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(54) A vacuum cleaner

(57) A vacuum cleaner (1) comprising a dust-collection reservoir (7) containing a fluid (8) and at least one duct (11) for conveying an air-flow comprising the dust into the reservoir (1), the flow being mixed with the fluid (8) so as to generate a dynamic and turbulent mixture, is characterized in that the reservoir (7) comprises means (16,17) for intercepting the flow in order to generate a swirling motion of the mixture inside the reservoir (7).

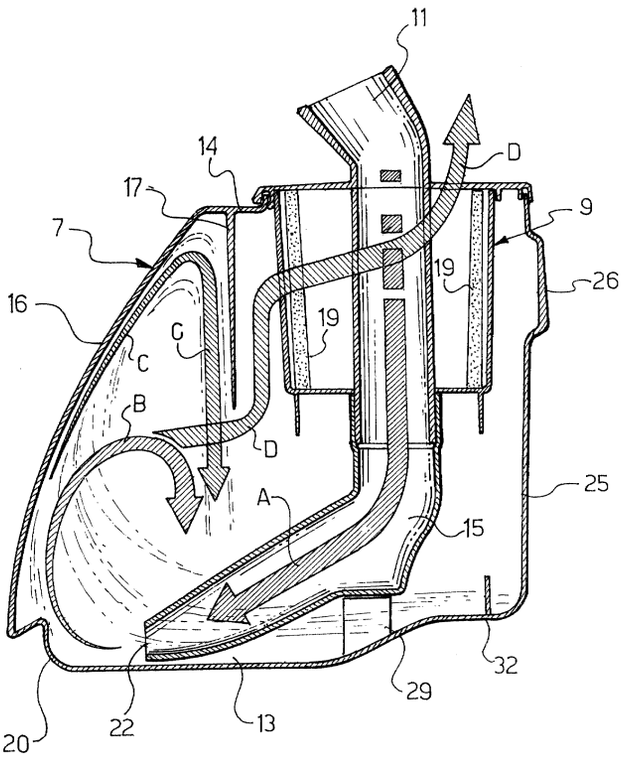

FIG.4

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Description

[0001] In general, the present invention relates to a cleaner, particularly for domestic use.

[0002] In particular, the present invention relates to a vacuum cleaner in which the dust is drawn into a reservoir containing a fluid, usually water, and is separated from the air by washing with the fluid.

[0003] There are various known vacuum cleaners of the above-mentioned type which comprise a suction pump in fluid communication with a reservoir containing water and a suction duct for conveying a flow of air containing dust into the reservoir.

[0004] In practice, when these cleaners are in operation, the suction pump creates an air-flow which enables the operator to collect the dust from a surface to be cleaned.

[0005] The air mixed with the suspended dust is conveyed inside a flexible hose and is thus transported into a reservoir of the cleaner in which it undergoes a type of washing by means of the water contained therein.

[0006] The dust is thus separated from the air and remains in the reservoir whilst the cleaned air is returned to the atmosphere surrounding the cleaner.

[0007] Although the operation of the above-mentioned vacuum cleaners is very good from a practical point of view, it has the serious drawback that some of the dust drawn in is not effectively separated from the air during the washing process so that it is finally returned to the atmosphere surrounding the cleaner.

[0008] Clearly, this drawback disadvantageously impairs the cleaning performance of the above-mentioned machines.

[0009] Moreover, bearing in mind that the extremely volatile nature of dust is the cause of allergic phenomena or similar conditions which frequently occur in sensitive people, the above-mentioned drawback is clearly particularly problematic.

[0010] The technical problem upon which the present invention is based is that of providing a vacuum cleaner which can be produced easily and economically and which achieves a more effective separation of the dust from a suction air-flow containing the dust, by washing with a fluid, so as to overcome the drawbacks mentioned above with reference to the prior art.

[0011] This problem is solved by a vacuum cleaner comprising a dust-collection reservoir containing a fluid and at least one duct for conveying an air-flow comprising the dust into the reservoir, the flow being mixed with the fluid so as to generate a dynamic and turbulent mixture, characterized in that the reservoir comprises interception means for generating a swirling motion of the mixture inside the reservoir.

[0012] The characteristics and the advantages of the vacuum cleaner according to the present invention will become clearer from the following description of a preferred embodiment thereof, given with reference to the appended drawings, in which:

Figure 1 is a perspective view of the vacuum cleaner according to the invention,

Figure 2 shows a vacuum cleaner according to the invention, in section,

Figure 3 is a perspective view of a dust-collection reservoir of the cleaner according to the invention,

Figure 4 shows the reservoir of Figure 3, in section and on an enlarged scale.

[0013] With reference to the drawings, the vacuum cleaner according to the invention, indicated 1, comprises a body 2 having wheels 3 and 4 at the bottom and a carrying handle 5 at the top.

[0014] The vacuum cleaner 1 also comprises a removable dust-collection reservoir 7, housed in the body 2 and containing, up to a predetermined maximum level, a fluid 8, for example, water, possibly mixed with deodorant products, fresheners, etc.

[0015] The reservoir 7 comprises a support base 13, an upper rim 14, a wall 16 having a substantially concave profile, and a baffle 17 which extends from the rim 14.

[0016] The support base 13 is connected to the curved wall 16 by means of a curved portion 20 shaped so as to create a profile for supporting the reservoir 7 in a corresponding seat 23 inside the body 2.

[0017] The reservoir 7 further comprises a substantially vertical wall 25 which, in the vicinity of its upper edge, forms a projection 26 for supporting the tank 7 in a corresponding seat 18 inside the body 2.

[0018] Moreover, the base 13 is connected to the wall 25 by means of a step-like portion 29 which terminates, in the vicinity of the wall 25, in a bearing edge 32 of the reservoir 7.

[0019] A hollow filter-holder 9 is fitted in the reservoir 7 and a substantially coaxial duct 11 extends through the filter-holder 9 in order to convey a flow of air and dust into the reservoir 7.

[0020] In particular, the filter-holder 9 is disposed in the vicinity of the baffle 17 on the side remote from the wall 16. It has conventional engagement means for fitting in corresponding seats of the upper rim 14.

[0021] The duct 11 terminates outside the cleaner 1 in an element 12 for the engagement of a conventional flexible hose 37 which enables the operator to pick up the dust from a surface to be cleaned.

[0022] Inside the reservoir 7, the duct 11 has an end portion 15 which is bent to form an elbow and has an opening 22 for delivering a flow of air and dust into the reservoir 7.

[0023] The end portion 15 preferably has a reduction in its cross-section in the vicinity of the opening 22 in order advantageously to increase the speed at which the flow of air and dust is delivered into the reservoir.

[0024] Moreover, the outlet profile of the opening 22 preferably has a substantially oval cross-section so that the flow of air and dust entering the reservoir 7 is rendered laminar.

[0025] The filter-holder 9 also has an external annular grating 21 which constitutes a first filtering element, and an internal, annular, spongy filter 19 for retaining particles of water transported by the air which has been cleaned of the dust.

[0026] The cleaner 1 further comprises, housed inside the body 1, a suction pump 33 driven by a motor in fluid communication with the filter-holder 9 and with the reservoir 7 by means of a duct 36.

[0027] A second filter-holder interposed in the duct 36 contains a filter 38 for removing any particles of dust which are transported by the air after the washing with the fluid and which, in the absence of this filter, would be returned to the atmosphere outside the cleaner 1.

[0028] The filter 38 is preferably of the type which can also remove, from a gaseous flow, particularly fine dust particles which might more easily escape separation during the washing of the air with the fluid.

[0029] The operation of the vacuum cleaner according to the present invention is described below with reference to a condition in which the cleaner is switched on and the reservoir 7 contains water as the washing fluid.

[0030] In this condition, a continuous flow of air and dust, indicated A in the drawings, is drawn in from a surface to be cleaned, by means of the flexible hose 37.

[0031] The flow is thus conveyed into the duct 11 and delivered into the reservoir by means of the opening 22 of the end portion 15.

[0032] The opening 22 is preferably beneath the free surface of the liquid and the air and dust are therefore quickly mixed with the water contained in the reservoir 7.

[0033] In the embodiment of the invention described, the opening 22 for delivering the flow of air and dust is advantageously disposed in the vicinity of the base 13 of the reservoir 7 so as to ensure that the components of the flow are mixed with a large volume of the liquid.

[0034] Naturally, the delivery opening 22 may be located in any position inside the reservoir 7 and, if necessary, even above the free surface of the fluid.

[0035] The mixing of the flow of air and dust with the water produces considerable turbulence in the resulting mixture, thus achieving a first effect of separation of the dust from the air.

[0036] This mixture is also dynamic with characteristics of motion which depend on various factors, amongst which is the entry speed and the direction in which the flow of air and dust is delivered into the reservoir.

[0037] According to the present invention, the direction in which the flow is delivered is such as to force the mixture against one wall of the reservoir 7 at a suitable speed.

[0038] In particular, in the currently-preferred embodiment, the direction in which the flow is delivered has a component substantially tangential to the base 13 and the mixture comprising water, air and dust is continuously urged against the wall 16 with the concave profile.

[0039] The interception of the mixture by the wall 16 brings about partial atomization of a portion of the mixture which, for example, follows the path indicated B in Figure 4, tending to be re-mixed with the flow of air and dust delivered continuously by the opening 22.

[0040] At the same time, a second portion of the mixture tends to rise along the wall 16, for example, following the path indicated C in Figure 4, and is urged against the baffle 17 also by virtue of the particular concave profile of the wall 16.

[0041] At this point, the portion of the mixture which is intercepted by the baffle 17 is partially atomized and falls back into the reservoir 7, coming into contact with the particles of air and water released by the first atomization and with the underlying portion of the mixture.

[0042] It should also be noted that the air particles released during the atomization of the portion of the mixture intercepted by the baffle 17 are also forced to move downwards, thus coming into contact with the mixture again.

[0043] The overall effect achieved by the vacuum cleaner according to the invention is therefore that of creating a swirling or continuously recirculating motion of the mixture in a region of the reservoir 7 delimited partially by the wall 16 and by the baffle 17 which act as means for intercepting the flow and atomizing the mixture.

[0044] This swirling motion advantageously enables the dust to be separated more effectively since the period of contact between the water and the air containing the dust as well as the exchange surface between air and water are increased as a result of the atomization.

[0045] It should also be noted that the forced downward direction of movement produced by the baffle 17 advantageously prevents the mixture and the moisture-rich air particles from being drawn into the filter-holder 9 immediately.

[0046] This could compromise the efficiency of operation of the filter 19 and could dangerously transport moisture towards electrical portions of the vacuum cleaner.

[0047] After washing with water, the air, cleaned of the dust and still having a certain moisture content, follows the path indicated D in Figure 4, passing through the grating 21 and the filter-holder 9 where the annular filter 19 removes the particles of water contained in the air.

[0048] The substantially dried air then passes through the duct 36, reaching the suction pump 33, and is finally released into the surrounding atmosphere.

[0049] Any residual dust particles which have not been separated by the washing with water in the reservoir 7 are substantially removed from the air by means of the filter 38 interposed in the duct 36.

[0050] The main advantage of the vacuum cleaner according to the present invention lies in its greater efficiency in separating the dust from the air in comparison with conventional water vacuum cleaners.

[0051] A further advantage of the vacuum cleaner is that it can be produced easily and economically, without

appreciable additional costs in comparison with conventional water vacuum cleaners.

[0052] Further considerable advantages of the vacuum cleaner according to the invention are that it is also safer and more practical in use.

[0053] In order to satisfy contingent and specific requirements, an expert in the art may apply modifications or adaptations to the above-described cleaner and may replace elements with other functionally equivalent elements, without thereby departing from the scope of protection of the invention as defined by the appended claims.

[0054] For example, the position and number of suction ducts for admitting the air and dust to the reservoir, the shape and size of the reservoir, of the walls, and of the baffle may be varied at will by the expert in the art in dependence on specific requirements.

[0055] Similarly, the baffle may be located in any region inside the reservoir, according to specific requirements for the interception of the flow, or may even be replaced by other functionally equivalent means.

[0056] Finally, the performance of the vacuum cleaner according to the invention, in terms of cleaning, may be further improved by the connection thereto of means for washing the surfaces to be cleaned.

[0057] For example, a spray device or apparatus for producing and delivering steam may be incorporated in the cleaner in order to wet the surfaces to be cleaned beforehand and hence to draw in a flow of moist air and dust.

[0058] This flow would then be subjected to washing according to the invention to separate the dust.

Claims

1. A vacuum cleaner (1) comprising a dust-collection reservoir (7) containing a fluid (8) and at least one duct (11) for conveying an air-flow comprising the dust into the reservoir (1), the flow being mixed with the fluid (8) so as to generate a dynamic and turbulent mixture, characterized in that the reservoir (7) comprises interception means (16, 17) for generating a swirling motion of the mixture inside the reservoir (7).

2. A vacuum cleaner according to Claim 1, in which the interception means comprise a wall (16) and a baffle (17).

3. A vacuum cleaner according to Claim 2, in which the wall (16) has a substantially concave profile.

4. A vacuum cleaner according to Claim 2 or Claim 3, in which the reservoir (7) further comprises a support base (13) from which the wall (16) extends, and an upper rim (14) connected to the wall (16).

5. A vacuum cleaner according to Claim 4, in which the baffle (17) extends from the upper rim (14) in the vicinity of the wall (16).

6. A vacuum cleaner according to any one of the preceding claims, in which the at least one duct (11) comprises an end portion (15) having an opening (22) for delivering the air-flow comprising the dust into the reservoir (7).

7. A vacuum cleaner according to Claim 6, in which the end portion is positioned in a manner such that the opening (22) is disposed beneath the free surface of the fluid (8).

8. A vacuum cleaner according to Claim 6 or Claim 7, in which the end portion (15) is positioned in a manner such that the direction in which the air-flow comprising the dust is delivered has a component substantially tangential to the support base (13).

9. A vacuum cleaner according to any one of Claims 6 to 8, in which the end portion (15) has a reduction in cross-section in the vicinity of the opening (22).

10. A vacuum cleaner according to any one of Claims 6 to 9, in which the outlet profile of the opening (22) has a substantially oval cross-section.

11. A vacuum cleaner according to any one of preceding Claims 4 to 10, further comprising a hollow filter-holder (9) fitted in the reservoir (7) and having an annular filter (19).

12. A vacuum cleaner according to Claim 11, in which the filter-holder (9) is positioned in the vicinity of the baffle (17) on the side remote from the wall (16).

13. A vacuum cleaner according to Claim 11 or Claim 12, in which at least one suction duct (11) extends coaxially through the filter-holder (9).

14. A vacuum cleaner according to any one of the preceding claims, further comprising means (33), in fluid communication with the reservoir (7), for drawing in the air-flow comprising the dust.

15. A vacuum cleaner according to any one of the preceding claims, in which the fluid (8) is water.

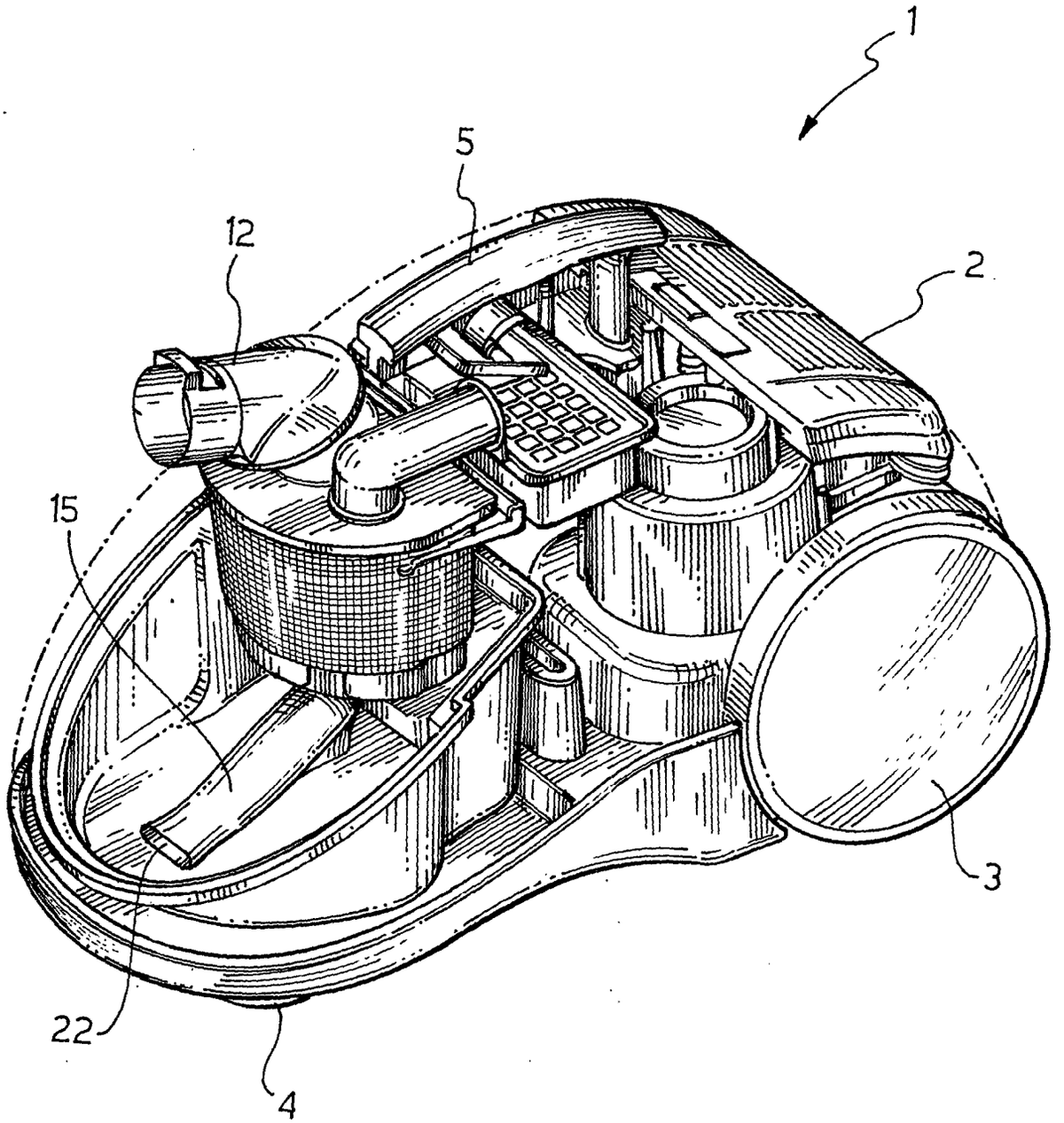

FIG.1

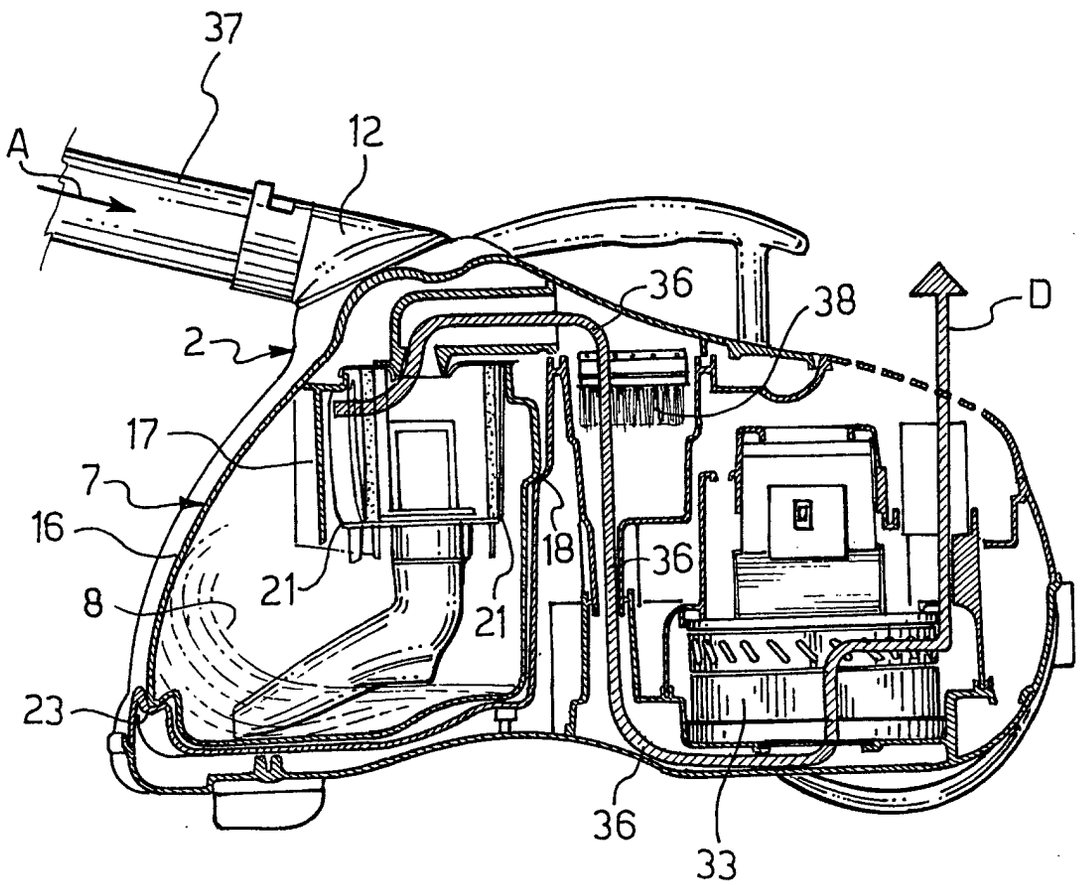

FIG. 2

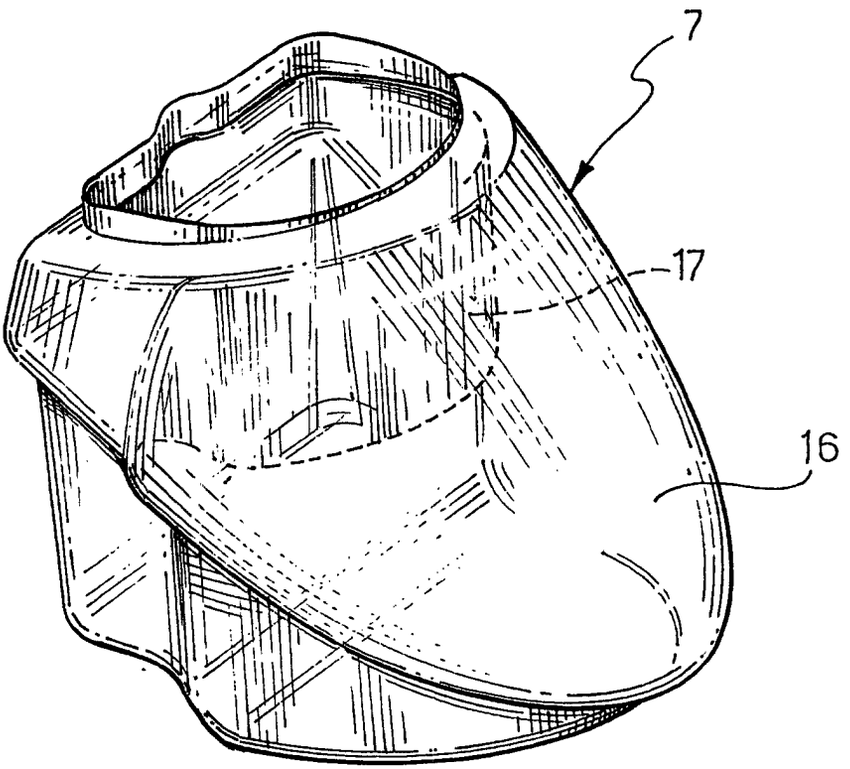

FIG.3

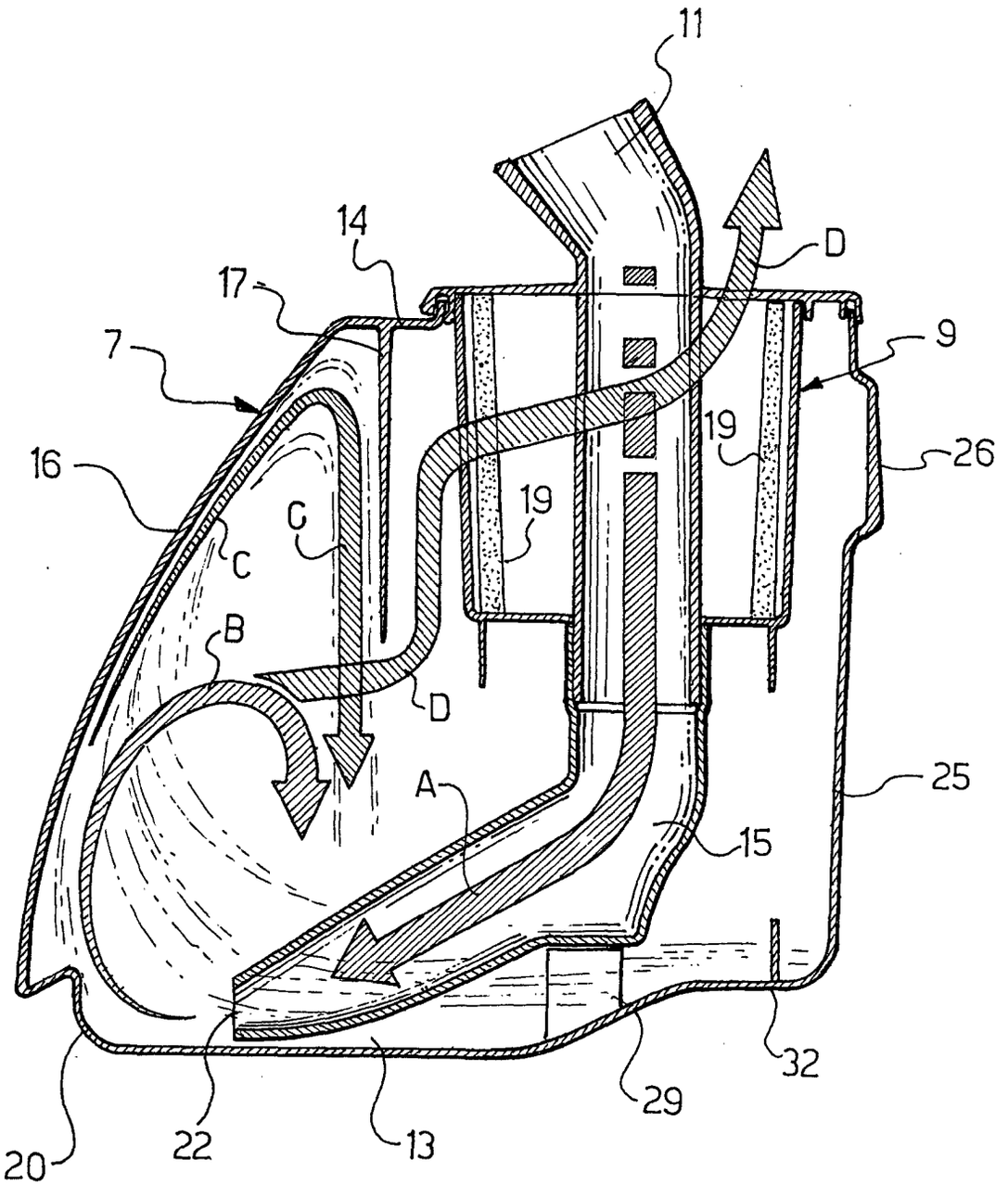

FIG.4

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EUROPEAN SEARCH REPORT

Application Number
EP 99 83 0819

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Y	WO 89 00021 A (PEARSON A ET AL) 12 January 1989 (1989-01-12) * abstract * * page 4, line 6 - page 5, line 7 * * figure 1 *	11,12	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 June 2000	Cabral Matos, A

CATEGORY OF CITED DOCUMENTS

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