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Description

The invention concerns a vacuuming robot.

Conventional vacuum cleaners are operated by a user who moves the vacuum cleaner and in particular moves the floor nozzle, through which dust is sucked in, over the surface to be cleaned. For example, conventional vacuum cleaners include a housing mounted on rollers and/or skids. Inside the housing there is a dust collection container with a filter bag. A floor nozzle is connected to the dust collection chamber via a suction pipe and a suction hose. With conventional vacuum cleaners, a motor fan unit is also located in the housing, which creates a vacuum in the dust collection container. In air flow direction the motor blower unit is located behind the floor nozzle, the suction pipe, the suction hose as well as the dust collection container or the filter bag. Since cleaned air flows through such motor blower units, they are sometimes also referred to as clean-air motors.

In earlier times, in particular, there were vacuum cleaners in which the dirty air sucked in was led directly through the motor blower and into a dust bag immediately adjacent to it. Examples of this are shown in US 2,101,390, US 2,036,056 and US 2,482,337. These types of vacuum cleaners are no longer very common today.

Such filthy air or dirty air motor blowers are also known as "dirty air motors" or "direct air motors". The use of such Dirty Air motors is also described in the documents GB 554177, US 4,644,606, US 4,519,112, US 2002/0159897, US 5,573,369, US 2003/0202890 or US 6,171,054.

In recent years, vacuuming robots have also gained popularity. Such vacuuming robots no longer have to be guided by a user over the surface to be cleaned; they rather drive the floor independently. Examples of such vacuuming robots are known from EP 2 741 483, DE 10 2013 100 192 and US 2007/0272463.

The disadvantage of these well-known vacuuming robots is that they only have low dust absorption. This is due to the fact that either the dust absorption is only achieved by the brushing effect of a rotating brush roller or motor blower units with very low power are used.

An alternative vacuuming robot is described in WO 02/074150. This vacuuming robot is constructed in two parts, comprising a container or blower module and a cleaning module which is connected to the blower module via a hose.

An automatic cleaning device is known from the JP 7-320. A vacuuming robot is described in US 5,815,880. The GB 2 344 750 shows a vacuuming robot on whose chassis a swivelling suction head is mounted.

Conventional vacuum cleaning robots often have difficulties when the surface to be cleaned is uneven. Such unevenness may be caused, for example, by a carpet lying on a hard floor (such as is parquet) and the vacuuming robot having to switch from the hard floor to the carpet. Other unevenness may exist in door thresholds, for example. Vacuuming robots regularly bump into such elevations of the surface to be cleaned and cannot move on because they cannot overcome the elevation.

Against this background, the invention's underlying task is to provide an improved vacuuming robot.

This task is solved by the object of claim 1. In accordance with the invention, a vacuuming robot is provided comprising a wheeled base, a stowage separator and a floor nozzle arranged at the floor area for receiving an air flow into the vacuuming robot, the floor nozzle being height adjustable with respect to the base.

The height adjustability of the floor nozzle enables the vacuuming robot to overcome uneven floors, in particular any elevations that occur. If, for example, the vacuuming robot, coming from a hard floor, touches a carpet edge with its floor nozzle, the floor nozzle can be raised with respect to the base so that the vacuuming robot can slide onto the carpet. The floor area itself cannot be height adjustable.

The floor nozzle is fluidically connected (aerodynamically) to the floor area and/or to the dust separator, for example via a hose and/or pipe connection. Through the floor nozzle, the air flow (e.g. sucked in) enters the vacuuming robot and then to the dust separator fluidically connected to the floor nozzle.

The height of the floor nozzle attached to the base can be adjusted by bringing the floor nozzle into an inclined position with respect to the base. The base can be aligned parallel to the surface to be cleaned. The inclined position can be such that the distanceis enlarged between the floor nozzle and a flat surface to be cleaned from the floor area.

The inclined or oblique position allows the vacuuming robot to push itself onto an elevation. If the floor nozzle at least partially rests on the floor (the elevation), the floor area can also be raised by moving the vacuuming robot (forward).

The floor nozzle can pivot to with respect the base. In this case, the height of the floor nozzle is adjusted by swivelling it around a swivelling axis. This makes it possible to bring the floor nozzle into an inclined position with respect to the base. In an initial position, the floor nozzle can be aligned parallel to the base and/or parallel to a surface to be cleaned.

The floor nozzle can be located on one side of the base. In particular, it may be located in front of the floor area (in the direction of motion intended). The base may include a housing. In this case, the floor nozzle can be mounted on or fastened to the housing. For example, it could be swivel-mounted at the housing of the base. The floor nozzle can be arranged at one side of the housing, especially in front of the housing (seen in the intended direction of movement).

With the vacuuming robots described above, the floor nozzle can be locked in a fixed position or in a number of fixed positions with respect to the base. This allows the floor nozzle to be fixed in a desired position with respect to the base, allowing the desired pressure conditions to be set at, under and/or in the floor nozzle, as well as the vacuuming robot to be pushed to an unevenness or floor elevation. In the case of a swivelling arrangement, it can be one or more swivelling or angular positions. Alternatively or additionally, the floor nozzle can be freely movable with respect to the base.

The vacuuming robots described above can include a distance and/or obstacle sensor. The distance and/or obstacle sensor can be an optical sensor or a pressure sensor. The distance and/or obstacle sensor can be located by the base or at the floor nozzle. A distance sensor or obstacle sensor is used to detect unevenness, in particular elevations.

The vacuuming robots described above include a stepper motor or servo motor to adjust the height of the floor nozzle with respect to the base. With such a stepper motor or a servo motor, for example, the floor nozzle can be moved (rotated) around a swivel axis.

The vacuuming robots described above can have a brush roller arranged in or on the floor nozzle. The brush roller (sometimes also referred to as a knocking and/or rotating brush) can be driven by an electric motor.

The floor nozzle has a floor plate with a base area that faces the area to be cleaned when the vacuuming robot is operating, with the floor plate having an air flow channel in the floor area through which air to be cleaned enters the floor nozzle. The base plate is also known as the nozzle base. The air flow channel is also called suction slot, nozzle opening, suction mouth or suction channel.

During operation of the vacuuming robot, the base plate can lie with its base surface in an initial position on the surface to be cleaned (the floor) or be at a distance from it. In particular. The base area can be arranged parallel to the area to be cleaned. The floor nozzle may have a bristle strip which, in the case of a gap, can be used to adjust the air flow through the slot between the surface to be cleaned and the floor plate. The air flow channel can have a curved or not curved shape parallel to the base. It can have two parallel, in particular straight, transverse sides. In particular, it may have a rectangular shape or base.

The longitudinal direction is defined as the direction in which the air flow channel parallel to the base of the floor nozzle has its minimum extension; the transverse direction is perpendicular to it (i.e. in the direction of the maximum extension of the air flow channel) and also parallel to the floor area. Thus the longitudinal sides, the sides along or parallel to the direction of minimum expansion and the transverse sides are the sides along the direction of maximum expansion in the plane of the floor area.

The floor nozzle can also have several air flow channels. A plurality of air flow channels may have the same shape or different shapes.

The floor nozzle may have a drive device to drive at least one of the wheels. The wheels may be designed to directly touch or contact the floor. Alternatively, they can be designed as drive wheels for a caterpillar chain. In the latter case, when the vacuuming robot is in operation, the caterpillar chain will directly touch the floor to move the vacuuming robot.

One of the wheels, several or all wheels can be omnidirectional wheels. This is particularly useful when the floor is directly touched by the wheels while the vacuuming robot is in operation.

The use of one or more omnidirectional wheels allows a very flexible and versatile movement of the vacuuming robot, allowing it to reliably reach and leave areas which are narrow and difficult to reach.

The floor nozzle can include a rotating device to rotate the air flow channel around an axis perpendicular to the floor area. Such a rotating device allows the air flow channel to be advantageously aligned to allow dirt and dust to enter the floor nozzle. This increases the suction efficiency of the vacuuming robot, particularly as the floor area worked by the floor nozzle due to the air flow channel is optimised. In particular, the rotating device can be designed as described in European Patent Application No. 15 151 741.4.

Each omnidirectional wheel may have on its circumference a plurality of rotatably mounted rollers or rolling elements whose axes are not parallel to the wheel axis (of the omnidirectional wheel). In particular, the axles of the rollers may be diagonal or transverse to the wheel axle. An example of an omnidirectional wheel is a Mecanum wheel described in the US 3,876,255.

The vacuuming robots described above may include a control device to control the height adjustment of the floor nozzle with respect to the base. In particular, the control device may be designed to automatically control the height adjustment of the floor nozzle with respect to the base. For example, the control device may be designed to control a tilting movement of the floor nozzle about a tilting axis.

The control device may be designed to control the above mentioned stepper motor or the above mentioned servo motor. The control device may be designed to control the height adjustment depending on or as a function of signals or data from a distance and/or obstacle sensor. For example, if a distance and/or obstacle sensor detects an unevenness or elevation, the control device can cause the floor nozzle to raise with respect to the base. Similarly, when a depression is detected, the control device can cause the floor nozzle to be lowered.

The vacuuming robots described above may include a pressure and/or air flow sensor to determine the pressure and/or velocity of the air sucked in. The control device may be designed to control the height adjustment of the floor nozzle according to or as a function of data or signals from a pressure and/or air flow sensor. In this way, the suction and/or air flow conditions can be adjusted as desired to achieve an optimised suction result.

The vacuuming robots described above may include a motor fan unit for sucking air through the floor nozzle. The motor blower unit can be a dirty air motor or a clean air motor.

The motor blower unit may have a radial blower, especially a single-stage blower. The use of a motor blower unit leads to particularly good cleaning and suction results. With a radial blower, the air is sucked in parallel or axially to the drive axis of the blower wheel and deflected by the rotation of the blower wheel, in particular by about 90°, and blown out radially.

The floor nozzle has a suction opening for establishing a fluid connection with the motor blower unit. This suction opening is in fluid connection with the air flow channel.

The motor blower unit can be positioned between the floor nozzle and the dust collection unit in such a way that an air stream sucked through the floor nozzle flows through the motor blower unit into the dust collection unit.

This means that a Dirty Air Motor is used advantageously in a vacuuming robot. Even with low motor power, a high volume flow can be achieved with the inventive vacuuming robot.

As an alternative, the motor blower unit can also be arranged fluidically behind the dust extractor in such a way that an air stream sucked in through the floor nozzle flows through the dust extractor into the motor blower unit. In this alternative, a clean-air motor is used in particular.

The vacuuming robots described above can have a floor nozzle module and a power supply module, with the floor nozzle module comprising the wheeled base and the floor nozzle connected to the base. The power supply module is mounted on wheels and has drive means to drive at least one of the wheels of the power supply module. The power supply module is connected to the floor nozzle module via a power supply cable to supply power to the floor nozzle module.

The design of the vacuuming robot with a floor nozzle module on the one hand and a power supply module on the other hand provides a versatile vacuuming robot. The floor nozzle module is powered by the (independently moving) power supply module. Therefore, the floor nozzle module does not need to have its own accumulators (rechargeable batteries) and can therefore be designed compactly and have less weight. This improves the mobility of the floor nozzle module. The floor nozzle module can also reach the areas to be sucked in, under restricted conditions.

The floor nozzle module and the power supply module are designed in this version as separate or (spatially) separate units; they are each mounted (separately) on their own wheels. The floor nozzle module and the power supply module can be moved independently of each other. In particular, they can only be connected to one another via the power supply cable.

The dust collector can be located on or in the floor nozzle module. Alternatively, the dust collector can be located on or inside the power supply module. In the latter case, the floor nozzle module and the power supply module are connected to each other via a suction hose. Through this suction hose, sucked-in air can be led through the floor nozzle into the dust separator.

The motor blower unit can be located on or inside the floor nozzle module. Alternatively, the motor blower unit can be located on or in the power supply module.

In any case, if the dust collector is located on or inside the power supply module and the motor blower unit is located on or inside the floor nozzle module, the motor blower unit includes a Dirty Air motor.

When a power supply module is provided, one, several or all wheels of the power supply module may be omnidirectional wheels.

As an alternative to the two module version, the vacuuming robot can also have only one modul. Then, for example, the dust collector and/or a power supply may be located on or in the wheeled base. In this case, no separate power supply module is provided.

The vacuuming robot can be a bag vacuum cleaner. A bag vacuum cleaner is a vacuum cleaner in which the sucked-in dust is separated and collected in a vacuum cleaner filter bag. In particular, the vacuuming robot can be a bag cleaner for disposable bags.

For the vacuuming robots described, the dust collector may comprise a vacuum cleaner filter bag, in particular with a surface area not exceeding 2000 cm², in particular not exceeding 1500 cm². The dust collector may consist in particular of such a vacuum cleaner filter bag.

The filter area of a vacuum cleaner filter bag is the total surface area of the filter material located between or within the edge seams (e.g. welds or adhesive seams). Any side or surface creases must also be taken into account. The area of the bag filling opening or inlet opening (including any seam surrounding this opening) is not part of the filter area.

The vacuum cleaner filter bag may be a flat bag or have a block bottom shape. A flat bag is formed by two side walls of filter material which are joined together along their circumferential edges (e.g. welded or glued). The bag filling opening or inlet opening can be provided in one of the side walls. The side surfaces or walls may each have a rectangular basic shape. Each side wall may comprise one or more layers of fleece and/or non-woven fabric.

The vacuuming robot in the form of a bag cleaner can comprise a vacuum cleaner filter bag, whereby the vacuum cleaner filter bag is designed in the form of a flat bag and/or as a disposable bag.

The bag wall of the vacuum cleaner filter bag may comprise one or more layers of a fleece and/or one or more layers of a non-woven fabric. In particular, it may comprise a laminate of one or more layers of a fleece and/or one or more layers of a non-woven fabric. Such a laminate is described, for example, in WO 2007/068444.

The term non-woven fabric is understood in the sense of the standard DIN EN ISO 9092:2010. Film and paper structures, in particular filter paper, are not regarded as a non-woven fabric. A "fleece" is a structure of fibres and/or continuous filaments or short fibre yarns which have been formed into a fabric by any process (except the interweaving of yarns such as woven fabric, knotted fabric, knitted fabric, lace or tufted fabric) but which have not been joined by any process. A joining process turns a fleece into a non-woven fabric. The fleece or the non-woven fabric can be dry laid, wet laid or extruded.

The suction devices described may include a holder for a vacuum cleaner filter bag. Such a holder may be located on, at or in the base and/or housing of the vacuuming robot.

Instead of a bag cleaner, the vacuuming robot may be a bagless vacuum cleaner, in particular with a blow-out filter with a filter area of at least 800 cm^2. A bagless vacuum cleaner is a vacuum cleaner in which the vacuumed dust is separated and collected without a vacuum cleaner filter bag. In this case, the dust separator may include an impact separator, a centrifugal separator or a cyclone separator.

The vacuuming robots described above may include a navigation device for the independent movement of the vacuuming robot. The navigation device may be coupled with a control device for controlling the height adjustment of the floor nozzle with respect to the base. In this way, the control of the height adjustment can also be carried out depending on or as a function of data or signals from the navigation device.

The vacuuming robots described may include one or more positioning devices. The positioning devices may include, in particular, cameras, displacement sensors and/or distance sensors. Distance sensors may be based on sound waves or electromagnetic waves, for example.

The navigation device may be coupled to one or more positioning devices. In particular, the navigation or autonomous procedure may be based on or as a function of the data or signals of one or more positioning devices.

Other features are described by the figures. The following figures show schematically on:

Figure 1 an example of a vacuuming robot consisting of two modules;

Figure 2 a block diagram of a vacuuming robot consisting of two modules;

Figure 3 an example of a vacuuming robot from one module.

Figure 1 is a schematic representation of a first example of a vacuuming robot 1. The vacuuming robot 1 shown comprises a power supply module 2 and a floor nozzle module 3, which is connected to the power supply module 2 via a flexible suction hose 4. In this design example, the vacuuming robot 1 has a two-module design, whereby the power supply module 2 and the floor nozzle module 3 are separate units which are only connected to each other via the suction hose 4.

The power supply module 2 is mounted on four wheels 5, whereby in the example shown each of these wheels is designed as an omnidirectional wheel. In principle, however, conventional wheels can also be used instead of the omnidirectional wheels. Each omnidirectional wheel 5 has a plurality of rotating rollers 6 on its circumference. The rotation axes of the rollers 6 are all not parallel to the wheel axis 7 of the respective omnidirectional wheel. For example, the rotation axes of the rollers can be at an angle of 45° to the respective wheel axis. The surfaces of the rollers or the rolling elements are domed or curved.

Examples of such omnidirectional wheels are described in US 3,876,255, US 2013/0292918, DE 10 2008 019 976 or DE 20 2013 008 870.

The power supply module 2 has a drive device to drive the wheels 5 of the power supply module. The drive unit can have a separate drive unit for each wheel 5, for example in the form of an electric motor, so that each wheel 5 can be driven independently of the other wheels. The rollers 6 can be rotated without drive.

The power supply module 2 can be moved in any direction by suitable driving individual or all wheels 5. If, for example, all four wheels 5 are moved at the same speed in the same direction of rotation, the power supply module moves straight ahead. By moving the wheels in opposite directions on one side, lateral movement or displacement can be achieved.

In principle, not all wheels must be designed to be drivable; individual wheels can also be provided without their own drive. In addition, it is also possible that individual wheels, even if they are basically drivable, are not driven for certain movements.

In alternative designs, the power supply module can also have fewer or more than four wheels. Not all wheels have to be designed as omnidirectional wheels. An example with three omnidirectional wheels is described in US 2007/0272463.

The floor nozzle module 3 comprises a base 8 and a floor nozzle 9 arranged on this base 8. In the example shown, the base 8 (and thus the entire floor nozzle module 3) is mounted on four omnidirectional wheels 5. In the design example, these wheels are smaller than the wheels of the power supply module 2. In an analogous form, the floor nozzle module 3 also has a drive device for the wheels 5. Here, too, the drive unit for each wheel comprises a separate drive unit, for example in the form of electric motors, in order to drive each wheel separately and independently of the other wheels. In this way, the floor nozzle module can also be moved in any direction by suitably driving the wheels. Alternatively, conventional wheels can be used instead of omnidirectional wheels.

Instead of wheels that - as in the illustrated example - touch the floor directly and will cause the vacuuming robot to move as a result of this contact, the wheels can also be designed as drive wheels for a caterpillar chain, so that the vacuuming robot is moved by a caterpillar drive.

The floor nozzle 9 is pivotally linked to the floor area 8 via a swivel joint 10. Due to this pivoting bearing, the floor nozzle 9 is height-adjustable in relation to the floor area 8 and can be tilted upwards.

The floor nozzle 9 has a floor plate with a base area that faces the floor, i.e. the area to be vacuumed, when the vacuuming robot is in operation. An air flow channel is installed in the base plate parallel to the floor area, through which the dirty air is sucked in and led via a flexible hose connection 11 into the floor area 8, from where it is led through the suction hose 4 to a dust separator in the power supply module 2.

The floor nozzle can have a rotating device to rotate the air flow channel about an axis perpendicular to the floor area.

In the example shown, the power supply module 2 has a housing 12 on which a motor blower unit 13 is arranged. From the motor blower unit 13, a pipe section 14 leads into the interior of the housing 12 to a vacuum cleaner filter bag located inside the housing and forming a dust collector. The vacuum cleaner filter bag can be attached to the inside of the housing 12 in a conventional removable manner, for example by means of a retaining plate.

In the arrangement shown, the floor nozzle 9, the hose section 11, the base 8, the suction hose 4, the motor blower unit 13 and the pipe section 14 provide a continuous fluidic or aerodynamic connection with the dust separator. The motor blower unit 13 is arranged between the suction hose 4 and the dust separator, so that dirty air sucked in through the floor nozzle flows through the motor blower unit 13 (in particular over the pipe section 14) into the vacuum cleaner filter bag arranged inside the housing 12.

The motor blower unit 13 is thus a dirty-air motor. In particular, it is a motor blower unit with a radial blower.

The motor blower unit has a volume flow of more than 30 l/s with an electrical input power of less than 450 W (determined in accordance with DIN EN 60312-1:2014-01 with orifice 8), a volume flow of more than 25 l/s with an electrical input power of less than 250 W and a volume flow of more than 10 l/s with an electrical input power of less than 100 W.

The blower diameter can range from 60 mm to 160 mm. For example, a motor blower unit can be used that is also used in Soniclean Upright vacuum cleaners (e.g. SONICLEAN VT PLUS).

The motor-blower unit of the SONICLEAN VT PLUS has been characterised according to DIN EN 60312-1:2014-01 as explained above. The motor blower unit was measured without vacuum cleaner housing. The versions in section 7.3.7.1 apply to the spacers required for connection to the measuring chamber. The table shows that high volume flows can be achieved with low speeds and low input power.

"Dirty air" (blower wheel diameter 82 mm) with orifice 8 (40 mm)				
Power input	Voltage	Speed	Vacuum box	Volume flow
[W]	**M**	[RPM]	[kPa]	[l/s]
200	77	15,700	0.98	30.2
250	87	17,200	1.17	32.9
300	95	18,400	1.34	35.2
350	103	19,500	1.52	37.5
400	111	20,600	1.68	39.4
450	117	21,400	1.82	41.0

Instead of a dirty air motor, the power supply module 2 can also have a conventional clean air motor arranged behind the dust separator in the air flow direction. In this case, the dirty air sucked-in would pass through the suction hose 4 to the power supply module 2, into whose housing 12 enters and is led into the dust separator, for example in the form of a vacuum cleaner filter bag.

The vacuuming robot 1 comprises a navigation device for the independent movement of the power supply module 2 and the floor nozzle module 3. For this purpose, an appropriately programmed microcontroller is arranged in the housing 12 of the power supply module 2. The navigation device is connected to devices for location determination. This includes a camera 15 and distance sensors 16. The distance sensors can be laser sensors, for example.

The navigation of the vacuuming robot is carried out in the familiar manner as described in WO 02/074150, for example. The navigation device arranged in the housing 12 controls both the drive unit of the power supply module 2 and the drive unit of the floor nozzle module 3.

For the latter, a device is provided for the transmission of control signals from the navigation device in the housing 12 of the power supply module 2 to the ground nozzle module 3, in particular to the drive device of the ground nozzle module. For this purpose, wireless transmitters/receivers can be provided on the sides of the power supply module 2 and the ground nozzle module 3 respectively. Alternatively, a wired connection for the transmission of control signals can be provided along the suction hose.

The floor nozzle module 3 can also support one or more positioning devices. For example, displacement sensors and/or distance sensors can be provided on the floor nozzle module. In order to use the appropriate information for control and navigation, appropriate signals are transmitted from the floor nozzle module to the navigation device.

The vacuuming robot's power supply can be wired or wireless. In particular, the power supply module can have 2 rechargeable batteries, which can, for example, be charged by cable or wirelessly (inductively). To charge the batteries, for example, the vacuuming robot 1 can automatically move to a charging station.

The floor nozzle module, in particular its drive unit, can be powered via a power supply cable in or along the suction hose 4. If the power supply to the drive unit of the floor nozzle module is not exclusively via a power connection via the suction hose 4, the floor nozzle module 3 itself can also have batteries.

Figure 2 is a schematic block diagram of a vacuuming robot 1 with a power supply module 2 and a floor nozzle module 3. The drive device for the wheels 5 of the power supply module 2 comprises on the one hand four drive units 17 in the form of electric motors and on the other hand a microcontroller 18 for controlling the electric motors.

In the power supply module 2, a navigation device 19 is also provided, which serves the independent movement of the power supply module and the floor nozzle module. The navigation device 19, comprising a microcontroller, is connected both to the microcontroller 18 of the drive device and to another microcontroller 20, which is part of the devices for position location. The navigation device 19, comprising a microcontroller, is connected both to the microcontroller 18 of the drive device and to another microcontroller 20, which is part of the positioning devices.

The navigation device 19 is also connected to the motor blower unit 13 in order to control it.

In the example shown, power is supplied by a battery 21, which can be charged wirelessly or wired. For the sake of clarity, not all power supply connections are shown in the figure.

The floor nozzle module 3 also has a drive device for the four wheels 5, where the drive device comprises, as in the case of the power supply module 2, a microcontroller 18 and four electric motors 17. The control signals for the drive device of the nozzle module 3 come from the navigation device 19, which is arranged in the power supply module 2. The signals are transmitted via a connecting line 22, which can, for example, be arranged in the wall of the suction hose. Alternatively, this signal transmission could also be wireless.

The floor nozzle module 3 comprises a base 8, on which the floor nozzle 9 is rotatably mounted via swivel joints 10. On the side of the floor nozzle 9 facing the surface to be cleaned there is a schematic air flow channel 24. Dirt air is sucked in through the air flow channel 24 and led via the floor area 8 and the suction hose 4 into the power supply module, or more precisely its dust separator.

In a first position (starting position), the floor nozzle 9 is aligned parallel to the base area and to the surface to be cleaned (flat). The floor nozzle can be locked in this position in particular.

As can be seen in Figure 1, a distance or direction sensor 25 is arranged on the floor nozzle 9. If this distance sensor or obstacle sensor 25 is used to detect an unevenness in the surface to be cleaned, such as an elevation, the height of the floor nozzle 9 can be adjusted in relation to the surface to be cleaned or in relation to the base area 8. The unevenness can be, for example, in a carpet edge or a door sill.

The height adjustment of the floor nozzle 9 is carried out, for example, by swivelling the floor nozzle around the swivel joint, via which the floor nozzle 9 is connected to the base 8. For this purpose, the rotary axes 10 can be designed as shafts, each of which is coupled to a stepper motor or a servo motor 26.

In the floor nozzle module 3 a control unit 27 is provided for controlling the height adjustment of the floor nozzle 9 in relation to the base 8. The control unit comprises a programmed microcontroller and is connected to the sensor

25. If the distance or obstacle sensor 25 detects an obstacle in the form of an elevation, for example, an appropriate signal is sent to the control unit 27, which then controls the electric motors 26 in such a way that the floor nozzle is swivelled by a certain angle by means of a rotation and thus lifted. In this new position, the floor nozzle can then be locked by stopping (or blocking) the electric motors 26.

The distance or obstacle sensor 25 can be used to check whether there is an obstacle or not with this (new) height adjustment or angle position of the floor nozzle 9. If an obstacle is still detected, the floor nozzle 9, for example, can be raised further.

Due to the raised floor nozzle 9, the floor nozzle module 3 is no longer blocked by the elevation, as it fits under the floor nozzle 9.

If the floor nozzle 9 sits or rests on such an elevation in the course of the forward movement, the base 8 will also lift up due to the inclined position of the floor nozzle 9 during further forward movement of the floor nozzle module. In this way the floor nozzle module 3 moves up and over the elevation.

The floor nozzle 9 can also have a distance sensor on its underside, i.e. on the side facing the surface to be cleaned. This distance sensor can, for example, be arranged in the base plate of the floor nozzle 9. This distance sensor can be used to determine the distance between the floor nozzle (its underside) and the surface to be cleaned. Changes in the detected distance can be used to determine whether the surface to be cleaned is uneven or not.

If a depression in the surface to be cleaned is detected in this way (e.g. the transition from a carpet to a hard floor), the floor nozzle can be lowered again. In a similar way, a decreasing distance between the floor area of the floor nozzle and the surface to be cleaned can be used to detect whether there is an increase and to initiate a corresponding upward movement of the floor nozzle.

The floor nozzle module 3, in particular the floor nozzle 9, can have an active brush roller (driven by an electric motor) or a passive brush roller (not driven by an electric motor).

Instead of the design shown in Fig. 1 and 2, in which the blower unit is arranged on the side of the power supply module, the blower unit can also be arranged on, on or in the floor nozzle module. In this case, the dust collector may also be located on the side of the floor nozzle module. This eliminates the need for a suction hose connection between the floor nozzle module and the power supply module. In this case only a power cable has to be provided between the power supply module and the floor nozzle module. Alternatively, the dust collector can still be provided on the side of the power supply module.

Instead of a two-module version, as schematically illustrated in Figures 1 and 2, the vacuuming robot can also consist of just one module, as schematically shown in Figure 3.

In this case, the floor nozzle 9 is also articulated to a base 8 via an axis of rotation or shaft 10, which in this case comprises the housing 12. In this design, the floor nozzle 9 can also be adjusted in height with respect to the base 8 by pivoting it around the axis of rotation 10. In an initial position, the floor nozzle 9 can be aligned parallel to a flat surface to be cleaned. A swivelling of the floor nozzle leads to an inclined position.

In this design example, the floor nozzle 9 also has an air flow channel on its underside (the side facing the surface to be cleaned), through which dirty air is sucked in and guided via a piece of hose 11 into the housing 12 of the base 8, inside the dust separator, for example in the form of a vacuum cleaner filter bag or an impact separator.

Patentkrav

1. Støvsugerrobot (1) omfattende en basisdel (8), der er monteret på hjul (5), en støvudskiller og en gulvdyse (9), der er anbragt på basisdelen, til optagelse af en luftstrøm i støvsugerrobotten (1), hvor gulvdysen (9) er udformet højdeindstilleligt i forhold til basisdelen,
hvor gulvdysen (9) kan bringes til en stilling, der hælder i forhold til basisdelen,
hvor gulvdysen (9) er drejeligt ledforbundet med basisdelen (8),
hvor gulvdysen omfatter en bundplade med en grundflade, der under drift af støvsugerrobotten vender mod fladen, der skal rengøres, hvor bundpladen i grundfladen har en luftstrømningskanal (24), som luft, der skal renses, kommer igennem ind i gulvdysen,
hvor støvsugerrobotten omfatter en trinmotor eller en servomotor (26) til højdeindstilling af gulvdysen i forhold til basisdelen.

2. Støvsugerrobot ifølge krav 1, hvor gulvdysen er anbragt på en side af basisdelen, især foran basisdelen.

3. Støvsugerrobot ifølge et af de foregående krav, hvor gulvdysen kan låses i en fast position eller en flerhed af faste positioner i forhold til basisdelen.

4. Støvsugerrobot ifølge et af de foregående krav, omfattende en afstands- og/eller forhindringssensor (16).

5. Støvsugerrobot ifølge et af de foregående krav, omfattende en børstevalse, er anbragt i eller på gulvdysen.

6. Støvsugerrobot ifølge et af de foregående krav, omfattende en styreindretning (27) til, især automatisk, styring af højdeindstillingen af gulvdysen i forhold til basisdelen.

7. Støvsugerrobot ifølge et af de foregående krav, omfattende en tryk- og/eller luftstrømningssensor til bestemmelse af trykket og/eller hastigheden af luften, der suges ind.

8. Støvsugerrobot ifølge et af de foregående krav, omfattende en motorblæserenhed til indsugning af en luftstrøm gennem gulvdysen.

9. Støvsugerrobot ifølge et af de foregående krav, hvor støvsugerrobotten er en posestøvsuger eller en poseløs støvsuger.

10. Støvsugerrobot ifølge et af de foregående krav, omfattende en navigationsindretning (19) til selvstændig kørsel af støvsugerrobotten.

11. Støvsugerrobot ifølge et af de foregående krav, omfattende en eller flere indretninger til placeringsbestemmelse.

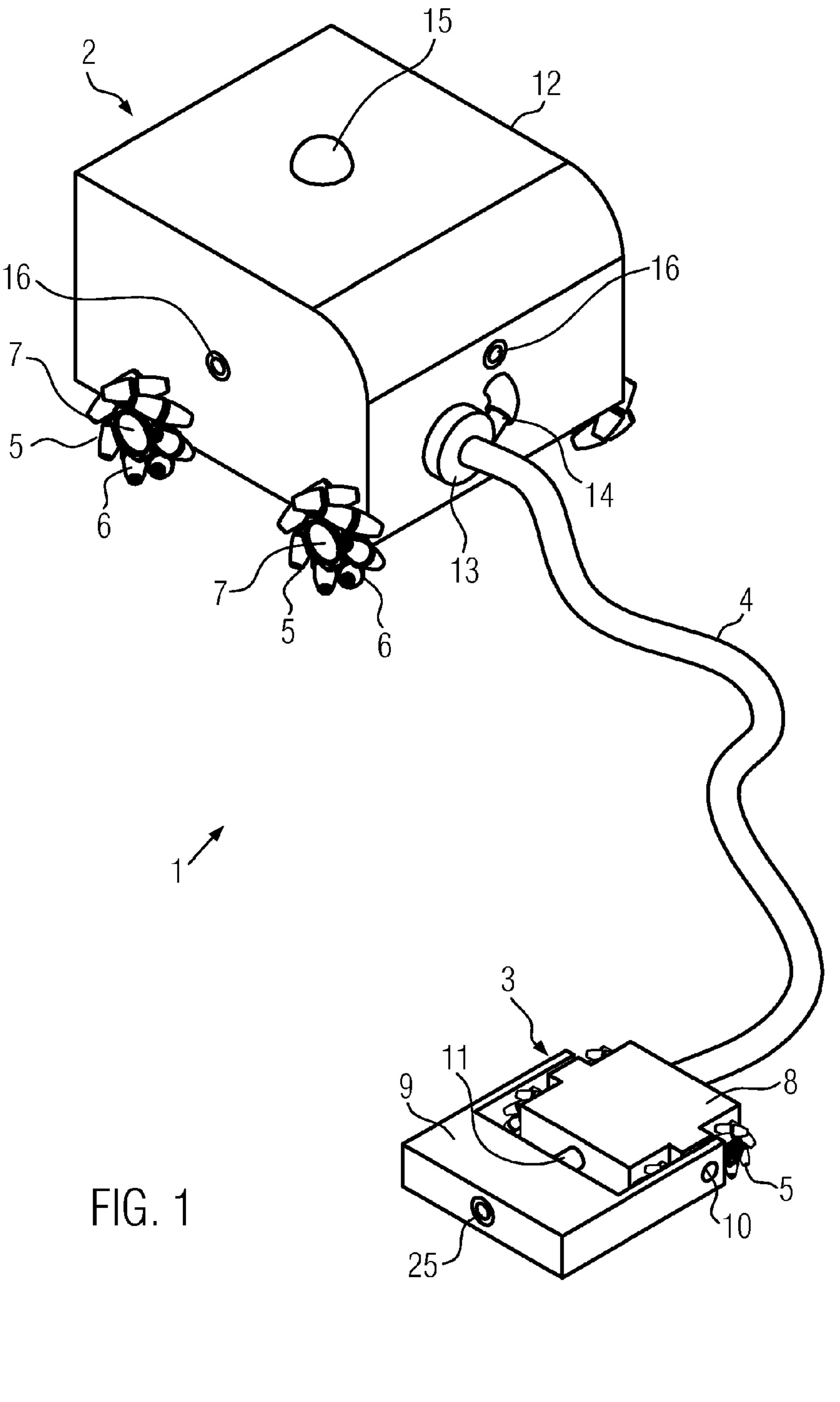

FIG. 1

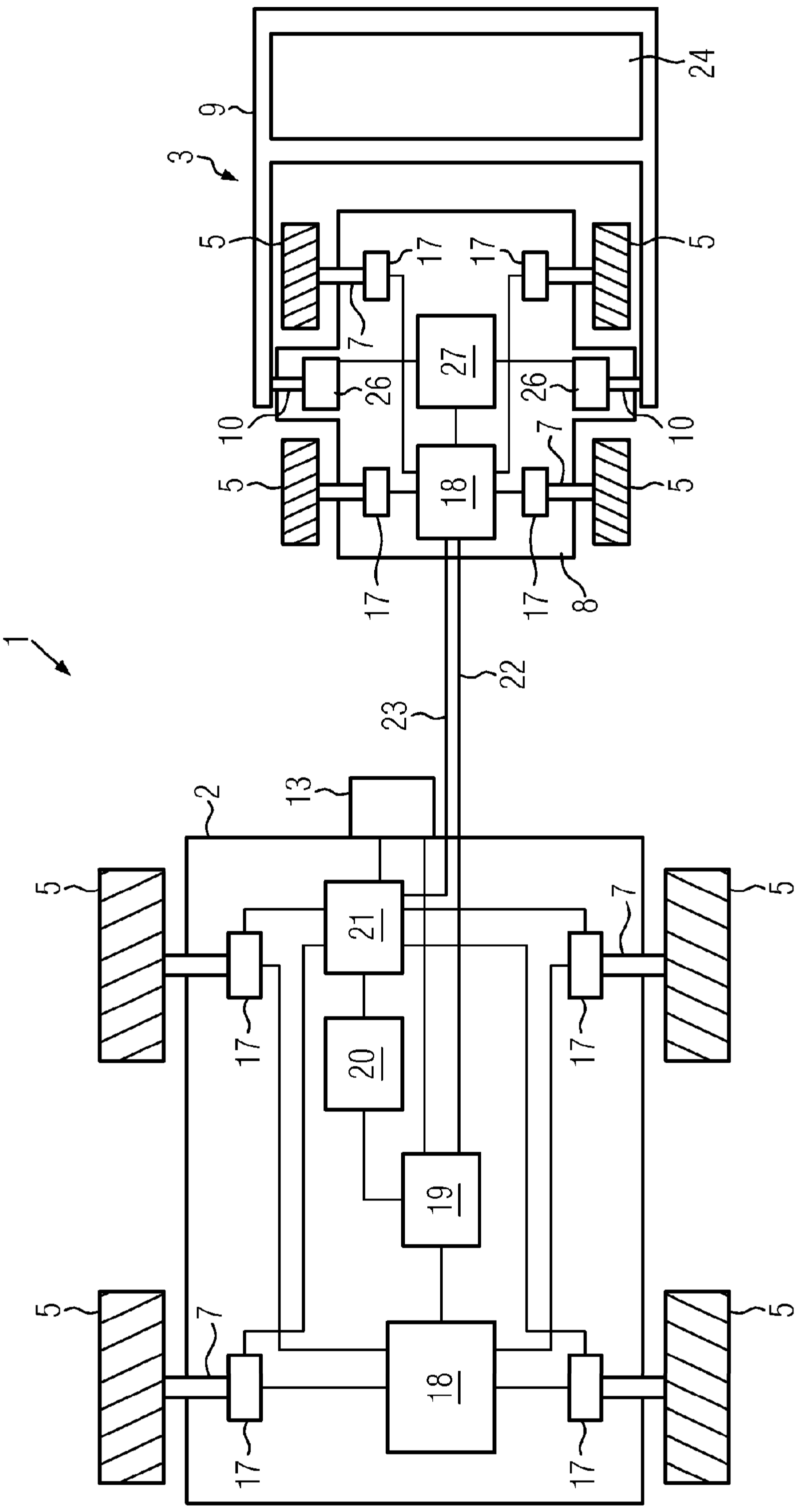

FIG. 2

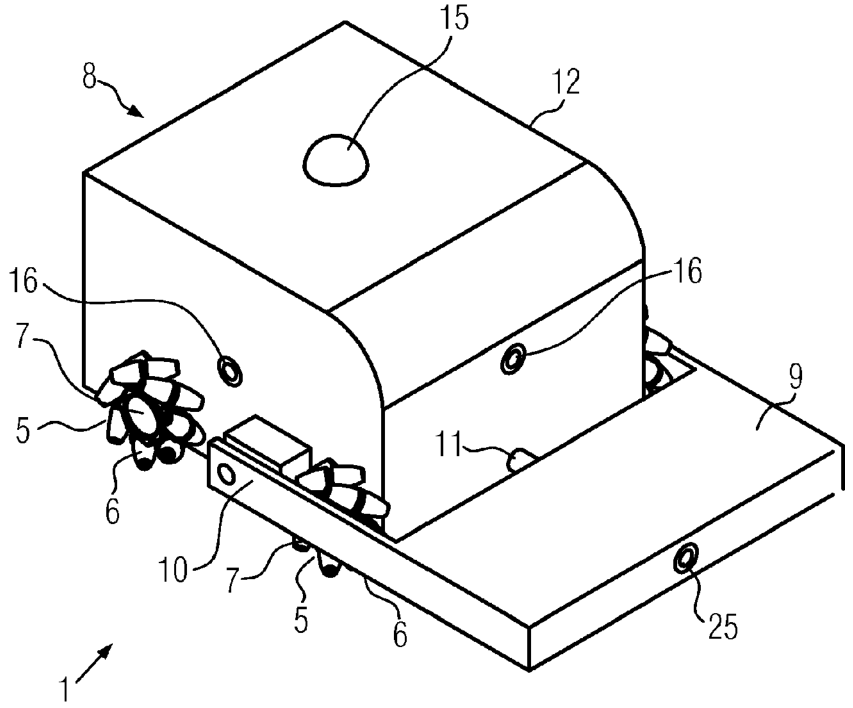

FIG. 3