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(54) **FLOOR CLEANING APPARATUS**

BODENREINIGUNGSMASCHINE

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(72) Inventor: **LISCIO Michele**
I-20146 Milano (IT)

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(74) Representative: **Lusuardi, Werther**
Dr. Lusuardi AG
Kreuzbühlstrasse 8
8008 Zürich (CH)

(73) Proprietor: **Wetrok AG**
8302 Kloten (CH)

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The invention relates to a floor cleaning apparatus according to the preamble of claim 1 and to a method for cleaning a floor using the same according to the preamble of claim 27.

2. Description of the Related Art

[0002] An apparatus for cleaning a floor surface is known from US 5,901,410 WINDMEISSER. This known cleaning apparatus is suitable for wet cleaning and comprises a front suction unit in front of the brushing means and a rear suction unit behind the brushing means. Fresh cleaning liquid is supplied to the brushing means from a first tank in either travel direction. The front suction unit and the rear suction unit both extend parallel to the brushing means and are both connected to a second tank. The cleaning liquid is sucked up by the rear suction unit when the cleaning apparatus is moved in forward travel direction and sucked up by the front suction unit when the cleaning apparatus is moved in a backward travel direction. A drawback of this known device is that both suction units are always active in either travel direction of the cleaning apparatus but only one of the front and rear suction units is used to suck up the cleaning liquid applied to the floor via the brushing means.

BRIEF SUMMARY OF THE INVENTION

[0003] It is an object of the invention to provide a floor cleaning apparatus which has a front and a rear suction unit and which permits to either increase the vacuum applied to a suction unit or to increase the suction volume flow rate without changing the vacuum turbine power.

[0004] The invention solves the posed problem with a floor cleaning apparatus comprising the features of claim 1 as well as with a method for cleaning a floor using the same and comprising the features of claim 27.

[0005] The advantages of the floor cleaning apparatus according to the invention are essentially to be seen in the facts that:

- during a movement of the cleaning apparatus in the forward travel direction the front suction channel is closed and the entire suction performance of the vacuum turbine is concentrated on the rear suction unit. Due to the closed front suction channel the suction volume flow rate is reduced and thus an increased vacuum in the rear suction channel can be achieved when the cleaning apparatus is moved in forward travel direction;
- during a movement of the cleaning apparatus in the backward travel direction the front suction unit opens

so that the front suction unit and the rear suction unit actively suck up cleaning liquid resulting in a combined high suction volume flow rate; and

- a vacuum turbine can therefore be used which has a constant suction power when either both suction units are simultaneously active thus allowing a high suction volume flow rate or when the rear suction unit is active only thus allowing a high vacuum.

[0006] In a special embodiment the closing member closes the front suction channel when the cleaning apparatus is moved in a forward travel direction.

[0007] In another embodiment the closing member opens the front suction channel when the cleaning apparatus is moved in a backward travel direction. Due to this configuration the front suction channel can be opened or closed by simply changing the travel direction of the cleaning apparatus.

[0008] In a further embodiment the rear suction unit comprises a rear suction channel which remains open during both movements of the cleaning apparatus in the forward and backward travel direction. This configuration permits the advantage that because the rear suction channel is open in either travel direction the suction volume flow rate of the cleaning unit can simply be increased by moving the cleaning apparatus in the backward travel direction.

[0009] In a further embodiment the front suction channel comprises a suction opening which is open towards a floor to be cleaned over the entire length of the front suction unit and the closing member closes the suction opening of the front suction channel when the cleaning apparatus is moved in a forward travel direction and opens the suction opening when the cleaning apparatus is moved in a backward travel direction. By this means a simple configuration of the closing member is achievable.

[0010] In another embodiment the front suction channel comprises a suction opening which is open towards a floor to be cleaned and the closing member comprises a lip with a front section which frontally limits the suction opening along its entire length and a rear section which rearwardly limits the suction opening along its entire length. By this means the advantage can be achieved that the front section of the lip can be used to close or open the suction opening of the front suction channel.

[0011] Preferably, the closing member is actuated by frictional forces acting on the front section of the lip due to a sliding movement of the same on a floor to be cleaned when the cleaning apparatus is moved in the forward travel direction of the cleaning apparatus or in the backward travel direction of the cleaning apparatus. The advantage of this configuration can be seen therein that the closing member can be actuated without any auxiliary drive or device and must not be separately actuated by the operator. Preferably, the lip is made of a resilient material permitting the advantage that the front section of the lip is biased into its initial configuration where the front

suction opening is opened.

[0012] In a further embodiment the front section of the lip has a vertical height HF and the rear section of the lip has a vertical height HR and wherein HF is larger than HR so that the front section is bendable across the suction opening. By this means the advantage can be achieved that when the cleaning apparatus is moved in the forward travel direction the front section of the lip is bent under the rear section so that consequently the suction slot is closed and only minimal or no suction is effected by the front suction unit. When the cleaning apparatus is moved in the backward travel direction the front section of the lip initially contacts the floor to be cleaned and is pushed oppositely to the backward travel direction, i.e. towards the front end of the cleaning apparatus so that the suction slot of the front suction unit is opened and the front suction bar fulfills in this condition the function of a standard suction bar.

[0013] Preferably, the front section of the lip is bendable as far as a portion of the front section extends below the rear section so that the suction opening of the front suction channel can be completely closed.

[0014] In a further embodiment the rear suction unit comprises a rear suction channel and both of the front suction channel and the rear suction channel are connected to a manifold so as to be in fluid connection with a single vacuum turbine. The advantage of this configuration is that the cleaning apparatus can be operated with a single vacuum turbine. Preferably, the cleaning unit comprises a first electric driving motor for the vacuum turbine and at least a second electric driving motor for the at least one brush.

[0015] In again a further embodiment the front suction unit and the rear suction unit extend transverse to the forward and backward travel direction of the cleaning apparatus. Preferably, when measured orthogonal to a vertical middle plane of the cleaning apparatus the front suction unit and the rear suction unit each have a length which is equal to or larger than a dimension of the at least one brush orthogonal to the vertical middle plane.

[0016] In another embodiment the cleaning apparatus further comprises a brush housing and the rear suction unit is attached to the brush housing by means of a resilient connecting device allowing the rear suction unit to move laterally with respect to the chassis against an elastic resistance provided by the resilient connecting device.

[0017] Preferably, the resilient connecting device comprises an elastic connector which forms a pivot joint affixed to the brush housing by means of a fastener. Preferably, the pivot joint has an axis of rotation extending essentially vertically.

[0018] In another embodiment the rear suction unit comprises a curved suction bar, preferably an essentially elliptically curved suction bar.

[0019] In a further embodiment the resilient connecting device comprises an elongated bracket having a first end affixed to the rear suction unit and a second end attached to the brush housing by means of an elastic connector.

Preferably, the elongated bracket is biased in a position of rest by means of the elastic connector wherein when in the position of rest the elongated bracket extends along a forward or backward travel direction of the cleaning apparatus.

[0020] In a further embodiment the at least one brush is rotatable about a rotational axis extending essentially vertically.

[0021] In another embodiment the cleaning apparatus further comprises a handlebar which is suitable to move the cleaning apparatus on a floor to be cleaned.

[0022] Preferably, the rear suction unit is arranged in front of the rear wheels. This configuration permits the advantage that when moving the cleaning apparatus in a forward travel direction the rear wheels move outside of the wet area of the floor to be cleaned.

[0023] In a further embodiment the cleaning apparatus further comprises a first tank which is attached to the chassis and which is configured as a receptacle with its smallest dimension X extending vertically with respect to the forward and backward travel direction of the cleaning apparatus. Preferably, the cleaning apparatus further comprises a second tank which is arranged in the rear portion of the cleaning apparatus and which is configured as a receptacle having a smallest dimension Z in the forward or rearward travel direction of the cleaning apparatus.

[0024] In another embodiment the cleaning apparatus can further comprise an elongated member which extends from the rear end of the chassis, wherein the second tank is attachable to the elongated member. Preferably, one end of the elongated member is rotatably affixed to the chassis by means of a hinge. This configuration permits the advantage that the elongated member with the second tank attached thereto can be backwardly rotated about the rotational axis of the hinge so as to permit to clean the floor under a table.

A BRIEF DESCRIPTION OF THE DRAWINGS

[0025] A special embodiment of the invention will be described in the following by way of example and with reference to the accompanying drawings in which:

Fig. 1 illustrates a side view of an embodiment of the floor cleaning apparatus according to the invention;

Fig. 2 illustrates an exploded perspective view of the front portion of the embodiment of the floor cleaning apparatus according to the invention shown in fig. 1;

Fig. 3 illustrates a sectional view of the brush housing along the vertical middle plane;

Fig. 4 illustrates a magnified sectional view of detail B in fig. 3; and

Fig. 5 illustrates a side view of an embodiment of the

floor cleaning apparatus according to the invention shown in fig. 1 with the second tank additionally illustrated in a vertical and backward tilted position.

DETAILED DESCRIPTION OF THE INVENTION

[0026] Although the invention is described in conjunction with a specific embodiment thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, it is intended to embrace all such alternatives, modifications and variations that fall within the spirit and broad scope of the appended claims.

[0027] All publications, patents and patent applications mentioned in this specification are herein incorporated in their entirety by reference into the specification, to the same extent as if each individual publication, patent or patent application was specifically and individually indicated to be incorporated herein by reference. In addition, citation or identification of any reference in this application shall not be construed as an admission that such reference is available as prior art to the present invention. To the extent that section headings are used, they should not be construed as necessarily limiting. The terms "comprises", "comprising", "includes", "including", "having" and their conjugates mean "including but not limited to". This term encompasses the terms "consisting of" and "consisting essentially of".

[0028] The terms "front", "rear", "forward" and "backward" are understood as being directed to a "forward travel direction" of the cleaning apparatus, i.e. a movement of the cleaning apparatus by manually pushing the handlebar towards the front portion of the cleaning apparatus so that the same moves on the floor to be cleaned with the front portion ahead. The term "backward travel direction" is meant to be the opposite travel direction by pulling the handlebar so that the cleaning apparatus moves on the floor with the rear portion ahead. The wording "lateral" or in "a lateral direction" is understood as located beside or extending in a cross direction with respect to the forward and backward travel direction. Furthermore, the terms "lower side of the chassis", "upper side of the chassis", "above", "below", "vertical" and "horizontal" are referenced to the cleaning apparatus positioned on the floor to be cleaned.

[0029] The term "chassis" is understood as being a framework which supports and/or holds in position the various parts of the cleaning apparatus and to which the handlebar is affixed and the rear wheels are rotatably attached.

[0030] As used herein, the singular form "a", "an" and "the" include plural references unless the context clearly dictates otherwise. For example, the term "a brush" or "at least one brush" may include a plurality of brushes.

[0031] Throughout this application, various embodiments of this invention may be presented in a range format. It should be understood that the description in range format is merely for convenience and brevity and should

not be construed as an inflexible limitation on the scope of the invention. Accordingly, the description of a range should be considered to have specifically disclosed all the possible subranges as well as individual numerical values within that range. For example, description of a range such as from 1 to 6 should be considered to have specifically disclosed subranges such as from 1 to 3, from 1 to 4, from 1 to 5, from 2 to 4, from 2 to 6, from 3 to 6 etc., as well as individual numbers within that range, for example, 1, 2, 3, 4, 5, and 6. This applies regardless of the breadth of the range.

[0032] Whenever a numerical range is indicated herein, it is meant to include any cited numeral (fractional or integral) within the indicated range. The phrases "ranging/ranges between" a first indicate number and a second indicate number and "ranging/ranges from" a first indicate number "to" a second indicate number are used herein interchangeably and are meant to include the first and second indicated numbers and all the fractional and integral numerals therebetween.

[0033] It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention, which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable subcombination or as suitable in any other described embodiment of the invention. Certain features described in the context of various embodiments are not to be considered essential features of those embodiments, unless the embodiment is inoperative without those elements. As used herein the term "method" refers to manners, means, techniques and procedures for accomplishing a given task including, but not limited to, those manners, means, techniques and procedures either known to, or readily developed from known manners, means, techniques and procedures by practitioners of mechanical engineering.

[0034] The word "exemplary" is used herein to mean "serving as an example, instance or illustration". Any embodiment described as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments and/or to exclude the incorporation of features from other embodiments.

[0035] The word "optionally" is used herein to mean "is provided in some embodiments and not provided in other embodiments". Any particular embodiment of the invention may include a plurality of "optional" features unless such features conflict.

[0036] Figs. 1 to 4 illustrate an embodiment of the cleaning apparatus 1 for wet cleaning of a floor 12. The cleaning apparatus 1 essentially comprises a front portion 16, a rear portion 17 with two lateral rear wheels 3, a chassis 2 and a cleaning unit 4 attached to the chassis 2. Exemplarily, the cleaning apparatus 1 can be provided with a handlebar 6 which is suitable to move the cleaning apparatus 1 on a floor 12 to be cleaned. Alternatively, the cleaning apparatus 1 can be driven by a motor and

controlled by the operator by means of control means attached to the cleaning apparatus 1 or can be controlled by a remote control. The handlebar 6 can be attached to the chassis 2 by means of an essentially vertically extending elongated member 9, e.g. a post so that the handlebar 6 permits to move the cleaning apparatus 1 manually in a forward and a backward travel direction. In various embodiments of the cleaning apparatus 1 according to the invention the cleaning unit 4 can comprise one or more brushes 20. Exemplarily, but not limiting, the embodiment of the cleaning apparatus 1 illustrated in fig. 1 to 5 is provided with a cleaning unit 4 comprising two brushes 20. The two brushes 20 are rotatably attached to a brush housing 22. The brushes 20 are rotatable about a rotational axis 21 each. The brushes 20 can for example, but not limited to, be arranged with their rotational axes 21 extending vertically on opposite sides of the vertical middle plane 18 and essentially vertically to the forward and backward travel direction of the cleaning apparatus. Alternatively, the one or more brushes 20 can be arranged with their rotational axes 21 extending horizontally in a lateral direction of the cleaning apparatus 1.

[0037] Further, the cleaning unit 4 can comprise a first tank 15, a second tank 13, preferably two rotatable brushes 20 and a suction device 25 permitting to suck up the dirty cleaning liquid. The first tank 15 is used for fresh water supply while the second tank 13 is used as a recovery water tank into which the dirty cleaning water sucked up from the floor 12 can be delivered by means of the suction device 25 via the flexible tube 33. Furthermore, the cleaning unit 4 can comprise a first electric driving motor (not shown) for driving the vacuum turbine 5 and a second and third electric driving motor (not shown) each for driving one of the two brushes 20. The cleaning apparatus 1 can be provided with a battery 35, preferably a lithium-ion battery to supply the electric driving motors with electric energy. The two brushes 20 can rotate with opposite senses of rotation.

[0038] Preferably, the first tank 15 is configured as a fresh water tank and the second tank 13 is configured as a recovery water tank. Furthermore, the first tank 15 can be detachably affixed to the chassis 2 by means of a quick fixing device and the second tank 13 can be detachably affixed to the elongated member 9 by means of a quick fixing device. The first tank 15, i.e. the fresh water tank is connected to a piping and/or flexible tube system (not shown) so as to allow water to flow from the first tank 15 via a nozzle 45 (fig. 2) to each one brush 20. The brushes 20 are arranged in front of the rear wheels 3 in the front portion 16 of the cleaning apparatus 1 and protrude from the lower side 19 of the chassis 2 so as to be contactable with the floor 12 to be cleaned. The brush housing 22 can be attached to the chassis 2 at the lower side 19 thereof.

[0039] The suction device 25 can comprise a front suction unit 8 arranged in front of the brushes 20, a rear suction unit 7 arranged rearward of the at least one brush 20 and a vacuum turbine 5 which is operatively connected

to the front suction unit 8 and to the rear suction unit 7. Each of the front and rear suction units 8, 7 can be attached to the brush housing 22. The front suction unit 8 can be configured as a linear suction bar and can comprises a front suction channel 29 and a closing mechanism 26 which closes the front suction channel 29 when the cleaning apparatus 1 is moved in a forward travel direction. The two brushes 20, the front suction unit 8 and the rear suction unit 7 define a floor contact region 44 for contacting the floor 12 to be cleaned when the cleaning apparatus 1 is in a working position as illustrated in fig. 1. The closing mechanism 26 opens the front suction channel 29 when the cleaning apparatus 1 is tilted backwards so as to raise the floor contact region 44 relative to the rear wheels 3. Apart from this the closing mechanism 26 opens the front suction channel 29 when the cleaning apparatus 1 is moved in a backward travel direction. Furthermore, the rear suction unit 7 comprises a rear suction channel 30 which is open during movement of the cleaning apparatus 1 in the forward and the backward travel directions. By this means the suction volume flow rate of the cleaning unit 4 can simply be increased by moving the cleaning apparatus 1 in the backward travel direction while the vacuum applied to the rear suction unit 7 can be increased by moving the cleaning apparatus 1 in the forward travel direction in which the front suction unit 8 is closed. The front suction channel 29 comprises a suction opening 24 which is open towards a floor 12 to be cleaned over the entire length of the front suction unit 8. The closing mechanism 26 can be configured in such a way that it closes the suction opening 24 of the front suction channel 29 when the cleaning apparatus 1 is moved in a forward travel direction and opens the suction opening 24 when the cleaning apparatus 1 is moved in a backward travel direction. For this purpose the closing mechanism 26 can comprise a lip 41 which can be configured as a plastic or rubber gasket, wherein the lip 41 can have a front section 27 (figs. 3 and 4) which frontally limits the suction opening 24 along its entire length and a rear section 28 which rearwardly limits the suction opening 24 along its entire length. When the cleaning apparatus 1 is moved forward or backward in its working position with the floor contact region 44 contacting the floor 12 to be cleaned the closing mechanism 26 is actuated, i.e. closed and/or opened by frictional forces acting on the front section 27 of the lip 41 due to a sliding movement of the front section 27 on the floor 12 to be cleaned when the cleaning apparatus is moved in its forward travel direction, i.e. with the front portion 16 of the chassis 2 ahead or in the backward travel direction, i.e. with the rear portion 17 of the chassis 2 ahead.

[0040] Preferably, the front section 27 and the rear section 28 of the lip 41 are made of a resilient material. By this means the front section 27 of the lip 41 can be biased into its initial configuration where the front suction opening 24 is opened when the floor contact region 44 including the lip 41 is lifted from the floor 12 to be cleaned. The front section 27 of the lip 41 has a vertical height HF

protruding from the bottom of the brush housing 22 and the rear section 28 of the lip 41 has a vertical height HR protruding from the bottom of the brush housing 22. Thereby, HF is larger than HR so that the front section 27 of the lip 41 is bendable across the suction opening 24 of the front suction channel 29. Upon moving the cleaning apparatus 1 in the forward travel direction the front section 27 of the lip 41 is bent under the rear section 28 and the suction slot 24 is closed. Upon moving the cleaning apparatus 1 in the backward travel direction the front section 27 of the lip 41 is pushed towards the front end 38 of the cleaning apparatus 1 so that the suction slot 24 of the front suction unit 8 is opened. Preferably, the front section 27 of the lip 41 is bendable as far as a portion of the front section 27 extends below the rear section 28 of the lip 41 so as to completely close the suction opening 24 of the front suction channel 29. The front suction unit 8 and the rear suction unit 7 extend transverse to the forward and backward travel direction of the cleaning apparatus 1 and - when measured orthogonal to a vertical middle plane 18 of the chassis 2 - the front suction unit 8 and the rear suction unit 7 each have a length which is equal to or larger than a dimension of the two brushes 20 orthogonal to the vertical middle plane 18. Further, the rear suction unit 7 comprises a rear suction channel 30 and both of the front suction channel 29 and the rear suction channel 30 are connected to a manifold 31 so as to be in fluid connection with a single vacuum turbine 5. The vacuum turbine 5 is configured to create sufficient vacuum for active suction of the cleaning liquid in a forward and backward movement of the cleaning apparatus 1. The cleaning apparatus 1 is configured so that in a forward movement the entire vacuum performance is concentrated on the rear suction device 7. This due to the fact that during a forward movement the front section 27 of the lip 41 prevents any airflow at the front suction device 8. During backward movement the front suction unit 8 allows airflow and actively suck up of cleaning liquid. During backward movement both suction units front 8 and back 7 actively suck up cleaning liquids.

[0041] As illustrated in figs. 1 - 3 the suction device 25 comprises a rear suction unit 7 which is attached to the brush housing 22 by means of a resilient connecting device 10 permitting the rear suction unit 7 to move laterally with respect to the chassis 2 against an elastic resistance provided by the resilient connecting device 10. The resilient connecting device 10 can comprise an elongated bracket 46 having a first end 49 affixed to the rear suction unit 7 and a second end 50 attached to the brush housing 22 by means of an elastic connector 11. The first end 49 of the elongated bracket 46 can be Y-shaped to provide a rigid fixation of the rear suction unit 7. The elastic connector 11 preferably forms a pivot joint affixed to the brush housing 22 by means of a fastener 47, wherein the pivot joint has an axis 42 of rotation extending vertically with respect to a forward or backward travel direction of the cleaning apparatus 1. The elastic connector 11 can con-

sist of a plastic or rubber. The outer periphery of the elastic connector 11 can be polygonally configured to prevent rotation between the elastic connector 11 and the elongated bracket 46 or can be rotationally stable affixed to the elongated bracket 46 by an adhesive or any other means known to the skilled person. By means of the elastic connector 11 the elongated bracket 46 is biased in a position of rest in which the elongated bracket 46 extends along a forward or backward travel direction of the cleaning apparatus 1. The rear suction unit 7 can be rearwardly spaced apart from the brush housing 22 by a spacing of minimum 30%, preferably minimum 35% of the diameter of one of the brushes 20. Due to the fact that the elongated bracket 46 is elastically attached to the brush housing 22 the rear suction unit 7 can follow the path of the brushes 20 when the cleaning apparatus 1 is moved along a curved path or can be elastically pressed against a vertical wall when the cleaning apparatus 1 is moved along this wall closely enough to elastically press the rear suction unit 7 out of its position of rest against the elastic resistance provided by the elastic connector 11. Preferably, the rear suction unit 7 comprises a curved suction bar extending on an arc around a rear portion of the two brushes 20 so that the brushes are partially encircled. In embodiments of the cleaning apparatus 1 with two brushes the rear suction unit 7 is preferably configured as an essentially elliptically curved suction bar to fit better around a portion of the rear periphery of the pair of brushes 20. Further, each a stopper pin 43 can be mounted on the top side of the brush housing 22 on either side of the vertical middle plane 18 so as to limit the swiveling motion of the bracket 11. Preferably, the stopper pins 43 limit the swiveling motion of the bracket 11 within an angle of maximum $\pm 60^\circ$, preferably of maximum $\pm 45^\circ$ and of minimum $\pm 30^\circ$, preferably of minimum $\pm 35^\circ$.

[0042] As best seen in fig. 5 the first tank 15 is attachable to the chassis 2 and is configured as a receptacle with its smallest dimension X extending vertically with respect to the forward and backward travel direction of the cleaning apparatus 1. Further, the cleaning apparatus 1 can comprise an elongated member 9 which extends from the end of the chassis 2 to the handlebar 6, wherein the second tank 13 is attachable to the elongated member 9. The second tank 13 has a smallest dimension Z extending essentially perpendicular to a plane defined by the elongated member 9 and the handlebar 6. One end of the elongated member 9 can be rotatably affixed to the chassis 2 by means of a hinge 39 having a rotational axis 40 extending in the lateral direction of the cleaning apparatus 1. By this means the elongated member 9 with the second tank 13 attached thereto can be backwardly rotated about the rotational axis 40 of the hinge so as to permit to clean the floor 12 under a table or under a bench. The elongated member 9 can be adjustable and loosely securable at a selected angle between -90° and $+90^\circ$ with respect to a horizontal plane. Thus, the elongated member 9 with the second tank 13 attached thereto can be rotated from an essentially vertical position which is

suitable to put aside the cleaning apparatus 1 on a minimum space to a horizontal position permitting a reduced overall height of the complete cleaning apparatus 1. The brushes 20 and the rear suction unit 7 define a floor contact region 44 when the cleaning apparatus 1 is in a working position and the first tank 15 can extend vertically with respect to the floor contact region 44 to a level of maximum 40 cm, preferably maximum 35 cm. In a preferred embodiment each of the first and second tanks 15, 13 can have a volume of typically 9 liters. In one embodiment the cleaning apparatus 1 can additionally comprise a mechanical actuation device (not shown), preferably a lever hoist to rotate the elongated member 9 about the rotational axis 40 of the hinge 39. By this means the weight of the second tank 13 must not be manually lifted or lowered by the user during an adjustment of the elongated member 9 with the second tank 13 attached thereto from a vertical position to a horizontal position or vice versa. The weight of the second tank 13 can be lifted or lowered by means of the mechanical actuation device. Preferably, the first tank 15 longitudinally extends over the front and the rear portion 16, 17 of the cleaning apparatus 1 so as to have a maximum horizontal cross-sectional area. The first tank 15 can taper towards the front end 38 of the chassis 2 to achieve a low front portion 16 of the cleaning apparatus 1 suitable to clean the floor 12 under e.g. a bench.

[0043] While various descriptions of the present invention are described above, it should be understood that the various features can be used singly or in any combination thereof. The scope of the present invention is accordingly defined as set forth in the appended claims.

Claims

1. Floor cleaning apparatus (1) comprising:

a front portion (16) and a rear portion (17); the rear portion (17) comprising two lateral rear wheels (3);
a chassis (2); and
a cleaning unit (4) attached to the chassis (2), wherein the cleaning unit (4) comprises:

at least one rotatable brush (20) which is arranged in the front portion (16) of the cleaning apparatus (1) so as to be contactable with a floor (12) to be cleaned; and
a suction device (25) including a front suction unit (8) arranged in front of the at least one brush (20) and a rear suction unit (7) arranged rearward of the at

least one brush (20),

characterized in that

the front suction unit (8) comprises a front suction channel (29) and a closing member (26) for closing the front suction channel (29).

2. Cleaning apparatus according to claim 1, wherein the closing member (26) closes the front suction channel (29) when the cleaning apparatus (1) is moved in a forward travel direction.
3. Cleaning apparatus according to claim 1 or 2, wherein the closing member (26) opens the front suction channel (29) when the cleaning apparatus (1) is moved in a backward travel direction.
4. Cleaning apparatus according to one of the claims 1 to 3, wherein the rear suction unit (7) comprises a rear suction channel (30) which remains open during both movements of the cleaning apparatus (1) in the forward and backward travel direction.
5. Cleaning apparatus according to one of the claims 1 to 4, wherein the front suction channel (29) comprises a suction opening (24) which is open towards a floor (12) to be cleaned over the entire length of the front suction unit (8) and wherein the closing member (26) closes the suction opening (24) of the front suction channel (29) when the cleaning apparatus (1) is moved in a forward travel direction and opens the suction opening (24) when the cleaning apparatus (1) is moved in a backward travel direction.
6. Cleaning apparatus according to one of the claims 1 to 5, wherein the front suction channel (29) comprises a suction opening (24) which is open towards a floor (12) to be cleaned and wherein the closing member (26) comprises a lip (41) with a front section (27) which frontally limits the suction opening (24) along its entire length and a rear section (28) which rearwardly limits the suction opening (24) along its entire length.
7. Cleaning apparatus according to claim 6, wherein the closing member (26) is actuated by frictional forces acting on the front section (27) of the lip (41) due to a sliding movement of the same on a floor (12) to be cleaned when, the cleaning apparatus is moved with the front portion (16) of the cleaning apparatus (1) ahead or with the rear portion (17) of the cleaning apparatus (1) ahead.
8. Cleaning apparatus according to claim 6 or 7, wherein the front section (27) of the lip (41) has a vertical height HF and the rear section (28) of the lip (41) has a vertical height HR and wherein HF is larger than HR so that the front section (27) is bendable across the suction opening (24).

9. Cleaning apparatus according to one of the claims 6 to 8, wherein the front section (27) of the lip (41) is bendable as far as a portion of the front section (27) extends below the rear section (28).

10. Cleaning apparatus according to one of the claims 1 to 9, wherein the rear suction unit (7) comprises a rear suction channel (30) and wherein both of the front suction channel (29) and the rear suction channel (30) are connected to a manifold (31) so as to be in fluid connection with a single vacuum turbine (5).

11. Cleaning apparatus according to one of the claims 1 to 10, wherein the cleaning apparatus (1) further comprises a brush housing (22) and the rear suction unit (7) is attached to the brush housing (22) by means of a resilient connecting device (10) allowing the rear suction unit (7) to move laterally with respect to the chassis (2) against an elastic resistance provided by the resilient connecting device (10).

12. Cleaning apparatus according to one of the claims 1 to 11, further comprising a first tank (15) which is attachable to the chassis (2) and which is configured as a receptacle with its smallest dimension X extending vertically.

13. Cleaning apparatus according to claim 12, further comprising

- a second tank (13) which is arranged in the rear portion (17) of the cleaning apparatus (1) and which is configured as a receptacle having a smallest dimension Z in the forward or rearward travel direction of the cleaning apparatus; and

- an elongated member (9) which extends from a rear end of the chassis (2); wherein

the second tank (13) is attachable to the elongated member (9).

14. Cleaning apparatus according to claim 13, wherein one end of the elongated member (9) is rotatably affixed to the chassis (2) by means of a hinge (39).

15. Method of cleaning a floor using the cleaning apparatus (1) according to one of the claims 1 to 14 and comprising the steps of:

- Moving the cleaning apparatus (1) in a forward travel direction to close the front suction channel (29) so as to apply an increased vacuum in the rear suction channel (30) which remains open; and/or

- Moving the cleaning apparatus (1) in a backward travel direction to open the front suction channel (29) so as to obtain a high combined

suction volume flow through the open front suction channel (29) and the open rear suction channel (30).

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Patentansprüche

1. Bodenreinigungsvorrichtung (1), umfassend:

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einen vorderen Abschnitt (16) und einen hinteren Abschnitt (17); wobei der hintere Abschnitt (17) zwei seitliche hintere Räder (3) umfasst; einen Unterbau (2); und eine Reinigungseinheit (4), die am Unterbau (2) angebracht ist, wobei die Reinigungseinheit (4) Folgendes umfasst:

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wenigstens eine drehbare Bürste (20), die im vorderen Abschnitt (16) der Reinigungsvorrichtung (1) angeordnet ist, derart, dass sie in Kontakt mit einem zu reinigenden Boden (12) gelangen kann; und eine Saugvorrichtung (25) mit einer vorderen Saugereinheit (8), die vor der wenigstens einen Bürste (20) angeordnet ist, und einer hinteren

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Saugereinheit (7), die hinter der wenigstens einen Bürste (20) angeordnet ist,

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dadurch gekennzeichnet, dass

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die vordere Saugereinheit (8) einen vorderen Saugkanal (29) und ein Verschlusselement (26) zum Verschließen des vorderen Saugkanals (29) umfasst.

2. Reinigungsvorrichtung nach Anspruch 1, wobei das Verschlusselement (26) den vorderen Saugkanal (29) verschließt, wenn die Reinigungsvorrichtung (1) in einer Vorwärtsbewegungsrichtung bewegt wird.

3. Reinigungsvorrichtung nach Anspruch 1 oder 2, wobei das Verschlusselement (26) den vorderen Saugkanal (29) öffnet, wenn die Reinigungsvorrichtung (1) in einer Rückwärtsbewegungsrichtung bewegt wird.

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4. Reinigungsvorrichtung nach einem der Ansprüche 1 bis 3, wobei die hintere Saugereinheit (7) einen hinteren Saugkanal (30) umfasst, der sowohl bei Bewegung der Reinigungsvorrichtung (1) in Vorwärts- als auch in Rückwärtsbewegungsrichtung geöffnet bleibt.

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5. Reinigungsvorrichtung nach einem der Ansprüche 1 bis 4, wobei der vordere Saugkanal (29) eine Saugöffnung (24) umfasst, die über die gesamte Länge

- der vorderen Saugereinheit (8) hinweg zu einem zu reinigenden Boden (12) hin offen ist und wobei das Verschlusselement (26) die Saugöffnung (24) des vorderen Saugkanals (29) schließt, wenn die Reinigungsvorrichtung (1) in einer Vorwärtsbewegungsrichtung bewegt wird, und die Saugöffnung (24) öffnet, wenn die Reinigungsvorrichtung (1) in einer Rückwärtsbewegungsrichtung bewegt wird.
6. Reinigungsvorrichtung nach einem der Ansprüche 1 bis 5, wobei der vordere Saugkanal (29) eine Saugöffnung (24) umfasst, die zu einem zu reinigenden Boden (12) hin offen ist, und wobei das Verschlusselement (26) eine Lippe (41) mit einem vorderen Teil (27) umfasst, der die Saugöffnung (24) über seine gesamte Länge hinweg vorne begrenzt, und einem hinteren Teil (28), der die Saugöffnung (24) über seine gesamte Länge hinweg hinten begrenzt.
7. Reinigungsvorrichtung nach Anspruch 6, wobei das Verschlusselement (26) durch Reibungskräfte betätigt wird, die auf den vorderen Teil (27) der Lippe (41) aufgrund einer Gleitbewegung desselben auf einem zu reinigenden Boden (12) einwirken, wenn die Reinigungsvorrichtung so bewegt wird, dass der vordere Abschnitt (16) der Reinigungsvorrichtung (1) vorne ist oder dass der hintere Abschnitt (17) der Reinigungsvorrichtung (1) vorne ist.
8. Reinigungsvorrichtung nach Anspruch 6 oder 7, wobei der vordere Teil (27) der Lippe (41) eine vertikale Höhe HF aufweist und der hintere Teil (28) der Lippe (41) eine vertikale Höhe HR aufweist und wobei HF größer als HR ist, so dass der vordere Teil (27) über die Saugöffnung (24) gebogen werden kann.
9. Reinigungsvorrichtung nach einem der Ansprüche 6 bis 8, wobei der vordere Teil (27) der Lippe (41) so weit biegsam ist, wie sich ein Abschnitt des vorderen Teils (27) unterhalb des hinteren Teils (28) erstreckt.
10. Reinigungsvorrichtung nach einem der Ansprüche 1 bis 9, wobei die hintere Saugereinheit (7) einen hinteren Saugkanal (30) umfasst und wobei sowohl der vordere Saugkanal (29) und der hintere Saugkanal (30) mit einem Verteiler (31) verbunden sind, so dass sie in Fluidverbindung mit einer einzelnen Vakuumpumpe (5) stehen.
11. Reinigungsvorrichtung nach einem der Ansprüche 1 bis 10, wobei die Reinigungsvorrichtung (1) ferner ein Bürstengehäuse (22) umfasst und die hintere Saugereinheit (7) an dem Bürstengehäuse (22) mittels einer elastischen Verbindungsvorrichtung (10) angebracht ist, die es ermöglicht, dass sich die hintere Saugereinheit (7) in Bezug auf den Unterbau (2) gegen den elastischen Widerstand der elastischen Verbindungsvorrichtung (10) bewegt.
12. Reinigungsvorrichtung nach einem der Ansprüche 1 bis 11, ferner umfassend einen ersten Tank (15), der am Unterbau (2) anbringbar ist und als ein Aufnahmebehälter konfiguriert ist, dessen kleinste Abmessung X sich vertikal erstreckt.
13. Reinigungsvorrichtung nach Anspruch 12, ferner umfassend
- einen zweiten Tank (13), der im hinteren Abschnitt (17) der Reinigungsvorrichtung (1) angeordnet ist und als ein Aufnahmebehälter konfiguriert ist, dessen kleinste Abmessung Z sich in der Vorwärts- oder Rückwärtsbewegungsrichtung der Reinigungsvorrichtung erstreckt; und
 - ein längliches Element (9), das sich von einem hinteren Ende des Unterbaus (2) erstreckt; wobei
- der zweite Tank (13) an dem länglichen Element (9) anbringbar ist.
14. Reinigungsvorrichtung nach Anspruch 13, wobei ein Ende des länglichen Elements (9) mittels eines Scharniers (39) drehbar am Unterbau (2) befestigt ist.
15. Verfahren zum Reinigen eines Bodens mithilfe der Reinigungsvorrichtung (1) nach einem der Ansprüche 1 bis 14 und folgende Schritte umfassend:
- Bewegen der Reinigungsvorrichtung (1) in einer Vorwärtsbewegungsrichtung, um den vorderen Saugkanal (29) zu schließen, um ein verstärktes Vakuum im hinteren Saugkanal (30) anzuwenden, der offen bleibt; und/oder
 - Bewegen der Reinigungsvorrichtung (1) in einer Rückwärtsbewegungsrichtung, um den vorderen Saugkanal (29) zu öffnen, um einen hohen kombinierten Ansaugvolumenstrom durch den offenen vorderen Saugkanal (29) und den offenen hinteren Saugkanal (30) zu erzielen.

Revendications

1. Appareil de nettoyage de sol (1) comprenant:
- une portion avant (16) et une portion arrière (17);
 - la portion arrière (17) comprenant deux roues arrière latérales (3);
 - un châssis (2); et
 - une unité de nettoyage (4) fixée au châssis (2), dans lequel l'unité de nettoyage (4) comprend:

au moins une brosse rotative (20) qui est agencée dans la portion avant (16) de l'appareil de nettoyage (1) de façon à pouvoir entrer en contact avec un sol (12) à nettoyer; et

un dispositif d'aspiration (25) comportant une unité d'aspiration avant (8) agencée devant l'au moins une brosse (20) et une unité d'aspiration arrière (7)

agencée vers l'arrière de l'au moins une brosse (20),

caractérisé en ce que

l'unité d'aspiration avant (8) comprend un canal d'aspiration avant (29) et un organe de fermeture (26) permettant de fermer le canal d'aspiration avant (29).

2. Appareil de nettoyage selon la revendication 1, dans lequel l'organe de fermeture (26) ferme le canal d'aspiration avant (29) lorsque l'appareil de nettoyage (1) est déplacé dans une direction de circulation vers l'avant.
3. Appareil de nettoyage selon la revendication 1 ou 2, dans lequel l'organe de fermeture (26) ouvre le canal d'aspiration avant (29) lorsque l'appareil de nettoyage (1) est déplacé dans une direction de circulation vers l'arrière.
4. Appareil de nettoyage selon l'une des revendications 1 à 3, dans lequel l'unité d'aspiration arrière (7) comprend un canal d'aspiration arrière (30) qui reste ouvert pendant les deux mouvements de l'appareil de nettoyage (1) dans la direction de circulation vers l'avant et vers l'arrière.
5. Appareil de nettoyage selon l'une des revendications 1 à 4, dans lequel le canal d'aspiration avant (29) comprend une ouverture d'aspiration (24) qui est ouverte vers un sol (12) à nettoyer sur la totalité de la longueur de l'unité d'aspiration avant (8) et dans lequel l'organe de fermeture (26) ferme l'ouverture d'aspiration (24) du canal d'aspiration avant (29) lorsque l'appareil de nettoyage (1) est déplacé dans une direction de circulation vers l'avant et ouvre l'ouverture d'aspiration (24) lorsque l'appareil de nettoyage (1) est déplacé dans une direction de circulation vers l'arrière.
6. Appareil de nettoyage selon l'une des revendications 1 à 5, dans lequel le canal d'aspiration avant (29) comprend une ouverture d'aspiration (24) qui est ouverte vers un sol (12) à nettoyer et dans lequel l'organe de fermeture (26) comprend une lèvre (41) avec une section avant (27) qui limite frontalement

l'ouverture d'aspiration (24) suivant sa longueur entière et une section arrière (28) qui limite vers l'arrière l'ouverture d'aspiration (24) suivant sa longueur entière.

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7. Appareil de nettoyage selon la revendication 6, dans lequel l'organe de fermeture (26) est actionné par des forces de frottement agissant sur la section avant (27) de la lèvre (41) en raison d'un mouvement de glissement de celle-ci sur un sol (12) à nettoyer lorsque l'appareil de nettoyage (1) est déplacé avec la portion avant (16) de l'appareil de nettoyage (1) devant ou avec la portion arrière (17) de l'appareil de nettoyage (1) devant.
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8. Appareil de nettoyage selon la revendication 6 ou 7, dans lequel la section avant (27) de la lèvre (41) a une hauteur verticale HF et la section arrière (28) de la lèvre (41) a une hauteur verticale HR et dans lequel HF est supérieure à HR si bien que la section avant (27) est pliable à travers l'ouverture d'aspiration (24).
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9. Appareil de nettoyage selon l'une des revendications 6 à 8, dans lequel la section avant (27) de la lèvre (41) est pliable jusqu'à ce qu'une portion de la section avant (27) s'étende en dessous de la section arrière (28).
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10. Appareil de nettoyage selon l'une des revendications 1 à 9, dans lequel l'unité d'aspiration arrière (7) comprend un canal d'aspiration arrière (30) et dans lequel le canal d'aspiration avant (29) et le canal d'aspiration arrière (30) sont tous deux raccordés à un collecteur (31) de façon à être en raccordement fluïdique avec une seule turbine à vide (5).
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11. Appareil de nettoyage selon l'une des revendications 1 à 10, dans lequel l'appareil de nettoyage (1) comprend en outre un logement de brosse (22) et l'unité d'aspiration arrière (7) est fixée au logement de brosse (22) au moyen d'un dispositif de raccordement résilient (10) permettant à l'unité d'aspiration arrière (7) de se déplacer latéralement par rapport au châssis (2) contre une résistance élastique fournie par le dispositif de raccordement résilient (10).
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12. Appareil de nettoyage selon l'une des revendications 1 à 11, comprenant en outre une première cuve (15) qui est fixable au châssis (2) et qui est configurée comme un réceptacle avec sa plus petite dimension X s'étendant verticalement.
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13. Appareil de nettoyage selon la revendication 12, comprenant en outre
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- une seconde cuve (13) qui est agencée dans la portion arrière (17) de l'appareil de nettoyage
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(1) et qui est configurée comme un réceptacle ayant une plus petite dimension Z dans la direction de circulation vers l'avant ou vers l'arrière de l'appareil de nettoyage; et

- un organe allongé (9) qui s'étend depuis une extrémité arrière du châssis (2); dans lequel

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la seconde cuve (13) est fixable à l'organe allongé (9).

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14. Appareil de nettoyage selon la revendication 13, dans lequel une extrémité de l'organe allongé (9) est apposée de façon rotative au châssis (2) au moyen d'une charnière (39).

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15. Procédé de nettoyage d'un sol à l'aide de l'appareil de nettoyage (1) selon l'une des revendications 1 à 14 et comprenant les étapes de:

- mouvement de l'appareil de nettoyage (1) dans une direction de circulation vers l'avant pour fermer le canal d'aspiration avant (29) de façon à appliquer un vide accru dans le canal d'aspiration arrière (30) qui reste ouvert; et/ou

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- mouvement de l'appareil de nettoyage (1) dans une direction de circulation vers l'arrière pour ouvrir le canal d'aspiration avant (29) de façon à obtenir un débit volumique d'aspiration combiné élevé à travers le canal d'aspiration avant ouvert (29) et le canal d'aspiration arrière ouvert (30).

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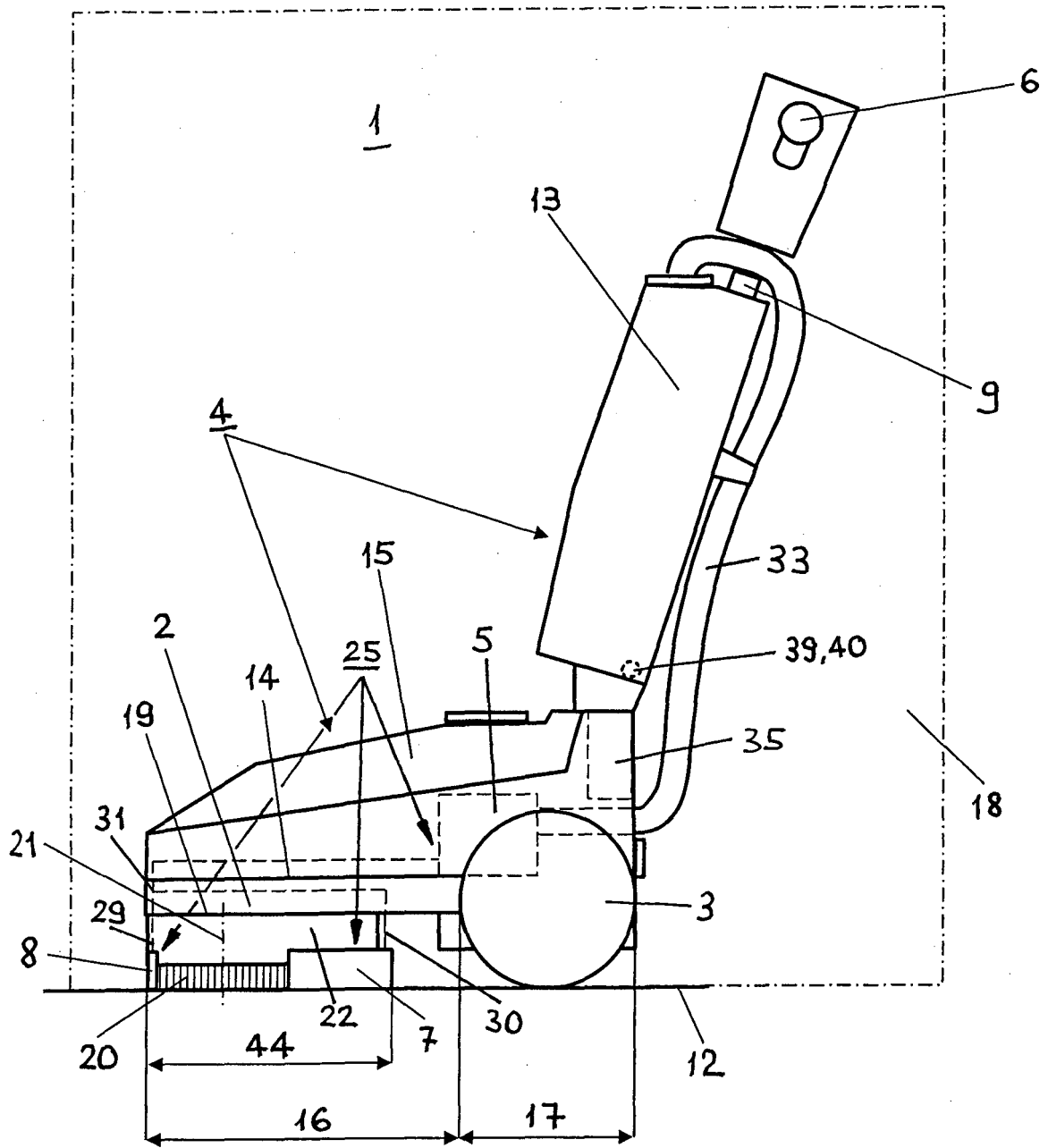


Fig. 1

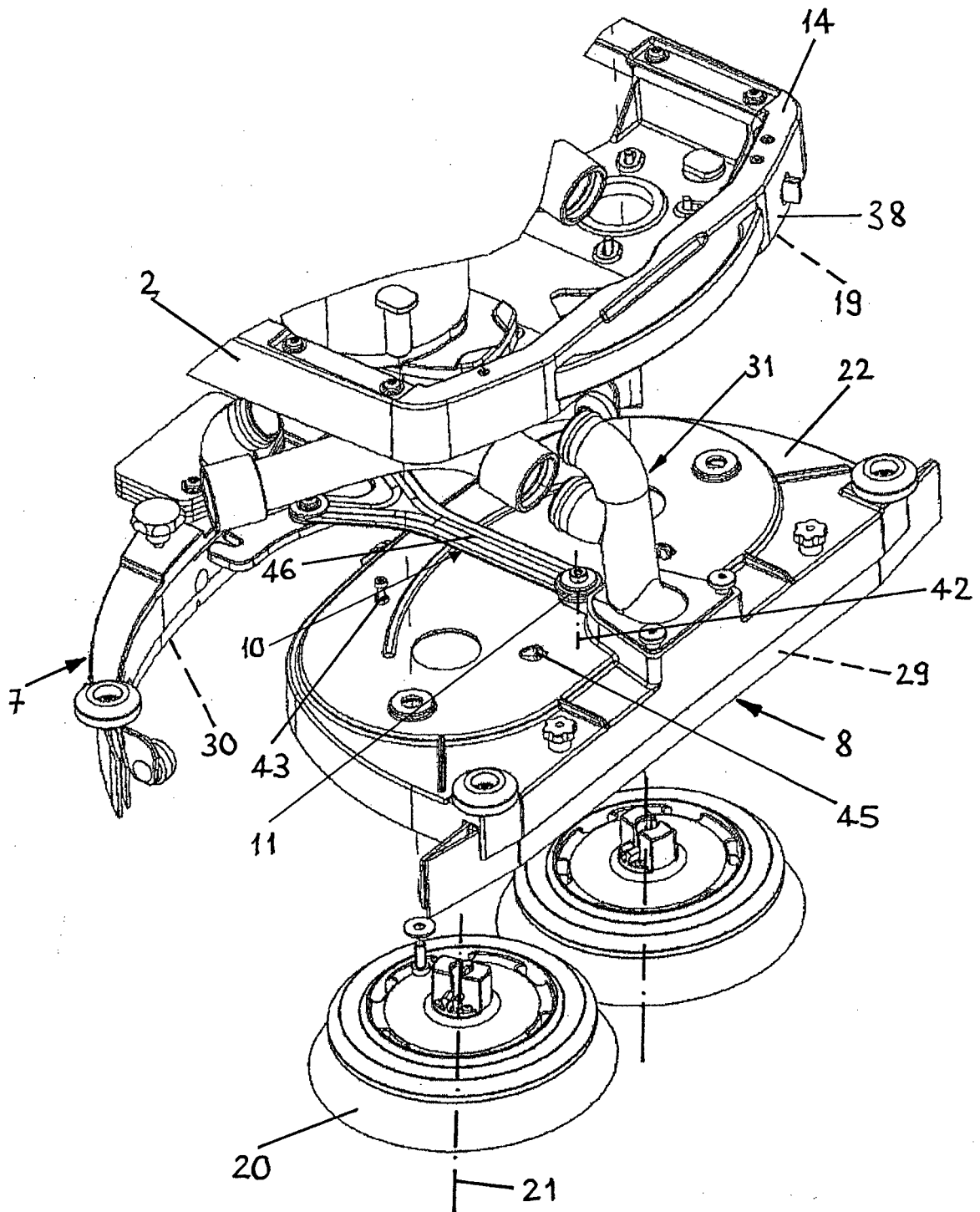
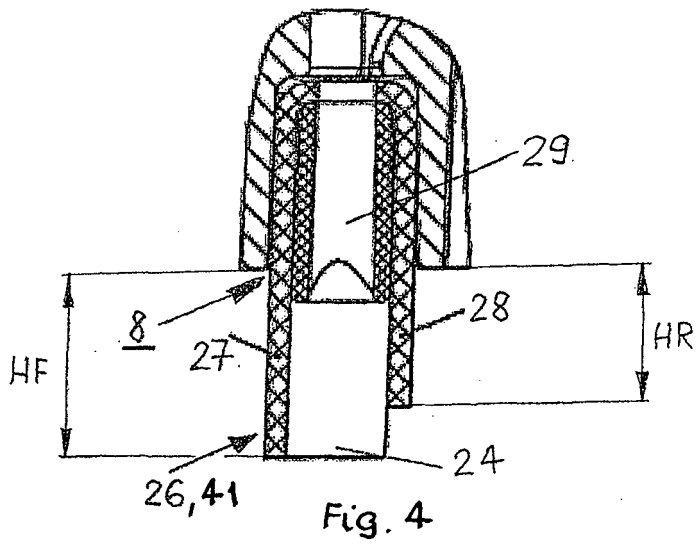
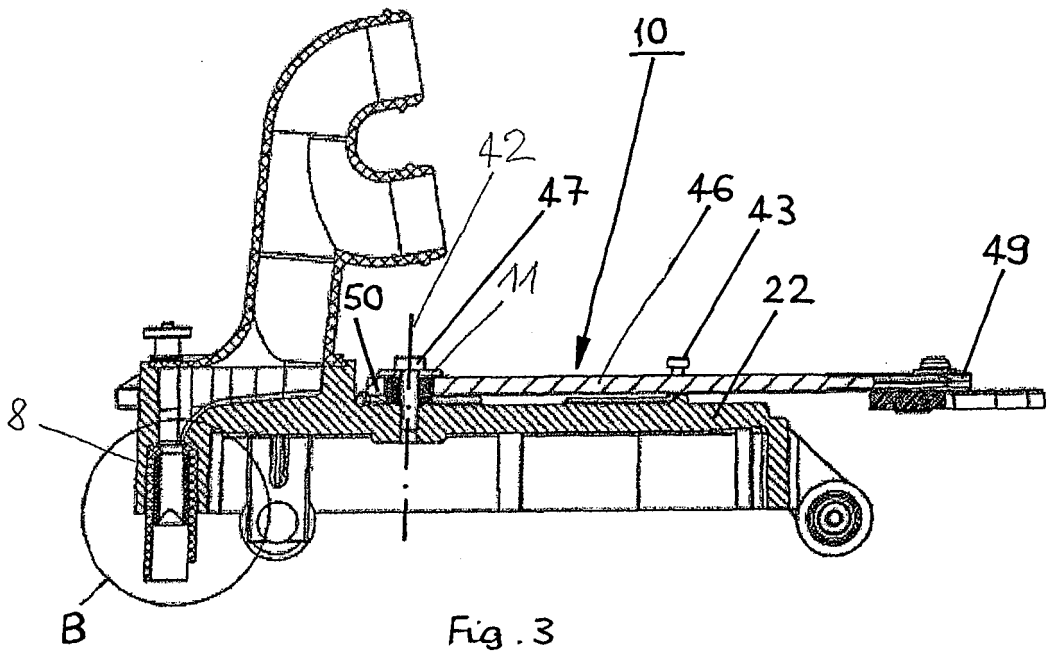


Fig. 2



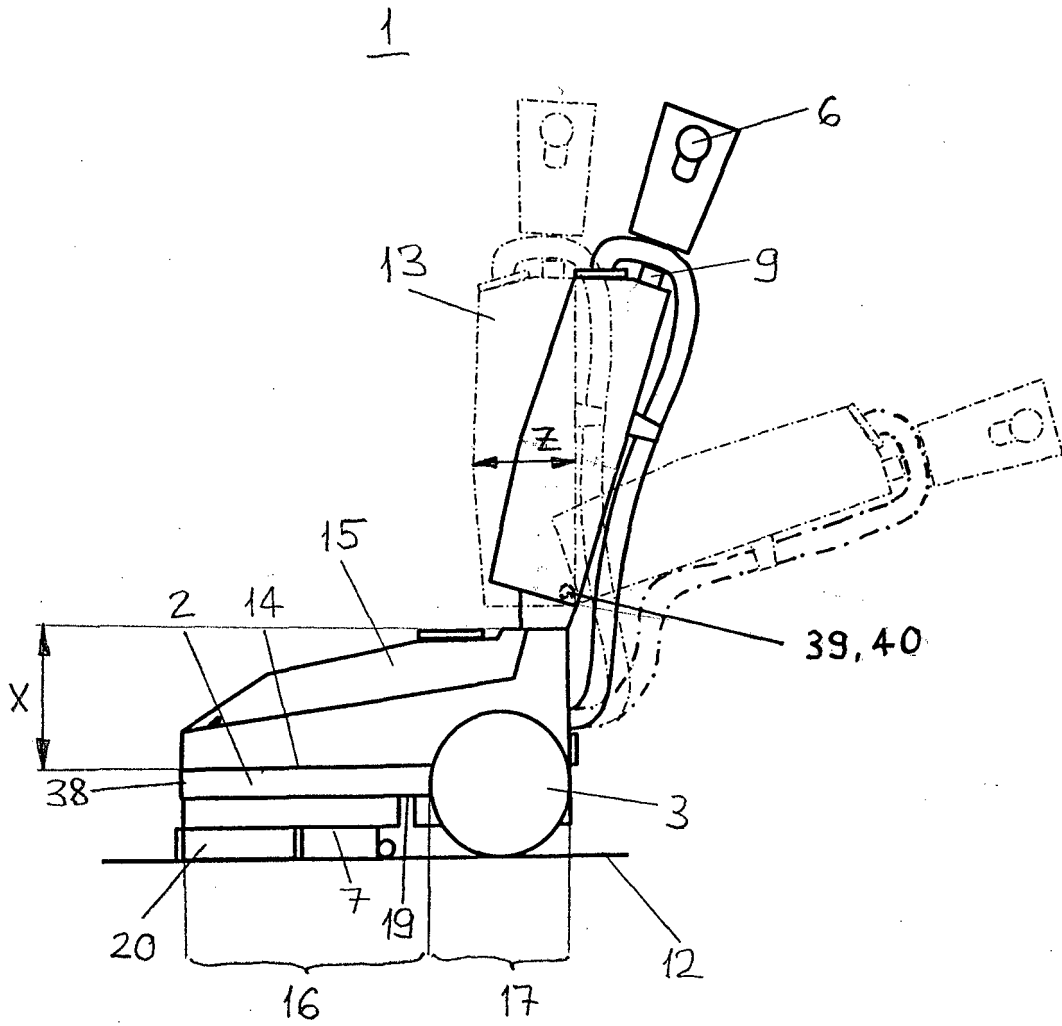


Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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