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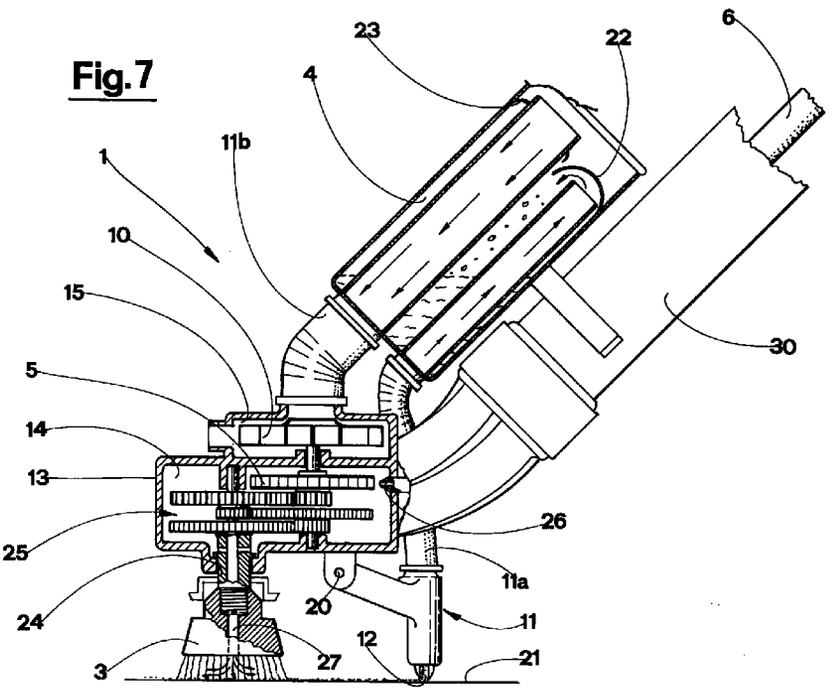
(54) A device for cleaning surfaces

(57) The device (1) for cleaning surfaces, in particular for floors, is hand-manoeuvred by an operator on the surface and is provided with a heated-steam delivery conduit (6) on which an impeller (5) of a steam turbine is located. The turbine is powered by steam passing through the delivery conduit (6), and in turn activates a centrifugal fan (10) which aspirates dirty liquid which forms on the surface. The steam exiting from the turbine is sent to a steam brush (3) from which a jet of steam directed at the surface exits.

Fig.7



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Description

The present invention relates particularly but not exclusively to the field of floor cleaning. In particular, the invention relates to a device which on command advances on a surface to be cleaned, and comprises a steam delivery conduit which directs, on command, a stream of vapour directly on to said surface.

The prior art teaches a device of this type, in which the steam delivery conduit is connected to a steam generator; the device is generally provided with a steam brush out of which flows a steam jet coming from the steam delivery conduit, and a rotatable roller brush for entraining the dirty liquid forming on the surface into a collection tank. This roller brush rotates by friction against said surface when advanced thereupon.

There is usually a grip for the operator, used for guiding the device.

This device, however, presents some drawbacks.

The first of these is that the roller brush constitutes an obstacle against smooth advancement of the device on the surface. This can lead to the device's being hard to push and manoeuvre, especially when operated by a single operator by hand.

Secondly, in order to obtain a good result, the steam brush has to be scrubbed vigorously against the surface. To help the operator in this, the prior art devices are fitted with a motor to rotate the brush. This leads to considerable constructional complexity, as well as creating a certain danger for the operator, who is working with electrically-driven elements near a wet surface.

A further disadvantage of prior art devices is that at the end of the operation the cleaned surface is still wet.

The main aim of the present invention is to obviate the above-mentioned drawbacks by providing a constructionally simple and economical device with which an operator can clean surfaces with reasonable expenditure of energy.

This aim is achieved by the device, as it is set out in the accompanying claims, which employs means for converting a part of the steam energy inside the delivery conduit into available mechanical energy.

The mechanical energy can advantageously be used for activating means for collecting the dirty liquid produced on the surface being cleaned, and for entraining same into a collection tank.

An advantage of the invention is represented by the fact that said means for collecting and entraining the dirty liquid are very simple and involve low energy consumption.

The mechanical energy made available can also be advantageously used, for example, to rotate the means for operating rotatably mounted on the device, such as, for example, a steam brush which, as well as issuing a jet of steam, scrubs the surface, or a steam brush which collects the dirty liquid from the surface.

Thanks to the invention the steam brush can act on the surface by scrubbing energetically and continuously thereupon with only a reasonable energy expenditure on the part of the operator.

A further advantage of the invention is that it does not require an electric motor to drive the brushes and therefore involves none of the risks usually connected with the presence of electric current near wet surfaces.

Thanks to the invention a particularly efficient and easily-manoeuvrable device for cleaning surfaces is provided.

A further advantage of the invention is that it provides a device which is fitted with means for collecting the dirty liquid from the surface to be cleaned, acting while the device is being moved back and forth on the surface. At the end of the operation the surface is dry.

Further characteristics and advantages of the present invention will better emerge from the detailed description that follows, of some preferred embodiments of the invention, illustrated in the form of non-limiting examples in the accompanying drawings, in which:

figure 1 is a vertical--elevation lateral view of a first embodiment of the invention, with some parts removed better to evidence others;
figure 2 is a lateral view from the left of figure 1, with some parts removed;
figure 3 is a vertical-elevation lateral view of a second embodiment of the device with some parts removed better to evidence others;
figure 4 is a lateral view from the left of figure 3 with some parts removed;
figure 5 is an enlarged-scale view of a detail of figure 4;
figure 6 is a vertical-elevation lateral view of a third embodiment of the device with some parts shown in section;
figure 7 is a vertical-elevation lateral view of a fourth embodiment of the device with some parts removed better to evidence others;
figure 8 is a brush applicable to the device of figure 7.

With reference to figures 1 and 2, 1 denotes in its entirety a device for cleaning surfaces, which advances on command on a floor 21 to be cleaned and which comprises a steam brush 3 connected to a delivery conduit 6. The delivery conduit 6 is passed through by a flow of steam which forms a vapour jet directed at the floor 21.

A sleeve 2 is fitted on the steam brush 3 for attaching a steam pipe, of known type and not illustrated in the figures, connected to a steam generator, also of known type. The steam arriving from the pipe is slightly heated to a pressure of usually between 3 and 4 bars.

The device 1 further comprises means for collecting and entraining the dirty liquid which forms on the floor 21 towards a collection tank 4 solidly mounted to the steam brush 3. These means for collecting and entraining comprise, in the embodiment of figures 1 and 2, a roller brush 7 which directs the dirty liquid towards the collection tank 4 by means of a ramp 8. The roller brush 7 comprises two coaxial half-brushes distanced one from the other.

The device further comprises means for transforming part of the steam energy in the delivery conduit 6 into mechanical energy. The means for transforming preferably comprise an impeller 5 of a steam turbine which is activated by the steam passing through the delivery conduit 6 and which activates the roller brush 7 by means of a gear reducer 9. A small transmission shaft 16 is also provided, connected to the roller brush 7 axle by means of a conical gear 17 situated between the two half-brushes.

The collection tank 4 is subdivided into two separate portions, each located at one of the half-brushes.

The roller brush 7 is elastically journalled to the steam brush 3 by means of a pivot 18 and a spring 19.

The delivery conduit 6 comprises a first tract 6a which supplies heated steam to the impeller 5 of the turbine and a second tract 6b which conveys the fluid exiting from said impeller 5 towards the steam brush 3.

With reference to figures 3, 4 and 5, which show a second embodiment of the invention, 21 denotes a floor to be cleaned, 1 a device for cleaning surfaces, and 2 a connection sleeve for connecting to a heated steam delivery, and 3 a steam brush, 6 a delivery conduit through which steam passes, 5 an impeller of a steam turbine actuated by steam passing through the conduit 6, and 6a a first tract and 6b a second tract of the conduit 6 which respectively supply the steam to the turbine and feed the exiting steam from the impeller 5 to the steam brush 3. There is also a collection tank for the dirty water, though not illustrated in the figures.

The second embodiment of the invention comprises means for conveying, that is, collecting and entraining the liquid forming on the floor being cleaned, which means comprise a centrifugal fan 10 activated by the impeller 5 of the turbine.

The centrifugal fan 10 is conformed and arranged such that it aspirates the dirty liquid from the floor 21 and sends it to the colection tank.

The centrifugal fan 10 operates internally of an aspiration conduit 11 which exhibits at one end thereof an inlet mouth 12 for the dirty liquid located near to the floor 21.

The device 1 comprises a box 13 provided with two chambers 14 and 15, separate and sealed, a first of which houses the impeller 5 and a second of which houses the centrifugal fan 10.

The chamber 14 housing the impeller 5 is equipped with an inlet 14i and an outlet 14u for the steam.

The chamber 15 housing the centrifugal fan 10 is equipped with an inlet 15i and an outlet 15u for the aspirated liquid.

The aspiration conduit 11 of the dirty liquid comprises a first tract 11a which goes from the inlet mouth 12 near the floor 21 to the inlet 15i of the aspirated liquid into the box 13. The first tract 11a is rigid and is solidly connected to the box 13 and hinged by a pivot 20 to the steam brush 3. The aspiration conduit 11 is further provided with a second tract, not illustrated, which goes from the outlet 15u to the collection tank.

With reference to figure 6, showing a third embodiment of the invention, 3 denotes a steam brush, in particular for floors, while 4 denotes a collection tank for dirty water aspirated from the floor, 6 a delivery conduit, 6a a first tract of conduit 6 supplying heated steam to a steam turbine, 6b a second tract supplying the fluid exiting from the turbine to the steam brush 3, and 13 a box, as in figure 5, which houses the steam turbine and a centrifugal fan 10. 14i and 14u respectively denote an inlet and an outlet predisposed on the box 13 for the steam passage through the turbine, while 15i and 15u denote respectively an inlet and an outlet for the air aspirated by the centrifugal fan 10 operating inside the box 13. 12 denotes an inlet mouth of the dirty water collected from the floor 21, while 11a denotes a first tract of an aspiration conduit of the dirty water.

In this version the centrifugal fan 10 aspirates only air from the collection tank 4, creating a depression therein. The first tract 11a of the aspiration conduit of the dirty water does not enter the box 13 and therefore the centrifugal fan 10 chamber, but discharges into the collection tank 4.

The tract of aspirating conduit leading from the collection tank 4 to the centrifugal fan 10 is protected by a shield 25 and does not aspirate liquid but not air. For this reason its mouth, internal of the collection tank 4, is kept constantly above the level of the liquid collected therein, so that even when the collection tank 4 contains a considerable level of liquid, the power absorbed by the pump is always limited.

The fluid exiting from the centrifugal fan 10 through the outlet 15u is only clean and hot air, due to the temperature of the adjacent turbine.

This outlet fluid is channel led into a drying conduit 11c which has one of its ends arranged in proximity of the surface to be cleaned. The clean hot air is thus sent on to the floor 21 and dries it.

The constructional modifications of this embodiment, here reported only schematically, are obvious and within the ability of any person skilled in the art.

With reference to figure 7, which shows a fourth embodiment of the invention, 1 denotes in its entirety a device for cleaning surfaces, which in the example is able to advance, on command, on a floor 21 to be cleaned and which comprises a steam brush 3 for cleaning surfaces.

6 denotes a steam delivery conduit which is connected to a steam generator of known type and not illustrated in the drawings. The steam delivery conduit is passed through by a quantity of steam such as to produce a jet thereof which flows through the steam brush 3 and is directed on to the floor 21. 30 denotes a hollow bearing structure 30 internally of which the delivery conduit 6 is arranged. The steam in the delivery conduit 6 is slightly heated.

5 denotes an impeller 5 of a steam turbine which is actuated by steam passing through the delivery conduit 6, and which constitutes a preferred means for convert-

ing a part of the steam energy in the delivery conduit 6 into available mechanical energy.

10 denotes a centrifugal fan which operates internally of an aspiration conduit 11 conformed and disposed to enable the dirty liquid to be aspirated through an inlet mouth 12 and send same to a collection tank 4. The centrifugal fan 10 is preferably coaxial to the impeller 5 of the turbine, as well as solidly connected thereto.

A box 13 comprising two chambers 14 and 15 is provided, which chambers are separate one from the other and are sealed. A first of the chambers 14 houses the impeller 5 of the turbine, while the second of the chambers 15 houses the centrifugal fan 10.

The aspiration conduit 11 of the dirty liquid comprises a first tract 11a which goes from the inlet mouth 12 to the collection tank 4. The first tract 11a is at least partially rigid and is journalled to the bearing structure 30 by means of a pivot 20, and can oscillate with respect to the bearing structure 30.

The centrifugal fan 10 aspirates only air from the collection tank 4, creating a depression therein.

The first tract 11a of the aspiration conduit 11 does not open into the centrifugal fan 10 but discharges into the collection tank 4. 11b denotes a second tract of aspiration conduit which goes from the collection tank 4 to the centrifugal fan 10, and which is protected by a shield 23. This second tract 11b does not aspirate liquid, but only air; for this reason its mouth situated inside the collection tank 4 is kept constantly above the level of the liquid collected therein. Simiilarly, the first tract 11a of aspiration conduit 11 is protected by a shield 22 curved towards the bottom of the collection tank 4 and kept constantly above the level of the liquid collected therein. In this way, even where there is a considerable quantity of liquid in the collection tank 4, the power absorbed by the centrifugal fan 10 is of modest entity.

The steam brush 3 is mounted, preferably removably by screw attachments, on a hollow shaft 24 rotatably coupled to the box 13 of the turbine, and is connected to the turbine by means of a reducer, preferably a gear reducer 25. The rotation axis of the hollow shaft 24 is normal to the surface to be cleaned. The steam passes through the cavity in the hollow shaft 24 and goes directly on to the surface to be cleaned.

26 and 27 respectively denote a nozzle for emission of steam on to the turbine and an internal conduit of the steam brush 3 through which the steam passes when exiting from the turbine to be directed at the floor 21.

The steam brush, driven by the impeller 5, is rotated with its axis normal to the surface of the floor, so that a vigorous and continuous scrubbing action is obtained without undue effort on the part of the operator, resulting in an especially well-cleaned floor.

Figure 8 shows a steam brush 3' which is somewhat modified with respect to the steam brush 3 of figure 7, in that it has a quick-fit attachment. In figure 2, two conduits 27' for the steam are afforded in the steam brush 3.

Other rotating tools can be operatively connected to the impeller 5 of the turbine.

In all of the embodiments described, the device 1 is pushed by the operator on a floor to be cleaned. The steam head in the delivery conduit 6 supplies and activates the impeller 5 of the turbine, which then powers the various tools which can be attached thereto, according to the embodiment.

In the first embodiment the turbine activates a roller brush 7 for collecting the dirty water; in the further embodiments the turbine activates the aspiration means for aspirating the dirty liquid; in the final embodiment (figures 7 and 8), apart from activating the means for aspiration, the turbine rotates a steam brush 3 which then scrubs the floor.

In each case the steam exiting from the turbine is sent to the steam brush 3 to carry out the cleaning action.

In the device of figures 1 and 2, the roller brush 7 is elastically journalled so as to absorb the bumps and vibrations to which it is subject during functioning of the device; in the other versions, thanks to the fact that the first tract 11a of the aspiration conduit 11 is pivoted at the pivot 20 - also elastically - the inlet mouth 12 is constantly positioned near the floor 21 so that the dirty liquid is efficiently aspirated even where the floor is not perfectly flat, and the whole aspiration system assembly is protected from bumps and impacts.

An advantage of the invention is that the group comprising the steam turbine, the centrifugal fan 10 and the box 13 is extremely compact and of very contained mass.

An advantageous detail of the device, in all embodiments, is that it efficiently collects the dirty water from the floor during both forward and backward movements; the turbine rotates the roller brush 7 (first embodiment) and the centrifugal fan 10 (other embodiments) in a same rotation direction, so that the dirty liquid is conveyed towards the collection tank 4, independently of the movement of the device 1 on the floor 21.

The invention provides a device for cleaning surfaces, especially floors, which is particularly light and practical to manoeuvre, apart from being extremely efficient and reliable.

Obviously, other systems of aspiration can be used instead of the centrifugal fan 10, such as membrane systems, piston systems, and so on.

Claims

1. A device for cleaning floors, which advances on command on a surface to be cleaned and comprises a delivery conduit (6) of steam conformed and arranged such as to direct steam on to said surface, characterized in that it comprises means for converting at least a part of steam energy passing through said delivery conduit (6) into mechanical energy.

2. A device as in claim 1, characterized in that it comprises means for conveying dirty liquid which forms on the surface towards a collection tank (4) therefor, which means for conveying are powered by said mechanical energy.

3. A device as in claim 2, characterized in that said means for conveying the dirty liquid comprise a centrifugal fan (10) which operates internally of an aspiration conduit (11) in such a way that the dirty liquid is aspirated from the surface (21) by an inlet mouth (12) of the aspiration conduit (11), and is sent to the collection tank (4).

4. A device as in claim 3, characterized in that said aspiration conduit (11) of the dirty liquid comprises a first tract (11a) which connects the inlet mouth (12) and the collection tank (4), and a second tract (11b), which starts internally of the collection tank (4) and leads to the centrifugal fan (10); said second tract (11b) having a mouth located internally of the collection tank (4) which is kept constantly above a level of the dirty liquid collected therein.

5. A device as in claim 3 or 4, characterized in that it comprises a drying conduit (11c) connected with an outlet of the centrifugal fan (10) and has itself an outlet arranged in proximity of the surface to be cleaned.

6. A device as in claim 2, characterized in that said means for conveying said dirty liquid comprise a roller brush (7) which is rotatable and pushes the dirty liquid towards the collection tank (4).

7. A device as in any one of the preceding claims, characterized in that said means for converting said steam energy comprise an impeller (5) of a steam turbine.

8. A device as in claims 7 or 3, characterized in that it comprises a box (13) provided with a sealed first chamber (14) and a sealed second chamber (15), which first chamber (14) houses the impeller (5) of the steam turbine, and which second chamber (15) houses the centrifugal fan (10).

9. A device as in any one of the preceding claims, characterized in that it comprises a rotatable steam brush (3) which is operatively associated to the surface to be cleaned, and which is rotated by means of said mechanical energy.

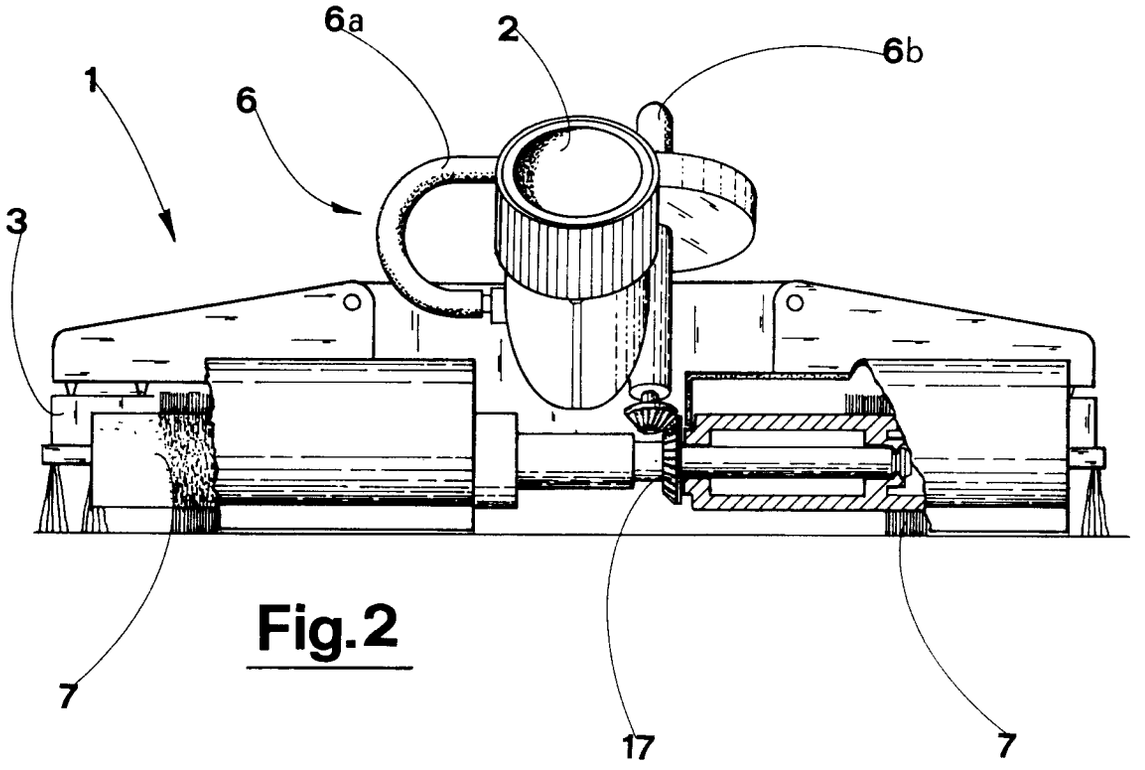


Fig.2

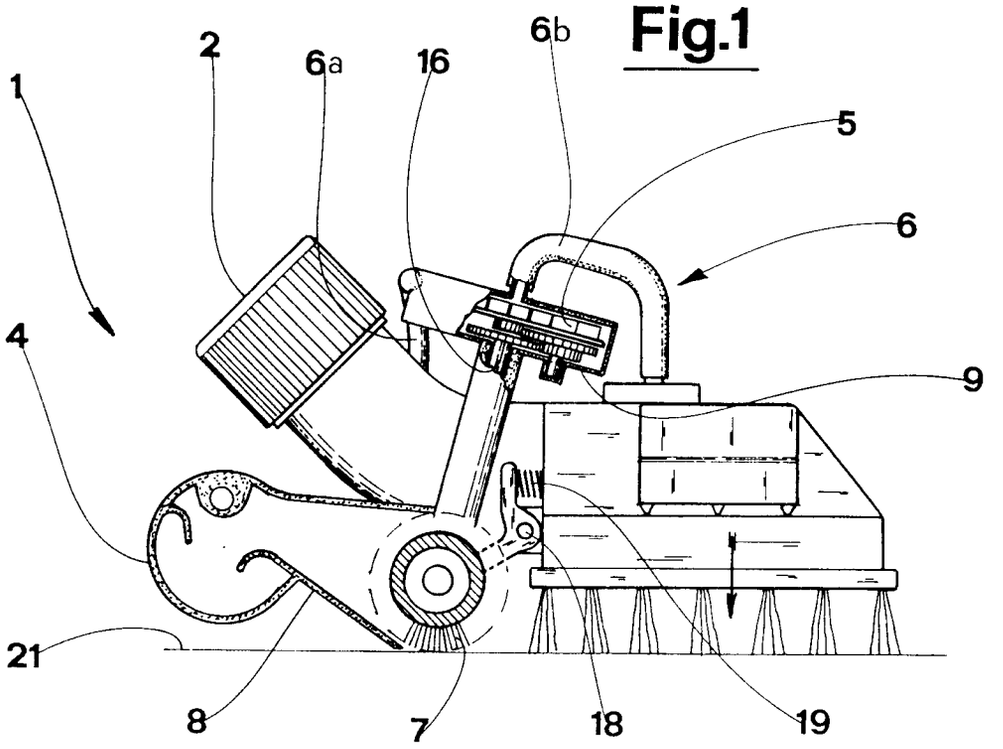
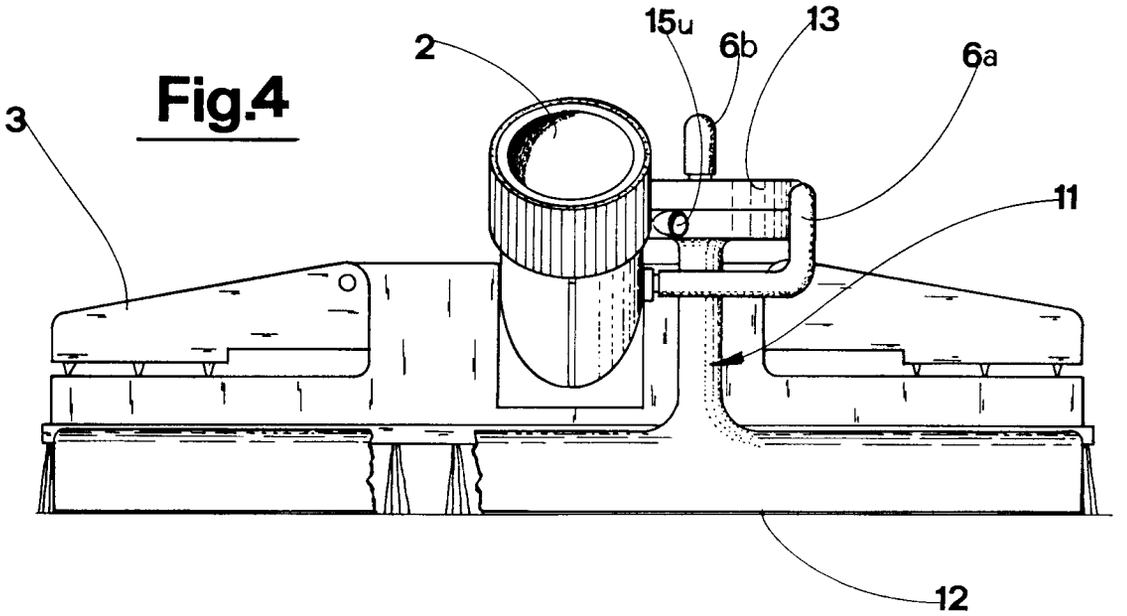


Fig.1

Fig.4



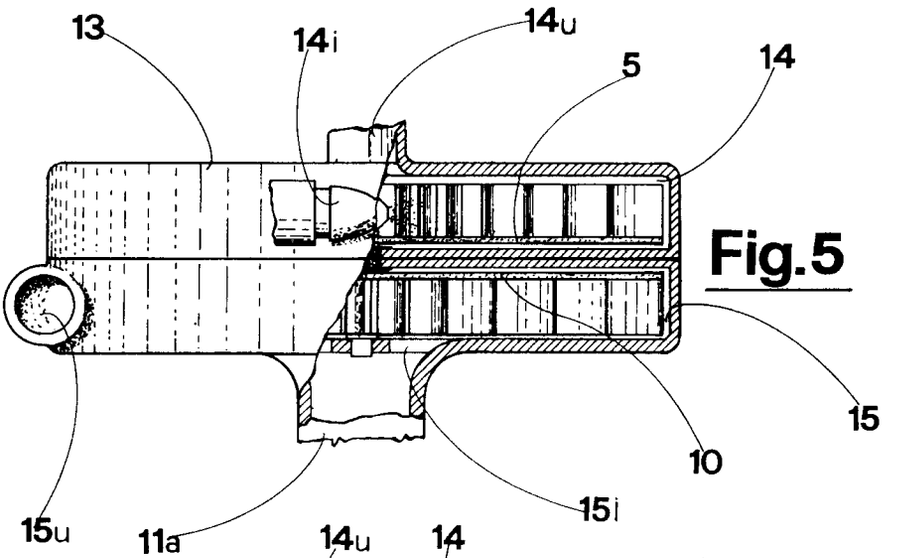


Fig.5

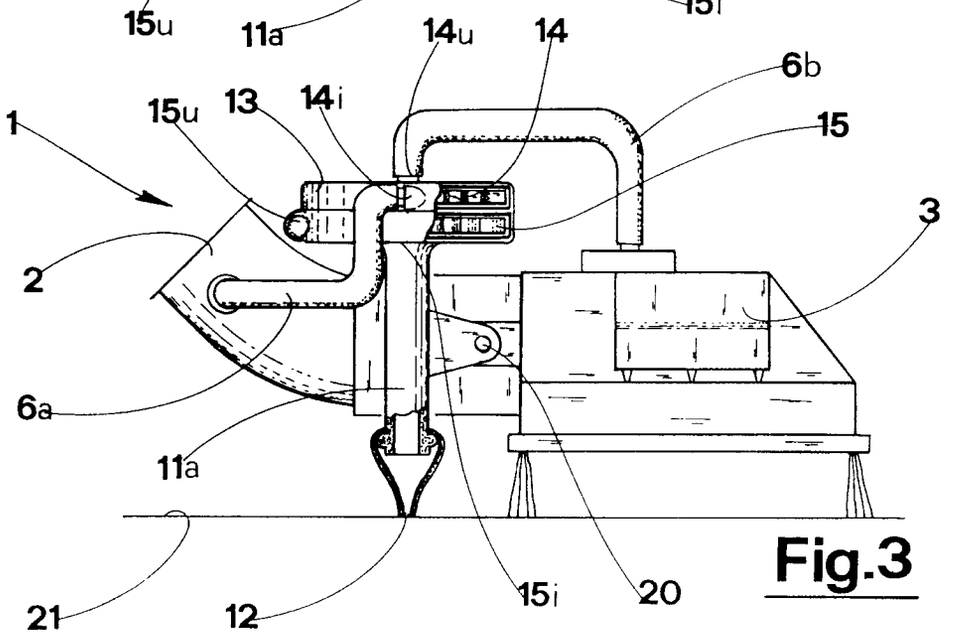
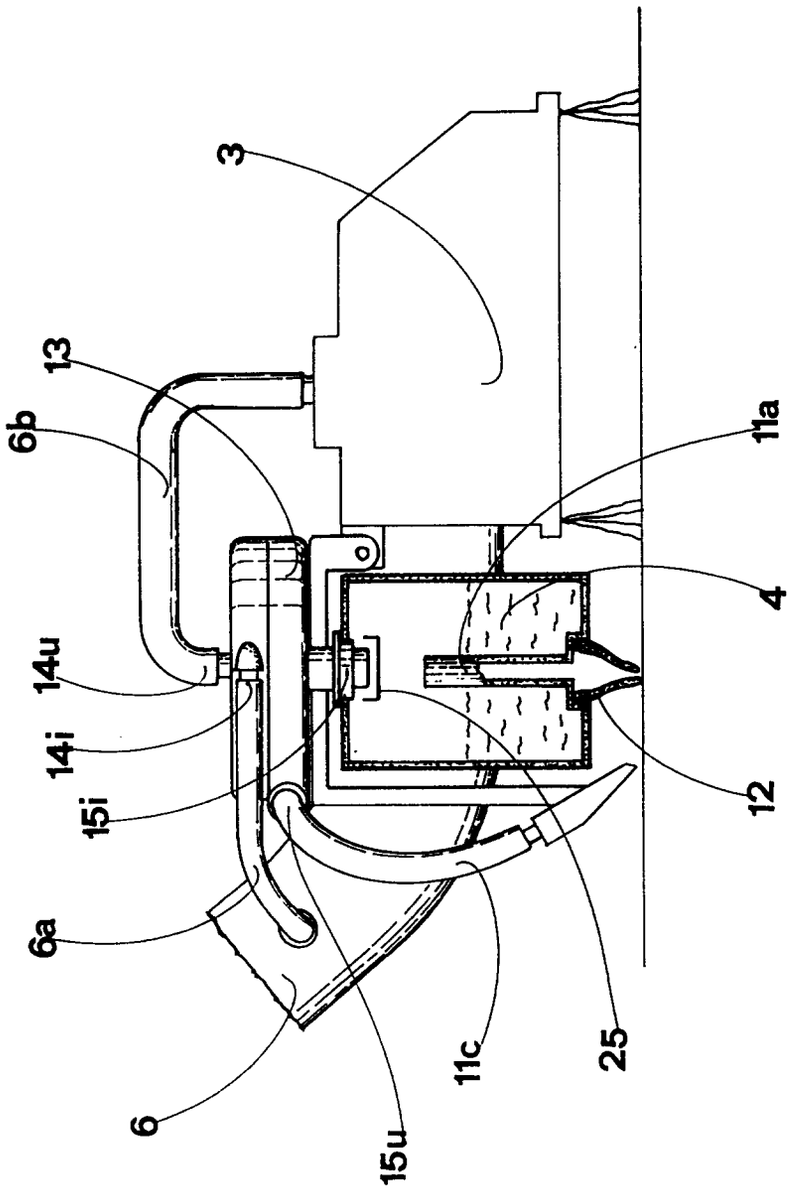


Fig.3

Fig.6



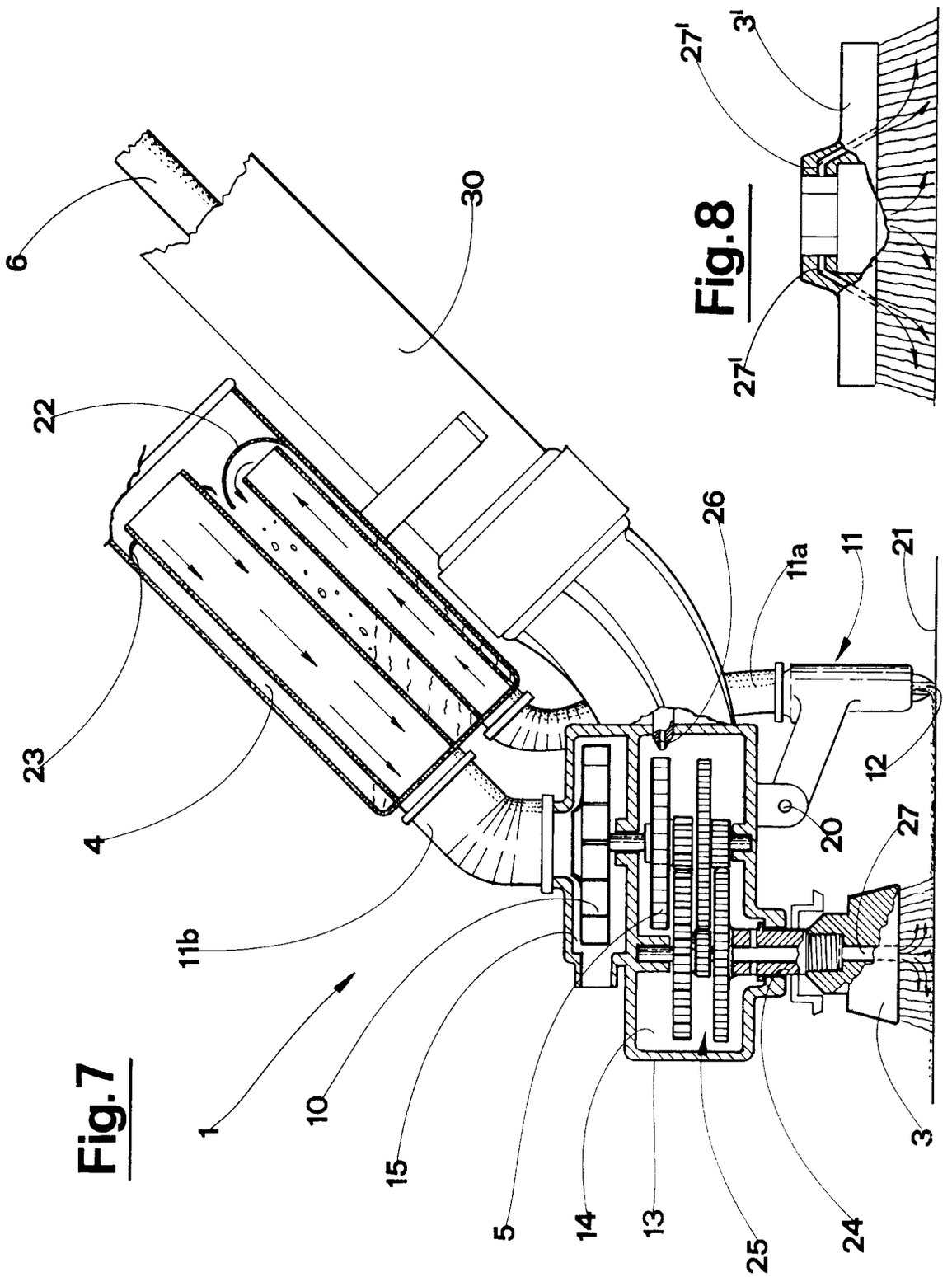


Fig.7

Fig.8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 83 0533

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
P,X	CH-A-684 994 (RADWULF SA) * the whole document *	1-3,7,8	A47L11/34
A	EP-A-0 155 621 (K. MEIDEL) * abstract; claims; figures *	1-4,7,8	
A	EP-A-0 430 415 (W.H. HENDRICK) * column 7, line 55 - column 10, line 35; figures *	1,6,7,9	
A	US-A-5 184 370 (T.K. JUNG) * abstract *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 March 1996	Vanmol, M

CATEGORY OF CITED DOCUMENTS

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