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(54) Multifunctional cleaning device

(57) A multifunctional cleaning machine comprises a handle (7) having a first end (7a) provided with a handgrip (8), a base (2) fastened to a second end (7b) of the handle (7) and provided with at least one main suction opening (4), suction means (9) in fluid communication with the main suction opening (4), a steam-producing boiler (15) positioned in the base (2) and connected with at least

one aperture (16) placed on the active portion (3). An auxiliary suction opening (33) positioned within the base (2) operates on a rotating brush (30) mounted close to the main suction opening (4). A selective-closure device (34) operates along a common suction duct (55) terminating at the main suction opening (4) and the auxiliary suction opening (33).

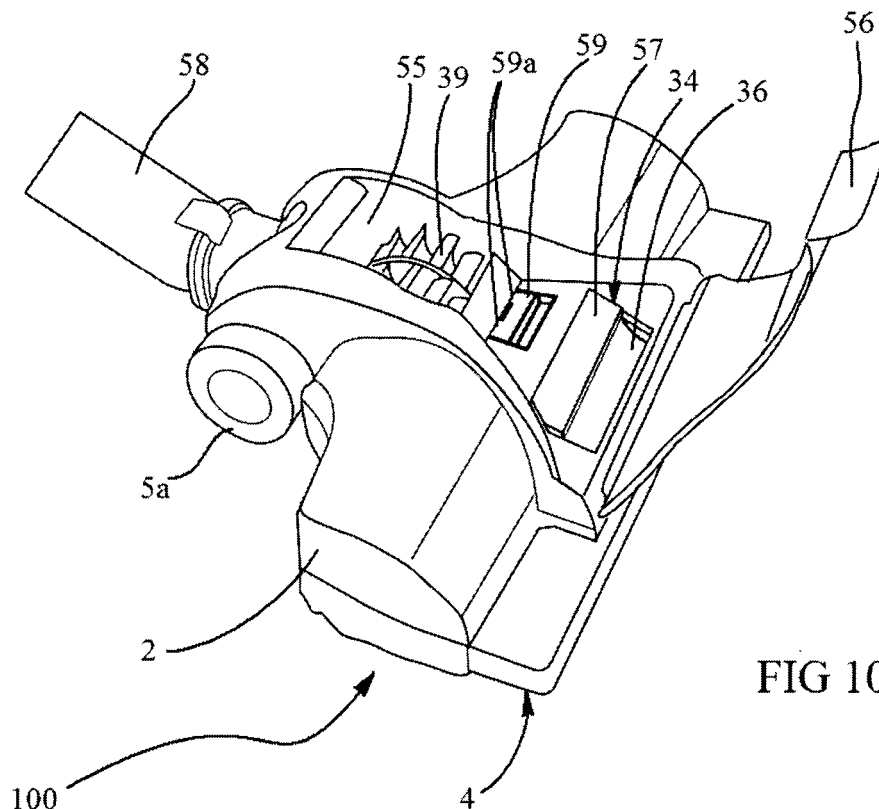


FIG 10a

Description

[0001] The present invention relates to a multifunctional cleaning device of the type comprising the features recited in the preamble of claim 1.

[0002] In more detail, the invention falls within the field of the electric suction brooms with water filtering and combined steam generation that are used, preferably in the housework, for cleaning a plurality of surfaces, such as floors, carpets, sofas, windowpanes, tapestry/upholstery, etc.

[0003] From the Italian utility model application No. BS20020037U in the name of the same Applicant, it is known a steam broom of the above mentioned type. This broom comprises a base body resting on wheels to which a handle is fastened which extends in height and is used for movement of the base. The handle carries a powered suction unit connected through a suitable duct with a suction opening placed on a lower portion of the base body. Further enclosed in the base body is a filtering water unit and a boiler for steam production. The steam is sent close to the suction opening to enable it to dissolve the dirt separating it from the surface to-be cleaned, so that it is sucked into the opening. Disadvantageously, the boiler takes up a great part of the inner volume of the base in order to enable it to hold a sufficient water amount for operation of the broom for an acceptable period of time.

[0004] The Applicant has found that the machines of the above described type can be improved under different points of view, above all in connection with the number of functions implemented in a single machine and as regards the machine efficiency.

[0005] In accordance with the present invention, the Applicant has identified the possibility of carrying out improvements on the above described machines which are capable of increasing the efficiency of the cleaning operations.

[0006] Accordingly, it is an aim of the present invention to provide a multifunctional cleaning machine that is able to efficiently operate on a plurality of surfaces having different features.

[0007] The foregoing and further aims that will become more apparent in the course of the following description are reached by a multifunctional cleaning device comprising the features recited in claim 1 and/or in one or more of the claims depending thereon.

[0008] Further features and advantages will be best understood from the detailed description of a preferred, but not exclusive, embodiment of a multifunctional cleaning machine in accordance with the present invention.

[0009] This description will be set out hereinafter with reference to the accompanying drawings, given by way of non-limiting example, in which:

- Fig. 1 shows a multifunctional cleaning machine in accordance with the present invention;
- Fig. 2 shows a first portion to an enlarged scale of the machine seen in Fig. 1;

- Fig. 3 shows a second portion to an enlarged scale of the machine seen in Fig. 1;
- Fig. 4 shows a third portion to an enlarged scale of the machine seen in Fig. 1 with some elements removed to better show others;
- Fig. 5 is a diagrammatic representation of a first element of the third portion shown in Fig. 4;
- Fig. 6 is a diagrammatic view in section of a second element of the third portion seen in Fig. 4;
- Fig. 7 is an exploded view of a third element of the third portion seen in Fig. 4;
- Figs. 8a and 8b show a detail of the enlarged third portion seen in Fig. 4 in the respective operating positions;
- Fig. 9 shows the machine seen in Fig. 1 in a different operating configuration; and
- Figs. 10a and 10b shown an alternative embodiment of the invention, in two different operating conditions.

[0010] With reference to the drawings, a multifunctional cleaning machine in accordance with the present invention has been generally denoted at 1.

[0011] The machine 1 comprises a base of a box-shaped structure 2 which has an active portion 3 designed to face a surface to be cleaned. In the drawings the active portion 3 corresponds to a lower face of base 2 and is therefore hidden. The active portion 3 is provided with at least one main suction opening 4 that, when the base 2 bears on the surface to be cleaned, lies opposite to the latter (Fig. 4). To facilitate sliding of the machine 1 on the surface to be cleaned, the base 2 can be provided with wheels 5a, 5b resting on the ground. In the embodiment shown in Fig. 1 the machine 1 comprises a pair of rear wheels 5a and a pair of front wheels 5b mounted in the vicinity of the main suction opening 4 (Fig. 1). The main suction opening 4 extends along a front edge of base 2 and carries at least one flexible tailpiece 6 slightly touching the surface to be cleaned (Fig. 4). In more detail, two flexible tailpieces 6 are preferably provided and they delimit the suction opening 4 on respectively opposite sides.

[0012] The machine 1 further comprises a handle 7 having a first end 7a provided with a handgrip 8 and a second end 7b opposite to the first one 7a, which is fastened to base 2. Handle 7 extends vertically from base 2 to enable a user to easily hold the handgrip 8, and is movable relative to base 2 around at least an articulation axis "X" perpendicular to the advancing direction of the machine 1.

[0013] Suction means 9, preferably installed on handle 7, is in fluid communication with the main suction opening 4, for the purpose of generating an air flow entering opening 4 and adapted to take in the dirt from the surface to be cleaned. According to a known scheme, the suction means 9 comprises an electric motor and a sucking fan, both not shown, in fluid communication with a pipe 9a (partly shown in Figs. 1, 3 and 9) communicating with the main suction opening 4.

[0014] The air flow entraining the dirt particles is filtered by a filtering unit 10 preferably comprising a filtering tank (Fig. 7). The filtering tank 10 is installed in a suitable housing 11 formed in the base 2 (Fig. 4) and at a lower portion 10a thereof contains a filtering liquid, water for example, adapted to filter the sucked air and to retain the dirt. To this end, the filtering tank 10 is interposed between the main suction opening 4 and the suction means 9 and has an inlet 12 directly in communication with the lower portion 10a, to enable the sucked air to be directly admitted into the water, and an outlet, not shown, which is disposed over the water surface. The outlet is formed in an upper portion of tank 10, defined by a lid 10b, for example (Fig. 1). As viewed from Fig. 7, tank 10 is provided with a conveyor 13 having an entry 13a communicating with the suction opening 4 through the inlet 12 and an exit 13b dipped in the filtering liquid.

[0015] Advantageously and unlike the machines of known type, in tank 10, into the filtering liquid, an impeller 14 is mounted the function of which is to break the air bubbles formed by the suction air to enable better mixing of the collected dirt present in the liquid and therefore a much more efficient filtering effect. To this end, the sucked air flow is conveyed against the impeller 14 by means of the conveyor 13 the exit 13b of which faces the impeller 14 itself. In addition to the above described filtering unit 10, the machine 1 may further comprise a filter cartridge 9b mounted in a removable manner in pipe 9a just before the fan belonging to the suction means 9 (Fig. 1).

[0016] Further associated with the machine 1 is a boiler 15 for steam production which is defined by a casing 15a integrating an electric resistor "R" (Fig. 5). Boiler 15 is positioned in the base 2 and is connected to at least one aperture 16 disposed on the active portion 3, preferably at the main suction opening 4. In the embodiment shown in Fig. 4, the boiler 15 is positioned between the tank 10 and the main suction opening 4. Aperture 16, possibly provided with a suitable diffuser not shown as it can be made in any known manner, is connected to boiler 15 through a pair of pipes 17 extending from an upper portion of the boiler 15 itself.

[0017] The multifunctional cleaning machine 1 in accordance with the present invention further comprises a reservoir 18 installed on handle 7 and in fluid communication with boiler 15, to supply the boiler with water (Fig. 1).

[0018] In more detail, handle 7 comprises a first portion 19 holding the reservoir 18 and a second portion 20 holding the suction means 9. The two portions 19, 20 are aligned along a major extension direction of handle 7 and, as visible in Fig. 2, can be separated from each other. In particular, the second portion 20 is connected to the base 2 through a joint 20a mounted on the base 2 itself and rotatable relative to said base around the articulation axis "X". Starting of the motor belonging to the suction means 9 can be obtained by inclining handle 7 relative to the vertical portion, through activation of a

switch, of known type and therefore not shown.

[0019] The reservoir 18 is connected to boiler 15 through a duct 21, seen in Figs. 2, 3, 4 and 5, running through the first portion 19, the second portion 20 and the base 2, to open into the area close to boiler 15 (Fig. 4).

[0020] The reservoir 18 is placed in a removable manner in a seat 22 formed in the first portion 19 (Fig. 1) and is preferably provided with a valve, of known type and therefore not shown, fitted close to duct 21, which valve is designed to prevent water leakage when the reservoir, still partly filled for example, is disengaged from handle 7.

[0021] A first stretch 23 of duct 21 extends starting from the reservoir 18 and terminates with an end 23a hooking a first end 24a of a second stretch 24 mounted in the second portion 20 (Fig. 2). The second stretch 24 terminates with a second end 24b to be connected to the first end 25a of a third stretch 25 extending in the base 2 (Fig. 3). Fig. 3 further shows electric contacts "C" set to power supply the resistor "R" of boiler 15.

[0022] Preferably, the hooking end 23a of the first stretch 23 as well as the second end 24b of the second stretch 24 are provided with respective valves designed to prevent water leakage when the first portion 19 is separated from the second one 20 and when the second portion 20 is separated from base 2, respectively. In addition, the third stretch 25 of duct 21 passes through the joint 20a and between two locators, not shown, one of which is fixedly mounted on base 2 and the other is movable with the joint 20a itself around axis "X". When handle 7 is perpendicular to the ground and the suction means 9 is shut off, the two locators lie close to each other and carry out a sandwiching action on duct 21, pressing it to such an extent that water passage is prevented. Alternatively, water delivery from the reservoir 18 can be controlled by a solenoid valve to be activated for opening following activation of the boiler and/or upon command of the user.

[0023] It is to be pointed out that arrangement of the reservoir 18 in the handle 7 enables the sizes of boiler 15 placed in the base 2 to be reduced, as compared with the sizes of the boilers used in the machines of known type. In fact, in the boiler 15 of the invention no water supply is required to be contained, except for the amount necessary for steam production. The required water is obtained, preferably in an automatic manner, from the reservoir 18. In fact, duct 21, shown in Figs. 2, 3, 4 and 5, brings the water into boiler 15 by gravitational fall.

[0024] An actuator 26 is operatively active on duct 21 to open or close water passage along duct 21 based on the water level in boiler 15. As viewed from Fig. 5, actuator 26 comprises a level sensor 27 mounted in boiler 15 and a closure member 28 connected to the level sensor 27. The closure member 27 is movable between a first position at which it shuts duct 21, and a second position at which it opens duct 21. In the preferred embodiment diagrammatically shown in Fig. 5, the level sensor 27 is defined by a float. Float 27 is hinged to a rod 29 in turn hinged to the casing 15a of boiler 15. The closure mem-

ber 28 is mounted on the rod 29 and is therefore movable together with float 27. The closure member 28 also faces a second end 25b of the third stretch 25 opening into boiler 15. Lowering of the water level, following water conversion into steam, causes lowering of the float 27 and the closure member 28 therewith, said closure member under a predetermined level value causing opening of duct 21. Then the water that from duct 21 flows into the boiler 15 causes a new level increase and rising of the float 27 and the closure member 28 until duct 21 is closed again.

[0025] The important reduction in the volume taken up by boiler 15 as compared with traditional boilers enables a rotating brush 30 to be mounted on the active portion 3, close to the main suction opening 4, said brush getting in contact with the surface to be cleaned, without involving an important increase in the bulkiness of the base 2. Preferably, the rotating brush 30 is disposed in side by side relationship with the main suction opening 4 (Figs. 4, 8a, 8b and 10b).

[0026] In the preferred embodiment, the rotating brush 30 comprises a shaft 31 extending parallel to and alongside the main suction opening 4. Shaft 31 is provided with bristles 32 radially moving away from the shaft 31 itself (Figs. 4, 8a and 8b).

[0027] Preferably, an auxiliary suction opening 33 is positioned within the base 2 and over the rotating brush 30, to take in the dust and dirt removed by the brush 30 itself. To this end, the auxiliary suction opening 33 is in fluid communication with the same suction means 9 that is active on the main opening 4 (Figs. 8a, 8b).

[0028] The suction openings 4, 33 converge and open into a common suction duct 55, only partly shown, entering the filtering tank 10 but, preferably, said suction openings can be alternately activated through a closing device 34 active both on the main suction opening 4 and the auxiliary suction opening 33 (Figs. 8a, 8b, 10a, 10b). The closing device 34 is movable between a first position at which it closes the communication between the suction means 9 and the main suction opening 4, and a second position at which it closes the communication between the suction means 9 and the auxiliary suction opening 33.

[0029] In the embodiment shown in Figs 8a and 8b the closing device 34 consists of a plate 35 slidably mounted to the base 2, at the region where the auxiliary 33 and main 4 suction openings meet. Plate 35 is provided with a passage so as to define a solid half 35a and a holed half 35b.

[0030] In more detail, the main opening 4 and auxiliary opening 33 converge into the common suction duct 55 through respective narrow stretches, each defined by a respective mouth 36, 37 (Figs. 8a, 8b). The holed plate 35 slides on both mouths 36, 37 and alternately closes either of them. In the configuration in Fig. 8a, the holed plate 35 with its solid half 35a closes the mouth 37 of the auxiliary opening 33. In the configuration in Fig. 8b the solid half 35a is superposed on and closes the mouth 36 of the main opening 4 and the plate passage is aligned

with the mouth 37 of the auxiliary opening 33.

[0031] Movement of the closing device 34 is carried out manually, access to plate 35 taking place through a door 56 shown in chain line and formed in an upper shield 38 of base 2 covering the boiler 35 and brush 30. Door 56, in the closed condition, extends flush with the upper shield and at the upper part delimits the common suction duct 55.

[0032] To cause rotation of brush 30, the machine 1 advantageously comprises a turbine 39 installed along the common suction duct 55, between the auxiliary suction opening 33 or the main suction opening 4 and the suction means 9. The turbine 39 is connected to brush 30 and causes rotation of the brush through the suction air flow.

[0033] As illustrated in Fig. 4, the turbine 39 is fitted on a shaft 40 rotatably mounted to the base 2. Shaft 40 lies parallel to and superposed on brush 30 and transmits motion to the latter by means of a drive belt 41.

[0034] Should it be required, deactivating means can be advantageously associated with the rotating body; said means will for instance comprise a locking insert 57 operatively in engagement through a wall of the base 2 and movable between a first operating position at which, as shown in Fig. 10b, it has an engagement tailpiece 57a spaced apart from turbine 39 and a second operating position at which the engagement tailpiece 57a interferes with turbine 39, as shown in Fig. 10a, to stop rotation thereof. Thus deactivation of the rotating brush 39 can take place in case of need, during cleaning of particularly delicate surfaces, for example.

[0035] As an alternative solution to turbine 39, in accordance with a variant not shown, the machine 1 may comprise an electric motor connected to the brush.

[0036] As exemplified in Figs. 10a and 10b, the portion of the base 2 integrating the main and auxiliary suction openings, 4 and 33, rotating brush 30, turbine 39, door 56 and closing device 34, can be made as one unit separated from the portion of the base 2 housing the boiler 15, if any, the suction means 9 and remaining components of the machine 1, to define a multifunctional device 100 in the form of a separate accessory provided with a connecting end piece 58. In known manner, the connecting end piece 58 can be connected by means of rigid pipes and/or flexible hoses to the suction means 9 and/or the possible boiler 15, possibly integrated into a holding structure made in the form of a carriage. In this manner, the device 100 lends itself to be also connected to apparatus having suction means, possible boiler and/or detergent feeding means of a different structure than the described one. In this embodying example, the closing device comprises a shutter 57 that is slidable or hinged with respect to base 2 close to the mouths 36, 37 terminating at the main 4 and auxiliary 33 suction openings, respectively. In the same manner as described with reference to Figs. 8a, 8b, shutter 57 is movable between a first position at which as shown in Fig. 10a, it closes mouth 37 of the auxiliary suction opening 33, and a second po-

sition at which it closes mouth 36 of the main suction opening 4, as shown in Fig. 10b.

[0037] The machine 1 is further provided with means 42 to dispense a detergent close to the suction opening 4. Referring particularly to Figs. 5 and 6, this means 42 preferably comprises a measuring dispenser 43 for the detergent, an inlet duct 44 entering the dispenser 43 and in fluid communication with the reservoir 18 installed on handle 7 and an outlet duct 45 coming out of the dispenser 43 and opening onto the rotating brush 30. The outlet duct 45 therefore brings the water/detergent mixture to the brush.

[0038] In the embodiment shown in Fig. 5, duct 21 carrying out water supply by gravitational fall is provided with a branch close to boiler 15; this branch has a first outlet connected to the second end 25b of the third stretch 25 and a second outlet opening into the inlet duct 44 (Figs. 4 and 5).

[0039] In more detail, the measuring dispenser 43 comprises a container 46 for solid soap in the form of tablets or powder. The container 46 has an inlet passage port 46a in communication with the inlet duct 44 and an outlet passage port 46b in communication with the outlet duct 45. The container 46 further has adjusting means 47 to modify the width of the inlet passage port 46a and/or the outlet passage port 46b and consequently vary the amount of water mixed with the detergent and conveyed to the brush 30. Advantageously, the adjusting means 47 is controlled through a knob 48 also defining the closing plug of container 46; the user can easily rotate said knob so as to adjust the passage ports 46a, 46b. Knob 48 is positioned above the shield 38 of base 2 (Fig. 1).

[0040] In the embodiment shown in Fig. 6, the container 46 adapted to define the adjusting means comprises an inner casing 49 integral with plug 48 and rotatably mounted in an outer casing 50. The inlet duct 44 and outlet duct 45 are rigidly fixed to the outer casing 50, while openings 50a, 50b are formed in the inner casing 49. Each passage port 46a, 46b is defined by a superposition between each opening 50a, 50b and the respective duct 44, 45. Rotation of the plug 48 and the inner casing 49 therewith enables this superposition and the width of the ports 46a, 46b to be varied between a fully closed configuration and a fully open configuration.

[0041] In order to distribute the water/detergent mixture along the whole brush 30, the machine 1 comprises a diffuser 51 that is in fluid communication with the outlet duct 45 and faces the rotating brush 30.

[0042] In addition and preferably, as shown in Fig. 5, the outlet duct 45 passes through the boiler 15 before reaching the diffuser 51. The stretch passing through the boiler 15 is preferably provided with a heat exchanger co-operating in heating the water and detergent passing through duct 45, to improve mixing and efficiency of them for cleaning purposes.

[0043] In use, the machine in accordance with the present invention can be utilised following different operating modalities.

[0044] In a first operating mode, in which boiler 15 keeps turned off and reservoir 18 is possibly removed, the machine 1 acts like a vacuum cleaner provided with a water filter, with or without the aid of the rotating brush 30.

[0045] In a second operating mode, with the reservoir 18 installed in the seat 22 and the boiler 15 turned on, the machine 1 works like a steam generator with or without simultaneous suction.

[0046] A third operating mode is obtained by acting on plug 48 to spray the brush 30 with the detergent contained in the container 46, simultaneously with or independently of steam delivery and/or suction.

[0047] In addition, by separating the second portion 20 from the base 2 and possibly separating the reservoir 18 from the first portion 19, the handle 7 can be used as a vacuum cleaner with a filter cartridge in a dry state.

[0048] Possibly, the second portion 20 can be provided with universal attachment means for connection to suction mouths 52, or the multifunctional device of Fig. 10a, 10b directly through the connecting end piece 58 or after interposition of rigid or flexible extension pipes/hoses or other auxiliary elements designed for operation of the machine as a vacuum cleaner (Fig. 9). In this configuration, handle 7 can be provided with a strap 53 for easy handling and transport.

[0049] Finally, the second portion 20 has a handhold or handle 54 and further it can be easily separated also from the first portion 19, so as to define a dry vacuum cleaner of the portable type.

[0050] The present invention achieves the intended purposes and has important advantages.

[0051] Due to the presence of the reservoir 18 in handle 7, bulkiness of the boiler 15 can be reduced and therefore additional elements capable of making the machine 1 much more efficient than the machines of known type can be installed on the base 2. In particular, the greater efficiency of the machine 1 in accordance with the invention results from adopting the rotating brush 30 and spraying the same with a heated detergent. A greater efficiency is also obtained through adoption of the impeller 14 enabling the filtering effect of tank 10 to be improved.

[0052] In addition, due to the possibility of simultaneously or alternately using the brush 30, a detergent sprayed thereon, and/or steam, and also due to the possibility of dismantling the machine 1 so as to use only part of the same, the machine appears to be very versatile and adapted to clean any surface.

Claims

1. A multifunctional cleaning device, comprising:

- a base (2) having an active portion (3) designed to face a surface to be cleaned and provided with at least one main suction opening (4),
characterised in that it further comprises:

- a rotating brush (30) mounted on the active portion (3) close to the main suction opening (4), to get into contact with the surface to be cleaned in side by side relationship with the main suction opening (4);
 - an auxiliary suction opening (33) positioned within the base (2) and operating on the rotating brush (30);
 - a common suction duct (55) leading to the main suction opening (4) and the auxiliary suction opening (33), and connectable to suction means (9).
2. A device as claimed in claim 1, wherein a closing device (34) is active on the main suction opening (4) and the auxiliary suction opening (33).
3. A device as claimed in claim 2, wherein the closing device (34) is movable between a first position at which it closes the communication between the common suction duct (55) and the main suction opening (4), and a second position at which it closes the communication between the common suction duct (55) and the auxiliary suction opening (33).
4. A device as claimed in claim 3, further comprising a turbine (39) installed along the common suction duct (55) and connected to the brush (30), to cause rotation of said brush (30) by means of a sucking air flow.
5. A device as claimed in one or more of the preceding claims, further comprising means (59) for selectively deactivating the rotating brush (30).
6. A device as claimed in claim 5, wherein the deactivating means (57) comprises a locking insert (59) engaged through a wall of the base (2) and movable between a first operating position at which it has at least one engagement tailpiece (59a) spaced apart from the turbine (39) and a second operating position at which the engagement tailpiece (59a) interferes with the turbine (39) to stop rotation thereof.
7. A multifunctional cleaning machine, comprising:
- a device (100) according to one or more of the preceding claims;
 - suction means (9) in fluid communication with the main suction opening (4);
 - a boiler (15) for steam production, positioned in the base (2) and connected to at least one aperture (16) formed in the active portion (3).
8. A multifunctional machine, in particular according to claim 7, further comprising means for dispensing a detergent in the region close to the suction opening (4).
9. A machine as claimed in claim 8, wherein the means (42) for dispensing the detergent comprises a measuring dispenser (43) for the detergent, an inlet duct (44) entering the measuring dispenser (43) and in fluid communication with a water reservoir (18), an outlet duct (45) coming out of the measuring dispenser (43) and opening onto a region close to the suction opening (4).
10. A machine as claimed in claim 9, wherein said outlet duct opens onto the rotating brush (30) to bring the water admixed with the detergent to said brush (30).
11. A machine as claimed in claim 9 or 10, further comprising a diffuser (51) in fluid communication with the outlet duct (45) coming out of the measuring dispenser (43).
12. A machine as claimed in claim 9, wherein the outlet duct (45) passes through the boiler (15), to heat the water admixed with the detergent.
13. A machine as claimed in claim 9, wherein the measuring dispenser (43) comprises a container (46) for the soap which has an inlet passage port (46a) in communication with the inlet duct (44) and an outlet passage port (46b) in communication with the outlet duct (45).
14. A machine as claimed in claim 13, wherein the container (46) further has adjusting means (47) to modify the width of at least one of said inlet passage port (46a) and outlet passage port (46b) and vary the flow rate of the water admixed with the detergent along the outlet duct (45).

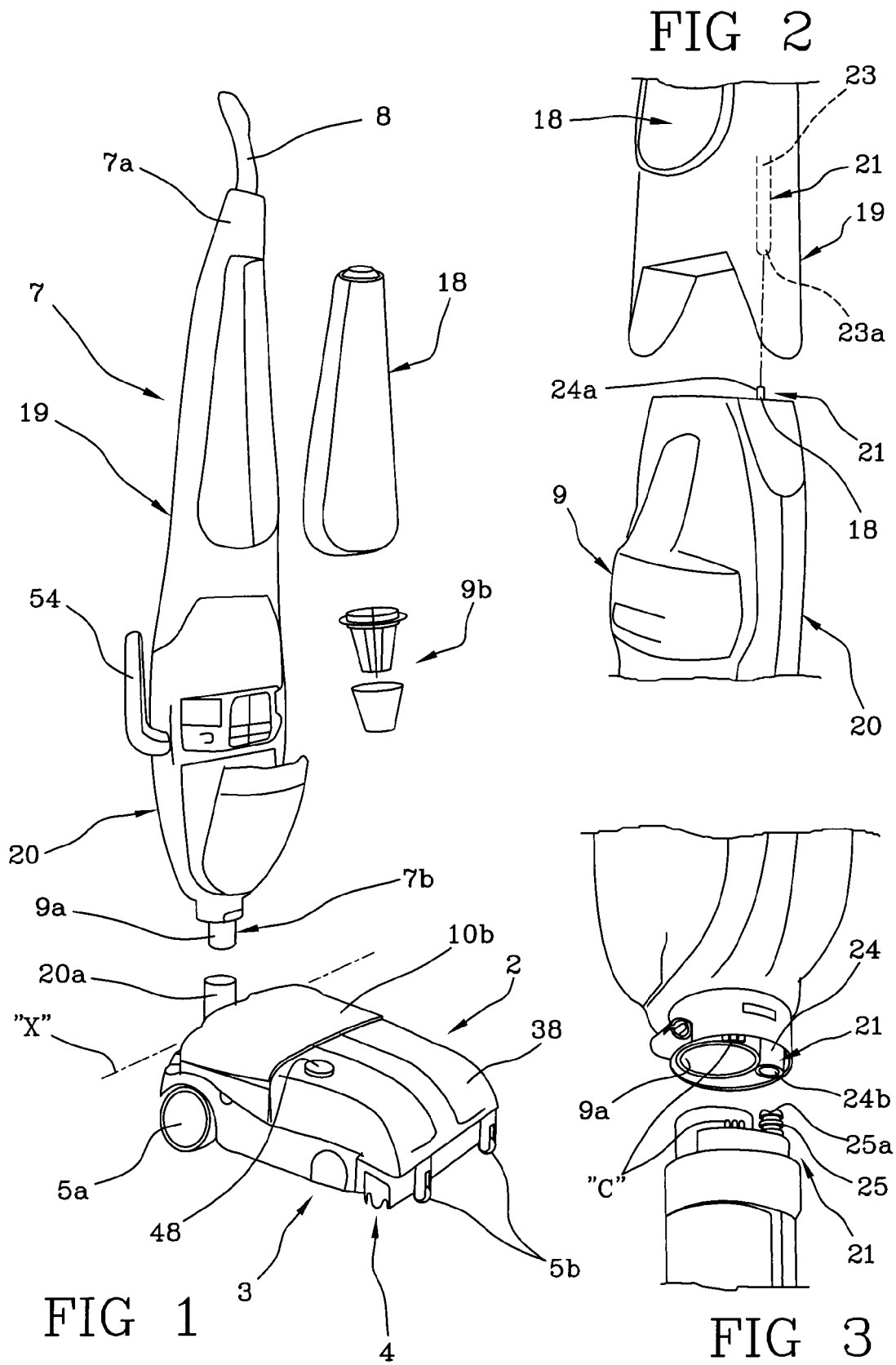


FIG 6

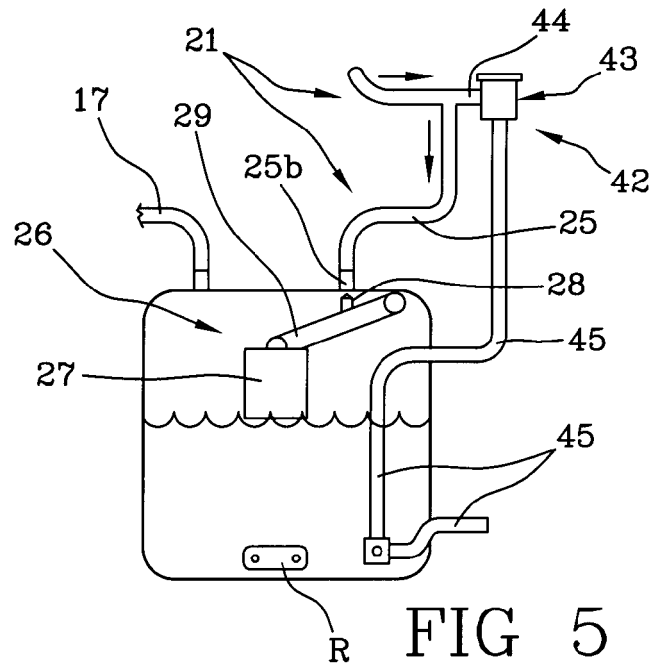
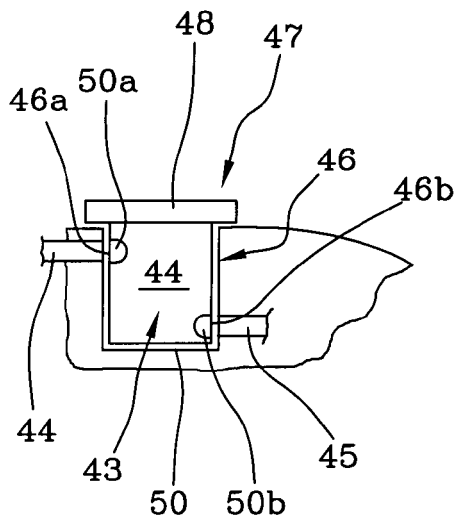


FIG 5

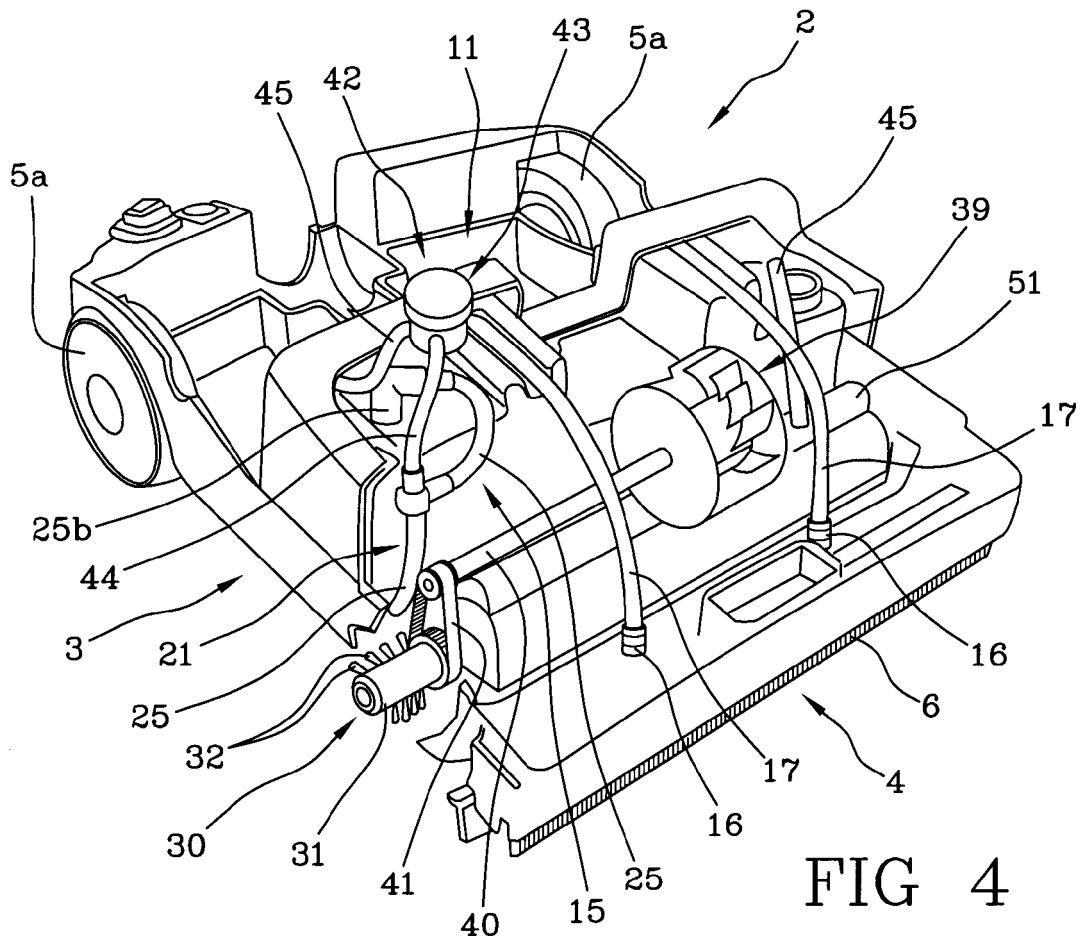
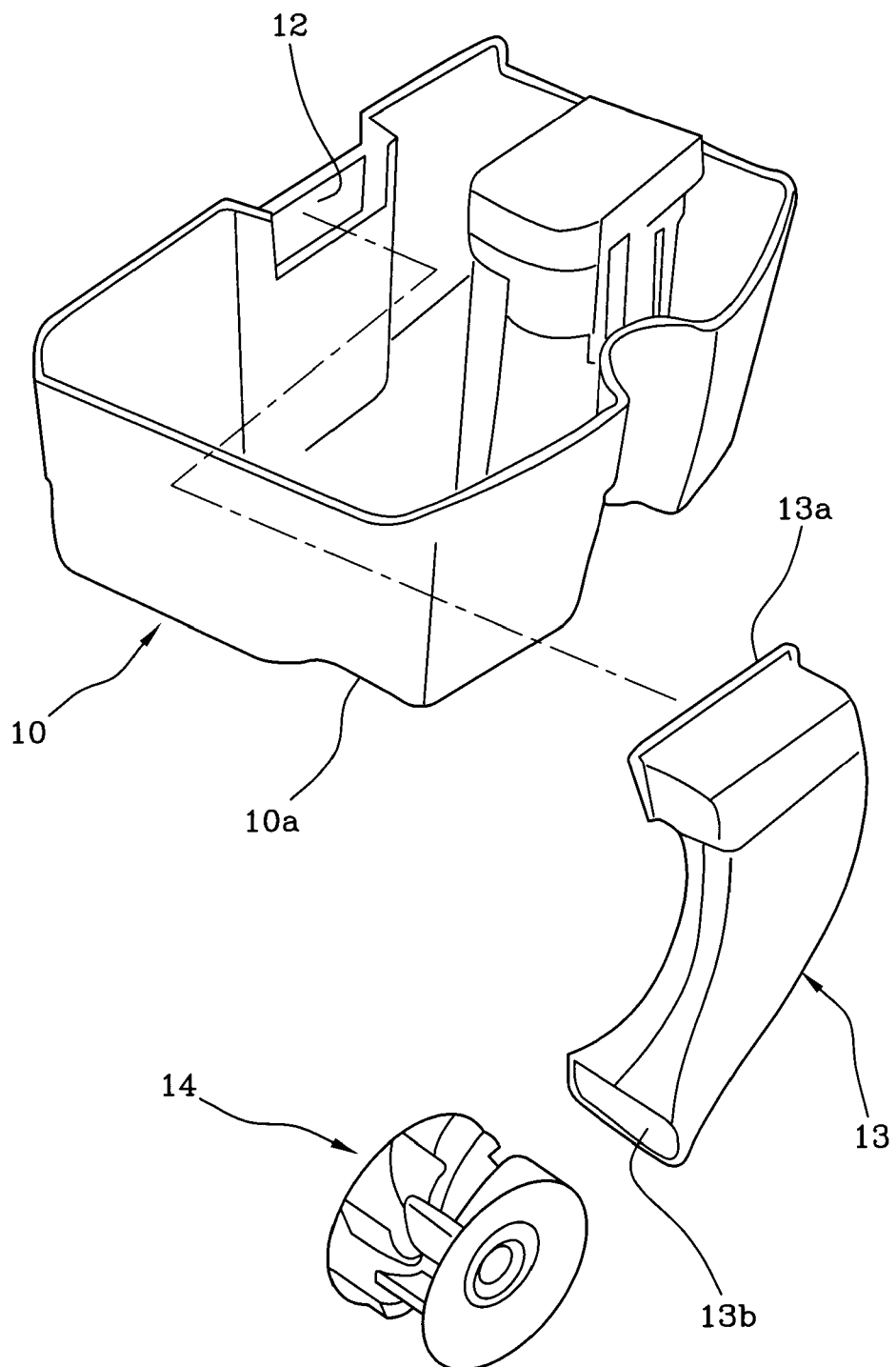


FIG 4

FIG 7



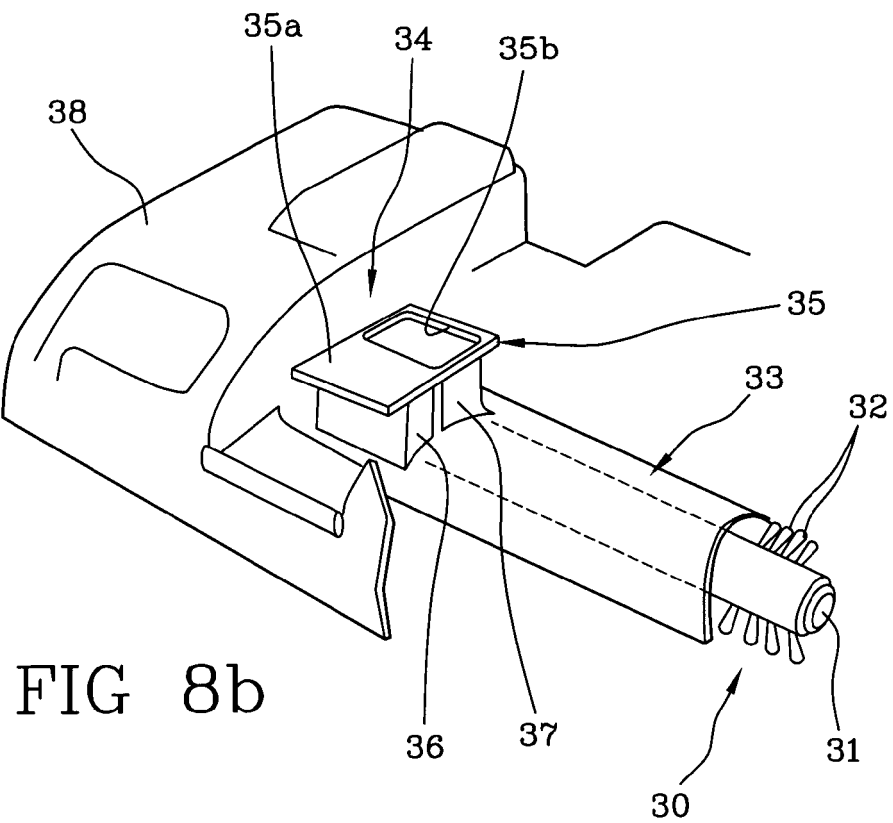
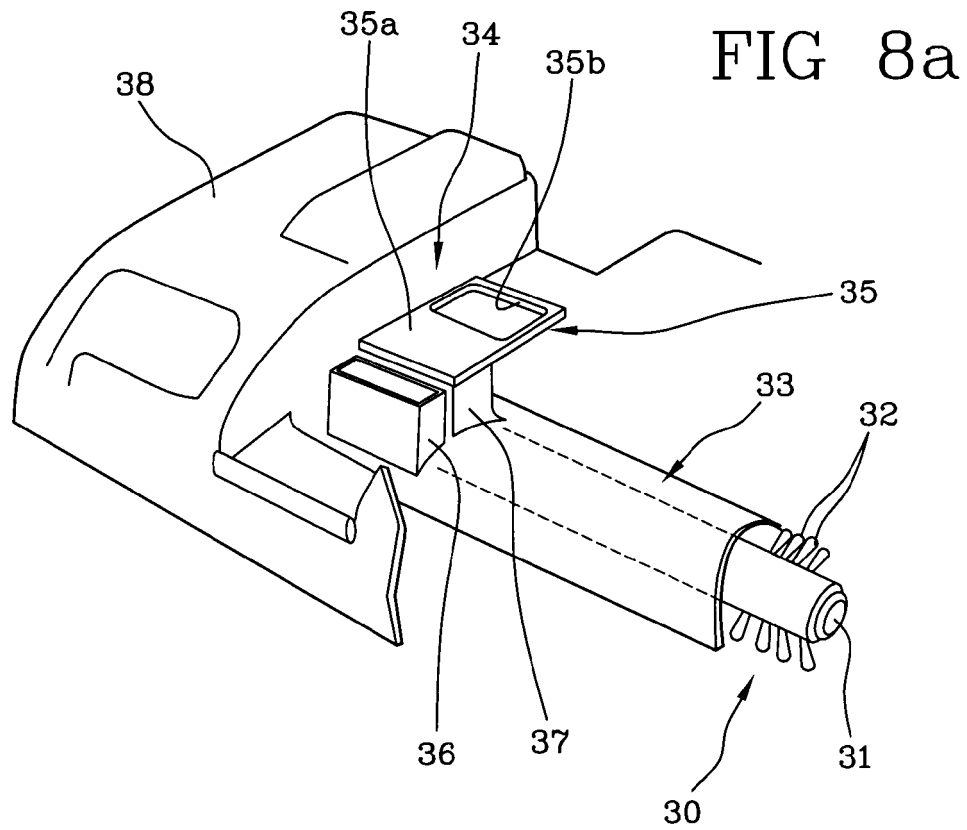


FIG 9

