(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 187 080 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
05.07.2017 Bulletin 2017/27

(51) Int Cl.:
A47L 5/14 *(2006.01)* ***A47L 9/08*** *(2006.01)*

(21) Application number: **15202839.5**

(22) Date of filing: **28.12.2015**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(71) Applicant: **MB "Markreva"**
94231 Klaipeda (LT)

(72) Inventor: **Ramaska, Mindaugas**
Klaipéda (LT)

(74) Representative: **Habermann, Hruschka & Schnabel**
Montgelasstrasse 2
81679 Munich (DE)

(54) DOUBLE AIR FLOW SYSTEM FOR VACUUM DEVICES

(57) A suction device that uses a semi-closed circulation system that causes both suction and blowing action across an opening in the fluid flow generating device head or suction component. The blowing agitates dirt/dust from the surface to be cleaned and is sucked back around the semi-closed loop which brings the dust into a separator or fluid cleaning system where dirt/dust is separated and cleaned and re-circulated through the system through the blowing inlet repeatedly. This provides increased efficiency and reduced power consumption while providing more effective cleaning.

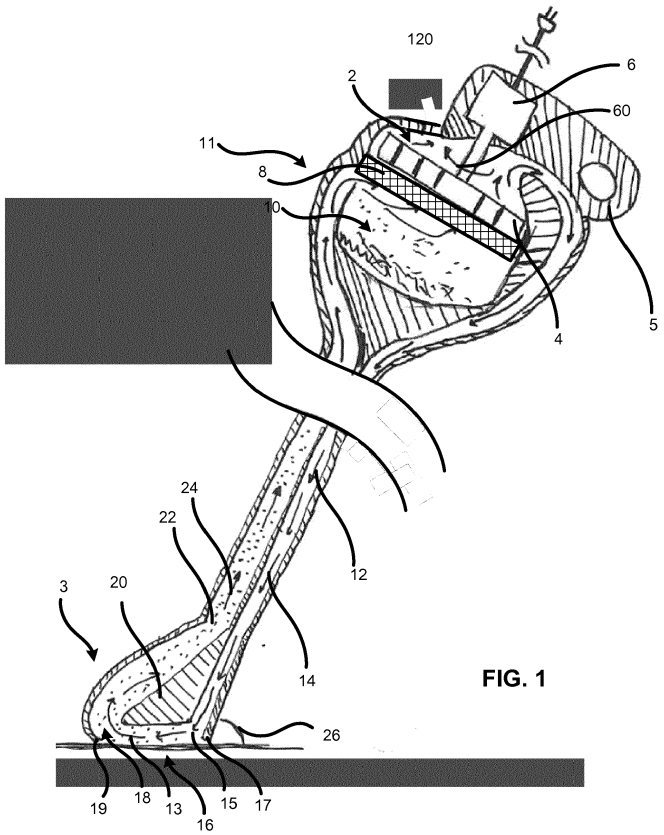

FIG. 1

EP 3 187 080 A1

Description

FIELD OF THE INVENTION

[0001] The following invention relates to vacuum devices, more particularly, the invention relates to a vacuum cleaner that uses blown air in combination with suction to carry and collect dirt and dust.

BACKGROUND OF THE INVENTION

[0002] Suction devices commonly work using "vacuum" (low pressure) that generates a one way flow from the cleaner head to a fluid (air is considered a fluid) cleaning system pushed out to the atmosphere. Dirt is lifted and collected due to air flow from the atmosphere to the low pressure area that is created by flow generator. Air viscosity is predominantly responsible for moving the dust and acting as a "carrier" to move the dust. The denser and more viscous the air is, the more effectively it can move the dust. Fast traveling fluid creates drag that by itself creates suction on surrounding surfaces due to the viscosity.

[0003] Comparing the same size outlet and inlet with same flow rate, the suction effect has a short distance but wide impact on the cleaning area. Blowing fluid is denser and more viscous and not loose speed as much as suction does as the fluid becomes farther from the source of the blowing.

[0004] Since blowing air on a cleaning surface can be more effective at moving dust and dirt than suction, it is desirable to take advantage of the blowing effect to move dust/dirt.

SUMMARY OF THE INVENTION

[0005] It is therefore an objective of the present invention to provide a suction device that takes advantage of blowing dust/dirt off a surface and collects that dust/dirt.

[0006] It is another objective of the invention to provide improved efficiency and reduced power consumption in comparison to prior vacuum cleaners, due to a semi-closed fluid flow system.

[0007] It is another objective of the invention to provide a semi-closed loop system that circulates fluid (such as air) through a vacuum device head to provide both blowing and suction at the vacuum device head.

[0008] The terms "coupled", "coupled to", "coupled with", "connected", "connected to", and "connected with" as used herein each mean a relationship between or among two or more devices, apparatus, components, systems, subsystems, and/or means, constituting any one or more of (a) a connection, whether direct or through one or more other devices, apparatus, components, systems, subsystems, or means, and/or (b) a functional relationship in which the operation of any one or more devices, apparatus, components, systems, subsystems, or means depends, in whole or in part, on the operation of any one or more others thereof.

[0009] The terms "first" and "second" are used to distinguish one element, set, data, object or thing from another, and are not used to designate relative position or arrangement in time.

[0010] Therefore, a suction component is arranged with an inlet and outlet, the inlet receiving air and passing the air across an opening towards an outlet, the passing of the air from inlet side to outlet side across the opening creates a blowing effect which moves dust and carries the dust to the outlet without blowing the dust away.

[0011] In one aspect, a suction device has a flow generator (2). A suction component (3) is connected to the flow generator (2). An inlet (12) is positioned on the suction component (3) and receives a fluid (14) from the flow generator (2). An outlet (22) is positioned on the suction component (3). An opening (16) in the suction component (3) is positioned between the inlet (12) and the outlet (22). Upon activation of the flow generator (2), the fluid (14) flows through inlet to the opening (16) where it reacts with the cleaning area positioned at the opening (16), the part of fluid bounces from the cleaning area and travels to the outlet returns (24) to the flow generator through the outlet (22) with a material (18). As the fluid travels from outlet to inlet it passes fluid cleaning system. The fluid cleaning system or separator (11) can be before or after the flow generator. For illustration purposes one possible combination of elements that can make up a fluid cleaning system includes a container (10) and filter (8) located before (up stream of) the flow generator (2).

[0012] The main function of the bouncing of the fluid is to remove stuck and unwanted things like dust, dirt and microorganisms from objects such as a rug using high density, high velocity fluid passing fluid. The fluid takes unwanted materials to the outlet. Because the suction and blowing air volume is the same through the inlet and outlet, there is very little air escaping the semi closed system.

[0013] Fluid with unwanted material (18) travels through the outlet (22) and through the fluid cleaning system (11) which separates the carried material (18) from the fluid (14).

[0014] In one example, a container (10) is downstream of the outlet (22) and receives the material (18) collected at the opening (16) such that the material (18) is transported from the suction component (3) towards the container (10) via the outlet (22) using suction created by the flow generator (2). Any flow generator could be used in this system. In one aspect the flow generator (2) could comprises a motor (6) and a fan (4). In another aspect any fluid cleaning system can be positioned in any place of the device. As one of possible illustration a filter (8) is located between the outlet (22) and the flow generator to separate the material (18) from the fluid (14) as shown in FIG. 1.

[0015] It is understood that fluid with the unwanted material (18) can be cleaned by any system including the container/filter system cleaning system or separator (11)

shown in FIG 1. Other cleaning systems (11) include centrifugal, bag and filter, water or any other systems that separate the material from the fluid.

[0016] Upon activation of the flow generator (2) the material (18) is moved to fluid cleaning system (11) by a combination of blowing (15) and suction (13), the blowing (15) due to the fluid (14) traveling from said inlet (12) across the opening (16) and suction (13) due to the fluid (14) being transported back towards the flow generator (2) via the outlet (22).

[0017] In one aspect the opening (16) defines a first edge (17) and a second edge (19). A separation element (20) is spaced apart from the first (17) and second (19) edges such that the first shortest distance (170) between the separation element (20) and the first edge (17) is shorter than a second shortest distance (190) between the separation element (20) and the second edge (19).

[0018] In one aspect the inlet (14) defines a cross-sectional area smaller than that of the outlet (22).

[0019] In yet another aspect, the fluid converges as it moves from the inlet (12) towards the opening (16) and diverges as the fluid moves from the opening (16) towards the outlet (22).

[0020] In some embodiments, the inlet and outlet have the same diameters and flow rate at a location between the flow generator (2) and the suction component (3). However this does not limit any combination of different outlet and inlet diameters or different flow rate between the inlet and outlet.

[0021] Other objects of the invention and its particular features and advantages will become more apparent from consideration of the following drawings and accompanying detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

FIG. 1 is a cross section view of an example fluid flow device according to the present invention.

FIG. 2A-E are detail cross section views of blowing and suction components for the fluid flow device shown in FIG. 1.

FIG. 2F is a detail cross perspective cutaway view of a blowing and suction component for the fluid flow device shown in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

[0023] Referring now to the drawings, wherein like reference numerals designate corresponding structure throughout the views. The following examples are presented to further illustrate and explain the present invention and should not be taken as limiting in any regard. In FIG.1, an exemplary fluid flow device is configured as a hand held vacuum cleaner. The housing (5) of contains the flow generator (2) and the container (10). The container is removable to allow the dust/dirt that is picked up to be discarded. The flow generator (2) includes a motor (6) and a fan (4) which is rotated (60) by the motor (6). This generates movement of fluid (14) or air as shown. The fluid (14) circulates out of the flow generator and towards inlet (12), past opening (16), outlet (22), into the container (10) and through filter (8) back past the fan (4). Air travels in semi-closed flow system that only effects the object in the opening (16).

[0024] In FIG. 1, the flow generator (2) is positioned between two passages that are connected to the inlet (12) and the outlet (22). One side of the flow generator (2) results in low pressure which creates suction to move material from the opening. The other side is used to push fluid (air) through the cleaning system. The air compresses as it reaches the opening and part of the air bounces off the object to be cleaned (external surface, rug or other object). This bouncing agitates or removes dust/dirt etc. (material) from the object to be cleaned and the suction carries the material back to the cleaning system 11. Air traveling from inlet directed in such way that it bounces and travels with its inertia towards the outlet by itself. Suction has wider effect area allowing the suction to suck air around the opening. This combination allows limited or no escape of air in the semi-closed flow system, which enables collection of dust and dirt at the same time.

[0025] The circulation of the air around the system results in blowing (15) of fluid at material (24') which is located on an external surface, for example a floor or rug. The blowing (15) agitates the material (24') as the suction component (3) is moved along the external surface. This agitation is as effective as rug pollination which creates a concentrated cloud of dust/dirt or material (18) within the suction component (3). Because the flow generator (2) creates a suction force (13) or low pressure, the flow of the fluid generally moves in a semi closed circle pattern back towards the flow generator. As can be seen, the flow (24) back towards the flow generator (2) includes material (18) lifted from the opening (16) as well as the fluid (14) which circulated past the opening (16).

[0026] To further concentrate the blowing action, distance (170) from the separation element (20) to the edge (17) is smaller than distance (190) between the separator and edge (19). This causes the fluid flow to converge towards the opening (16) and diverge away from the opening. The cross section or average cross section of the outlet (22) may also be larger than that of the inlet (12). Angle (26) may also be adjusted by changing the positioning of edge (17) and (19) relative to each other. A shallower and sharper angle may result in different agitation forces and bouncing action across the opening. As one example, FIG 2B provides a configuration which may be adapted for 2mm velour carpet. Any sharper outlet angle to the opening will increase dust pushed inside a breathable object like a couch. This means that fluid flow attack angle to the surface and its power may be dependent on the composition and permeability of the

object being cleaned. Depending on the surface selected, the angle may be adjustable to suit the cleaning object, or a kit may include different fluid flow device heads that create different compression of the fluid and different angles to modify the bouncing and agitation effect of the system.

[0027] FIG. 2A-F shows a detail view of the vacuum head or suction component (3). The Vacuum head may be connected to many different configurations of flow generators to take advantage of the suction and blowing action to agitate and collect dust/dirt. As can be seen in FIG 2B and 2E, the fluid compresses towards the opening (16) which results in higher viscosity to assist in moving dust/dirt. FIG. 2C shows different paths parts of the fluid may take while travelling between the inlet and outlet. As can be seen, some of the fluid bounces against the cleaning surface and some air moves across the opening without bouncing against the cleaning surface.

[0028] It is also understood that the blowing via the inlet may be turned off in certain cases. In the example shown in FIG 1, the housing would include an opening to the atmosphere that allows fluid to be expelled once cleaned by the fluid cleaning system or separator (11) and sucked in by the flow generator. Therefore, a cleaning surface can first be used to clean visible or loose dust/dirt and then the blowing action can be turned on to create the semi-closed system described herein which uses the blowing action to agitate the difficult to clean dirt that may be trapped, for example in a rug.

[0029] Although the invention has been described with reference to a particular arrangement of parts, features and the like, these are not intended to exhaust all possible arrangements or features, and indeed many other modifications and variations will be ascertainable to those of skill in the art.

Claims

1. A suction device having a flow generator (2) and **characterized by**:

a suction component (3) connected to said flow generator (2) ;
an inlet (12) positioned on said suction component (3) and receiving a fluid (14) from said flow generator (2);
an outlet (22) positioned on said suction component (3);
an opening (16) in said suction component (3) positioned between said inlet (12) and said outlet (22);
upon activation of said flow generator (2), said fluid (14) enters said inlet such that said fluid reaches said opening (16) and returns (24) to said flow generator through said outlet (22) with a material (18).

2. The suction device of claim 1 further comprising:

a separator (11) downstream of said outlet (22) and
separating the material (18) collected at said opening (16) from the fluid (14).

3. The suction device of any preceding claim, wherein the flow generator (2) comprises a motor (6) and a fan (4).

4. The suction device of any of claims 2-3, wherein said separator (11) includes a filter (8) and a container (10) located between said outlet (22) and said flow generator to separate the material (18) from the fluid (14).

5. The suction device of claims 2-4, wherein upon activation of said flow generator (2) said material (18) is moved to said container (10) by a combination of blowing (15) and suction (13), the blowing (15) due to said fluid (14) traveling from said inlet (12) across the opening (16) and suction (13) due to said fluid (14) being transported back towards said flow generator (2) via said outlet (22).

6. The suction device of any preceding claim further comprising:

said opening (16) defining a first edge (17) and a second edge (19);
a separation element (20) spaced apart from said first (17) and second (19) edges such that said a first shortest distance (170) between said separation element (20) and said first edge (17) is shorter than a second shortest distance (190) between said separation element (20) and said second edge (19).

7. The suction device of any preceding claim, wherein said inlet (14) defines a cross-sectional area smaller than that of said outlet (22).

8. The suction device of any of claims 2-7, wherein the separator (11) is selected from the group consisting of:

a vacuum bag, a filter, a centrifugal separator, a water based fluid separator and combinations thereof.

9. The suction device of any preceding claim, wherein said fluid converges as it moves from the inlet (12) towards the opening (16) and diverges as the fluid moves from the opening (16) towards the outlet (22).

10. The suction device of any of claims 4-9, wherein said container (10) is downstream of said outlet.

11. The suction device of any preceding claim, wherein said flow generator is activated by rotation (60) of a fan (4).

12. The suction device of any of claims 2-11, wherein the fluid travels in a semi-closed flow system, which allows the fluid to re-circulate continuously through the flow generator and a separator.

13. A vacuum cleaner including the suction device of any preceding claim.

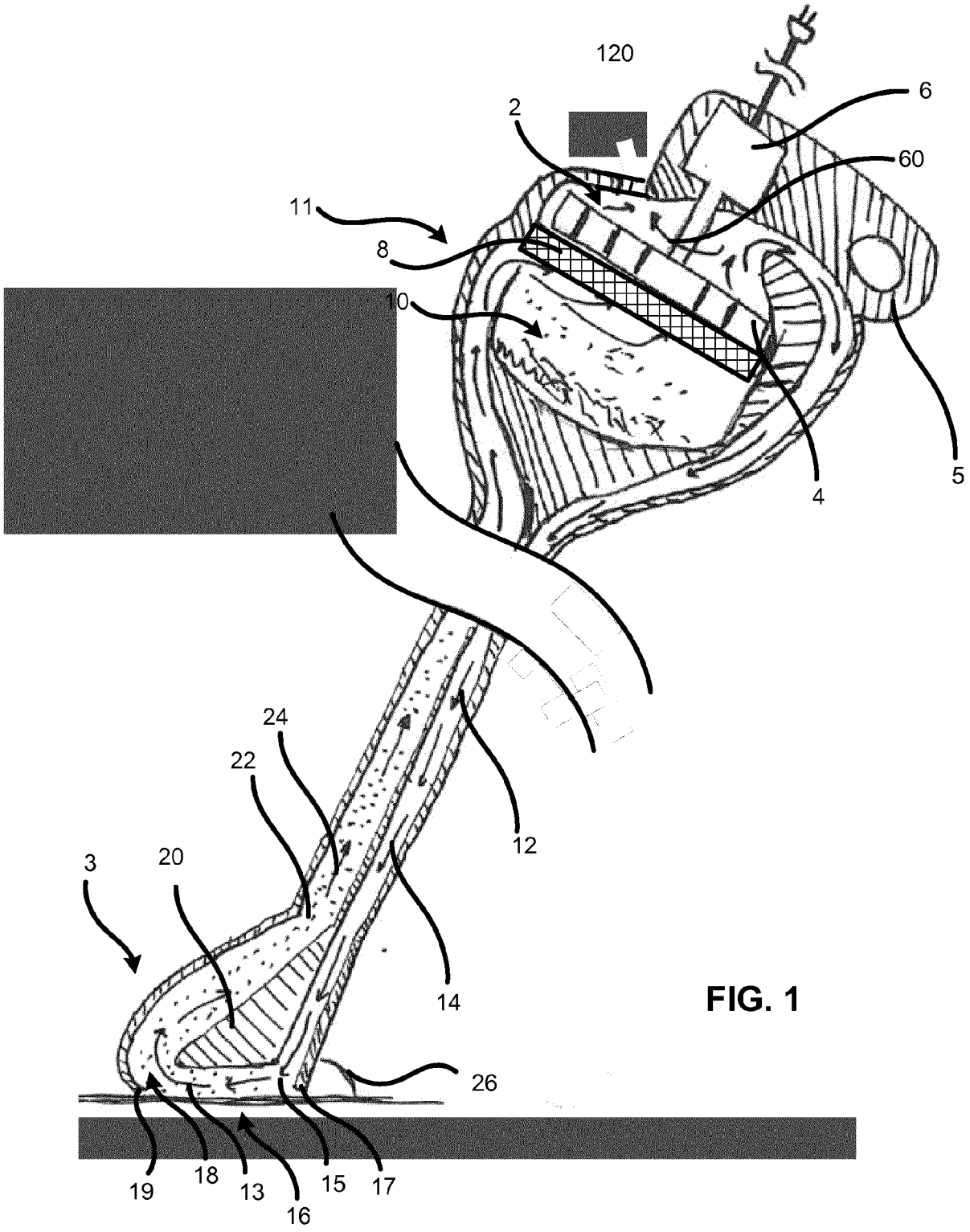

FIG. 1

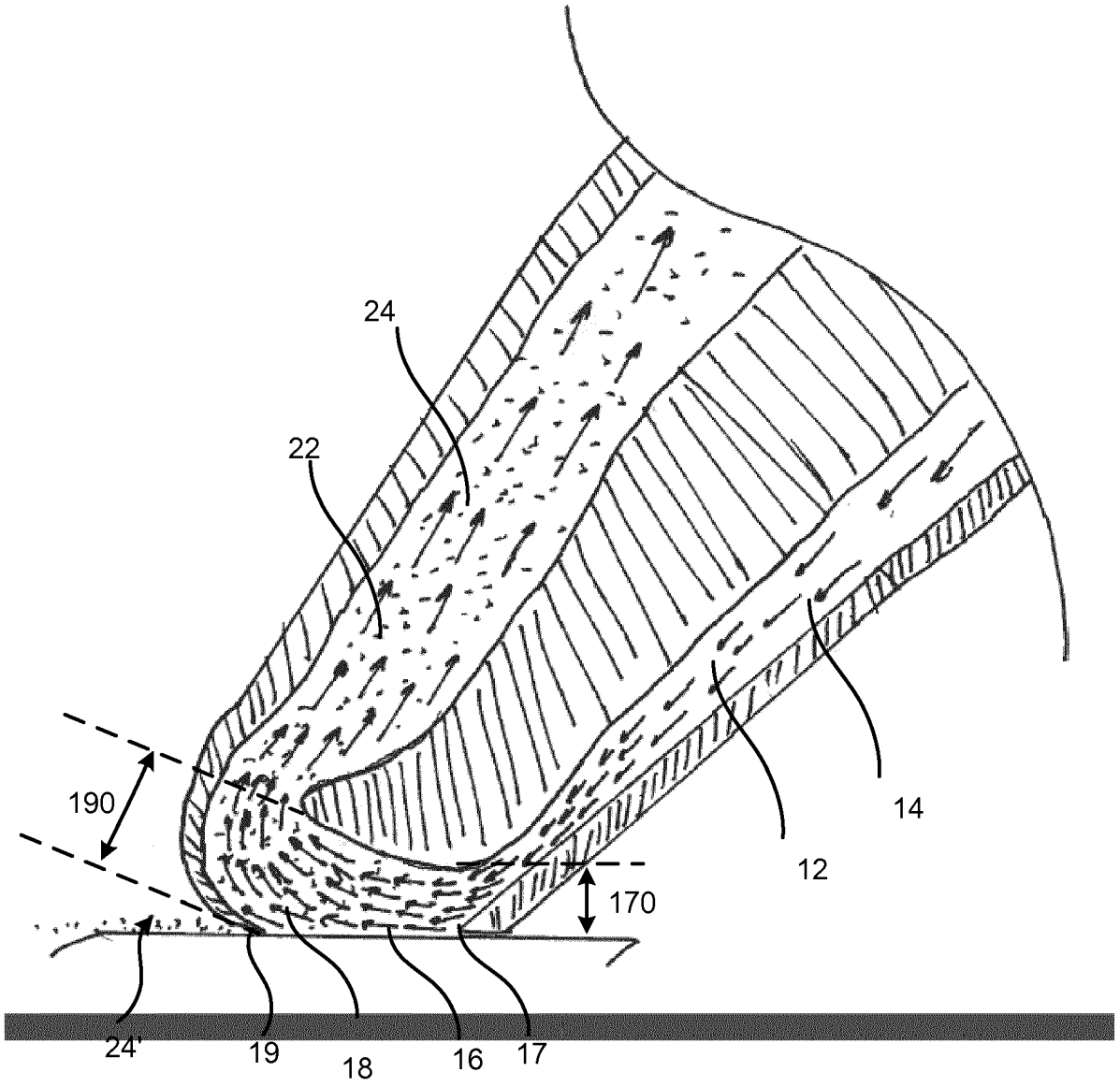

FIG. 2A

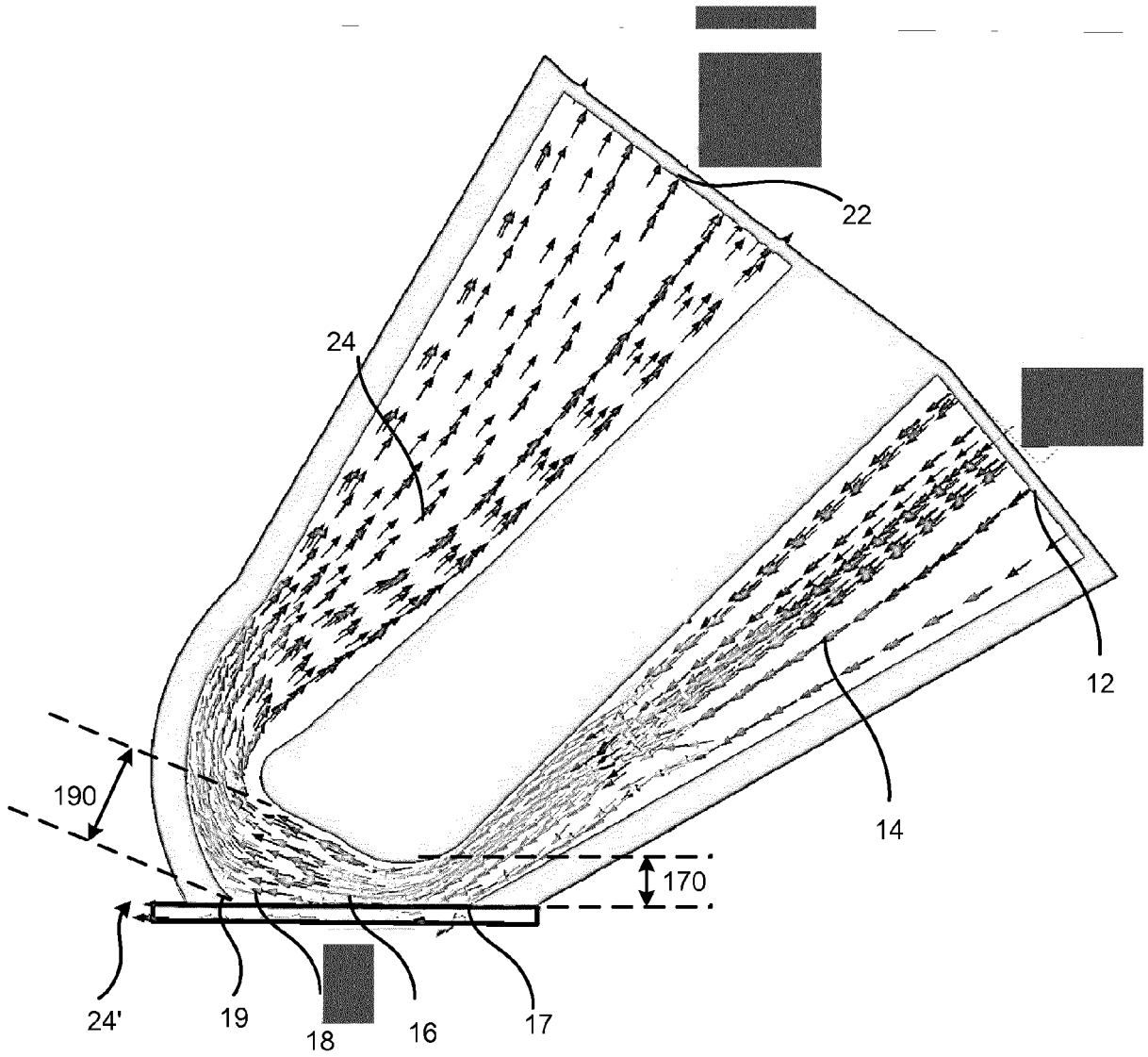

FIG. 2B

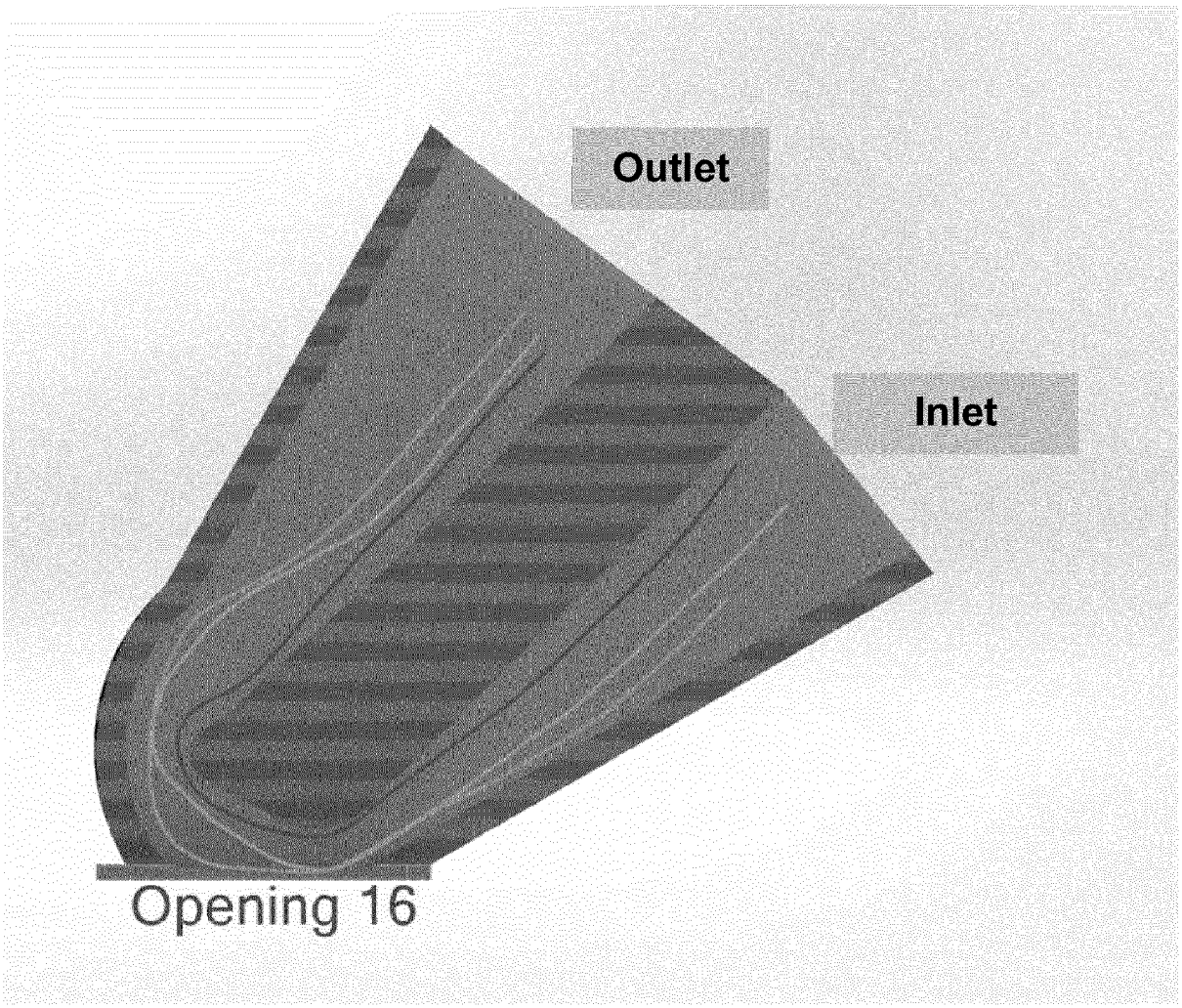

FIG. 2C

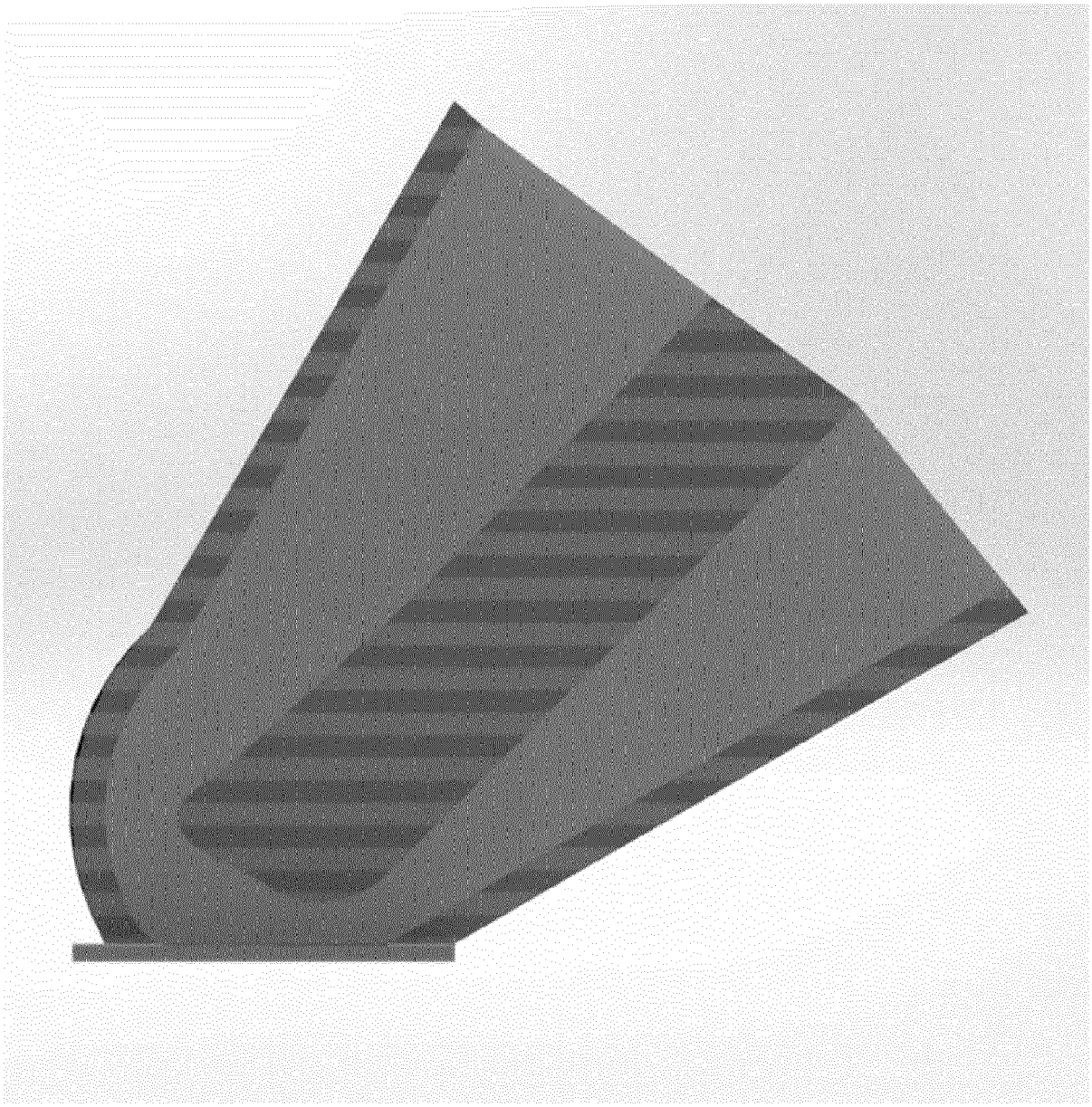

FIG. 2D

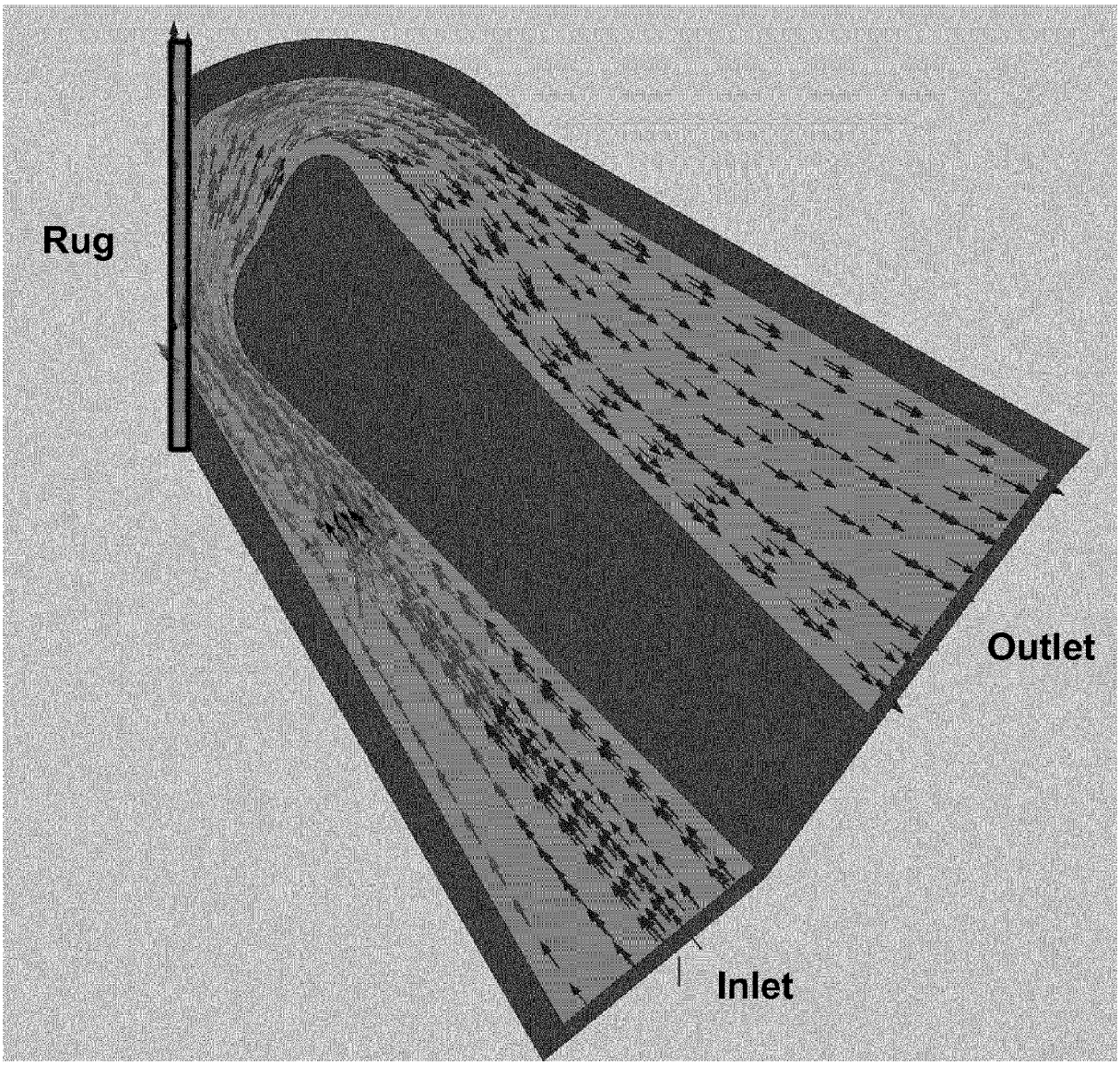

FIG. 2E

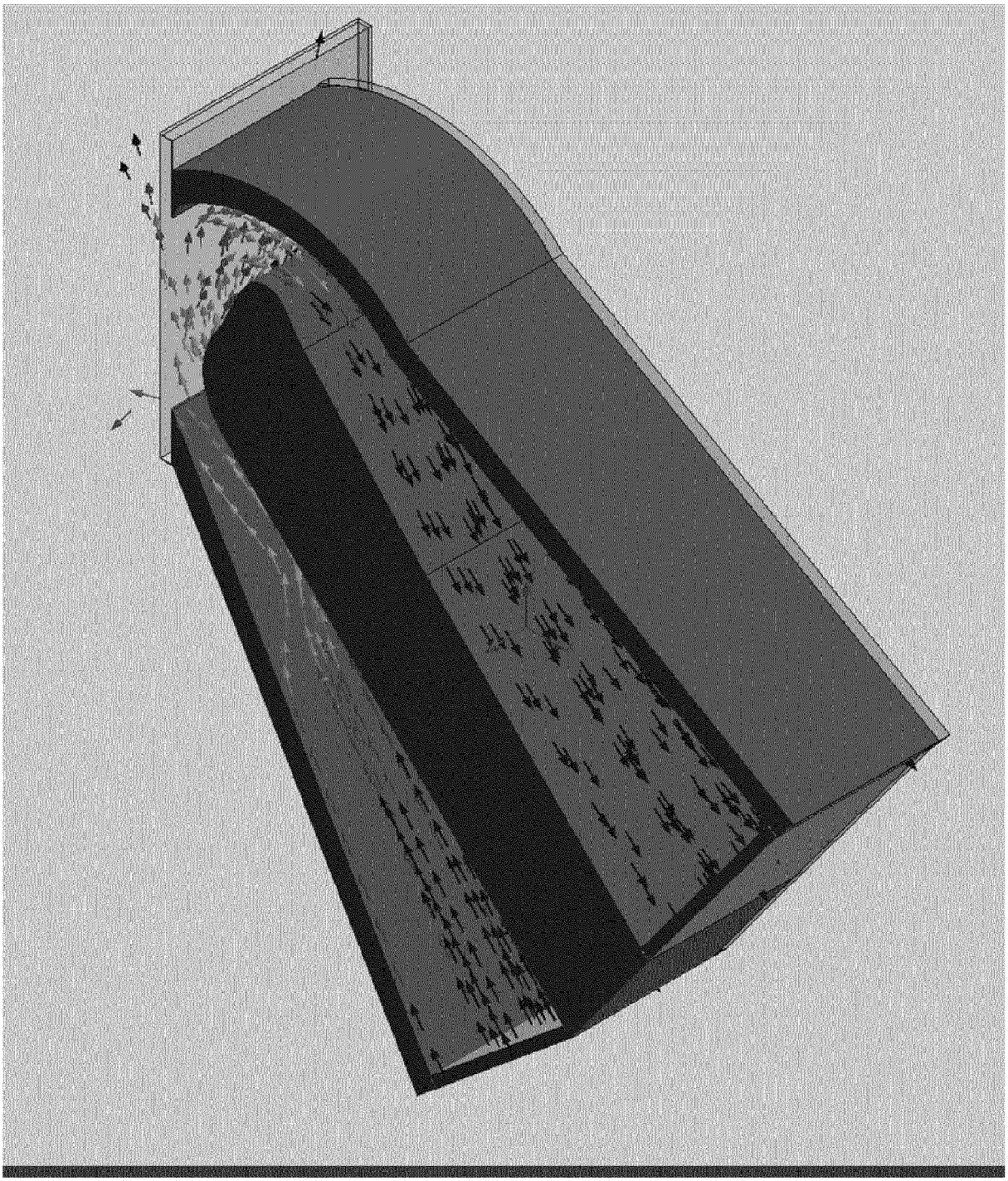

FIG. 2F

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 15 20 2839

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 501 675 A1 (ELECTROLUX NORTHERN [GB]) 2 September 1992 (1992-09-02) * column 2, lines 28-57 * * column 3, line 49 - column 4, line 2 *	1-13	INV. A47L5/14 A47L9/08
X	US 5 613 269 A (MIWA HIROHIDE [JP]) 25 March 1997 (1997-03-25) * figure 1E *	1-13	
X	US 2002/020296 A1 (ILLINGWORTH LEWIS [US]) 21 February 2002 (2002-02-21) * figures 4,5 *	1-13	
			TECHNICAL FIELDS SEARCHED (IPC)
			A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	31 May 2016	Eckenschwiller, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 20 2839

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

31-05-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0501675 A1	02-09-1992	AU 1122392 A	27-08-1992
		CA 2061676 A1	26-08-1992
		EP 0501675 A1	02-09-1992
		FI 920824 A	26-08-1992
		JP H06200507 A	19-07-1994
		NO 920732 A	26-08-1992
		NZ 241728 A	27-09-1994
		ZA 9201262 A	25-11-1992
US 5613269 A	25-03-1997	NONE	
US 2002020296 A1	21-02-2002	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82