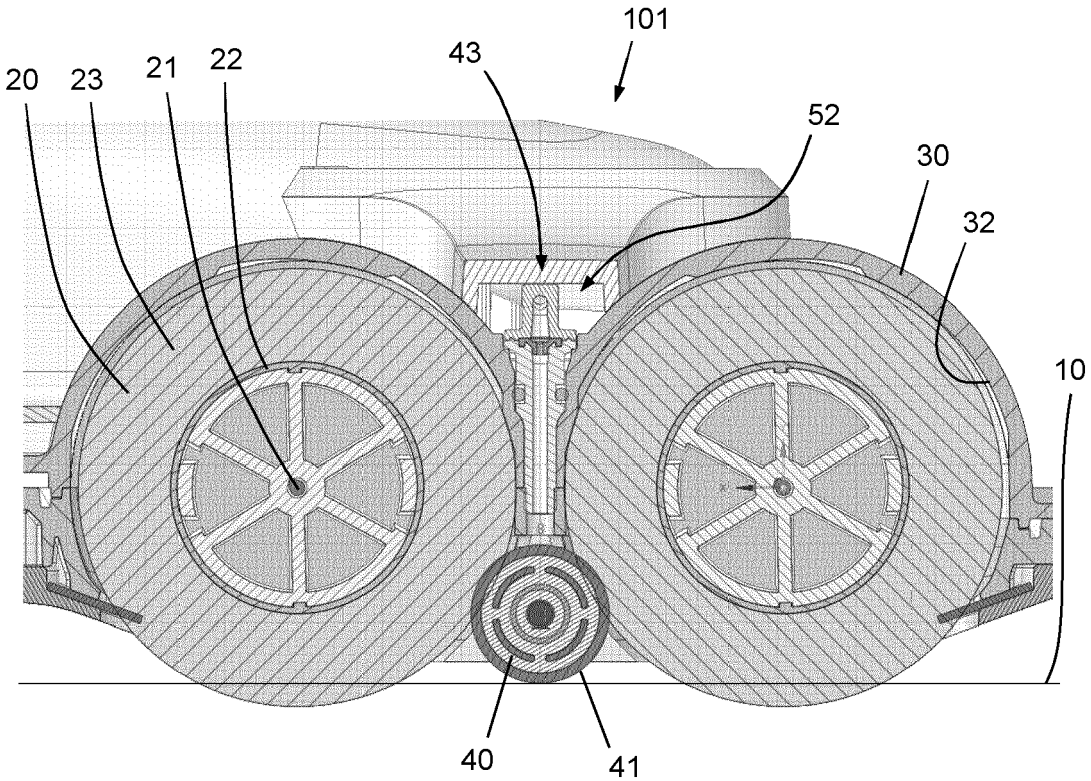


Fig. 3

Fig. 4



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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	19 February 2024	Masset, Markus

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