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(54) Title: CONTAMINANT EJECTION VALVE

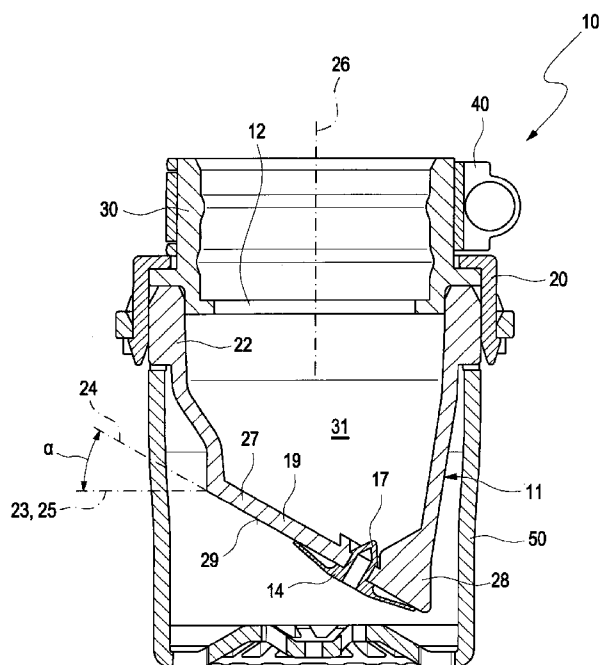


Fig. 1

(57) Abstract: The invention pertains in general to a valve for a filtering element and, more specifically, the invention is related to a valve used in a housing which holds a filtering element, such as an air filter for an internal combustion engine. According to one embodiment of the invention, the contaminant ejection valve (10) comprises a body (11) which comprises an upper part and a lower part, the upper part comprising an opening (12) which is intended to be installed in and in fluid communication with a housing of a filtering element, the lower part having an inclined plane which is integrated with the body and likewise comprising at least one opening (13) for the ejecting of contaminants; and diaphragm (14) mounted in said at least one opening (13), formed in the lower part of said body, to allow a controlled ejection of contaminants when there is a neutral and/or positive pressure inside the housing of the filtering element.



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CONTAMINANT EJECTION VALVE**Field of the invention**

5 [001] The invention pertains in general to a valve for a filtering element and, more specifically, the invention is related to a valve used in a housing which holds a filtering element, such as an air filter for an internal combustion engine, for the ejecting of
10 contaminants which build up in said housing.

Prior art

[002] Filters or filtering elements, which terms
15 are used indistinctly in the present document, are means commonly used to separate a fluid from undesirable elements, such as a contaminant, which may consist of a solid or a liquid.

20 [003] In the case of internal combustion engines, various filters are used to separate contaminants from the fluids normally used by such engines, such as oil filters, air filters, and fuel filters. In the specific case of an air filter, this is generally composed of a
25 filtering means, such as paper or fabric, arranged in a structure and enclosed in a housing which has the purpose of both protecting the filter and guaranteeing a controlled flow of air to ensure an adequate filtration.

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[004] In order to prevent the build-up of contaminants and, consequently, prevent the collapsing of the filtering element due to blockage of the air passage, the housings of air filters contain a valve,
35 generally located upstream from the entry to the

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filtering element, whose purpose is to eject contaminants which build up at the entry of the system composed of the air inlet, housing, and filtering element. This valve basically consists of a diaphragm
5 of truncated cone format, made of an elastomer material, which ejects the contaminants by gravity after a certain build-up has occurred.

[005] Despite being widely used in the housings of
10 air filters, such valves have certain drawbacks. First of all, since the ejection of the contaminants occurs solely by the action of gravity, a significant build-up of contaminants is necessary for the valve to be able to eject them and therefore these contaminants can be
15 recirculated to the filtering element before being adequately ejected. As a result, the service life of the filtering element ends up being reduced. This problem is particularly acute in locations where there is a major build-up of contaminants, especially those
20 whose particles have a significant size, such as mining areas and farming areas.

[006] In addition, such a valve is relatively efficient for contaminants of small to medium size,
25 while contaminants which have a relatively large particle size can get trapped inside the valve and not be adequately ejected.

[007] Therefore, a need exists for a contaminant
30 ejection valve for an air filter housing which provides a more efficient and reliable ejection of the contaminants building up in front of the air inlet of the filtering element.

35 **Description of the invention**

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[008] In order to overcome the above-mentioned drawbacks, the invention deals with a contaminant ejection valve, which valve is intended in particular to be installed in a housing of an air filter, which comprises:

- a body comprising an upper part and a lower part, the upper part comprising an opening which is intended to be installed in and in fluid communication with a housing of a filtering element, the lower part having an inclined plane which is integrated with the body and likewise comprising at least one opening for the ejecting of contaminants; and
- a diaphragm installed in said at least one opening, formed in the lower part of said body, to enable the controlled ejection of contaminants when there is a neutral and/or positive pressure inside the housing of the filtering element.

[009] According to additional and/or alternative embodiments of the invention, the following characteristics, alone or in any technically possible combinations, can also be present:

- said body comprises a truncated cone format;
- said valve additionally contains a sealing means;
- said valve additionally contains a means of pressing said body against said sealing means;

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- said body additionally contains means of fitting to said means of pressing;
- said valve additionally contains a receptacle to
5 hold the contaminants ejected;
- said receptacle is secured to said means of fitting of said body; and
- 10 - said inclined plane has an inclination in the range of 30° to 45° in relation to the horizontal plane.

Brief description of the drawings

15

[010] The invention shall now be described in regard to its particular embodiments, making reference to the enclosed figures. These figures are schematic, their dimensions or proportions might not correspond to
20 the reality, since they are meant only to illustrate an embodiment of the invention in didactic form, where:

25

[011] Figure 1 is a side sectional view of a valve according to one embodiment of the invention;

[012] Figure 2 is an exploded perspective view of the valve of Fig. 1;

[013] Figure 3 is a lower perspective view of the
30 installed valve of Fig. 1.

Description of embodiments of the invention

[014] The invention is now described with regard to
35 its particular embodiments, making reference to the

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enclosed figures. In the figures and in the following description, similar parts are labelled in the course of the specification and in the figures with the same reference numbers. The figures are not necessarily
5 drawn to scale. Certain characteristics might be shown with enlarged scale, or somewhat schematically, and certain details of conventional elements might not be shown, for better clarity and a more concise description. The invention is capable of different
10 embodiments. Specific embodiments are described in detail and shown in the figures, with the understanding that they should be viewed as an illustration of its principles, and are not intended to limit the invention to what is merely illustrated and described in the
15 present specification. It should be recognized that the various teachings of the embodiments discussed hereinafter can be employed separately or in any adequate combination to produce the same technical effects. Moreover, for purposes of description in the
20 present specification the terms "upper", "lower", "right", "left", "rear", "front", "vertical", "horizontal", and derivatives of same shall refer to the embodiment of the invention as oriented in Figure 1.

25

[015] With regard to figures 1 to 3, there is shown a valve (10) according to one embodiment of the invention. The valve comprises a body (11) which has an upper end (22) and a lower end (19), the upper end (22)
30 comprising a body opening (12) and is intended to be installed in a housing (not shown) of a filtering element, such as an air filter. Of course, the housing also has an opening to enable fluid communication with said body opening (12) of the valve body (11). The
35 valve body (11) encloses an interior (31) in which

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contaminants can be collected. Said contaminants coming from said filter element and entering the valve body (11) through the body opening (12).

5 [016] At the lower end (19), the body (11) likewise comprises at least one ejection opening (13), or more than one ejection opening (13, 13'), as shown in Fig. 2, intended to allow the ejecting of contaminants which have built up in the interior (31) of the valve body
10 (11), as will become more clear from the description given in the course of this specification. Preferably, according to Fig. 1 the valve body (11) has at the lower end (19) an inclination in the direction of the ejection opening (13, 13') to enable the build-up of
15 contaminants in the ejection opening (13, 13') itself. In other words, the inclination guides contaminants due to the effect of gravity downwards and towards the at least one ejection opening (13, 13'). An angle α of this inclination may vary according to the design
20 specifications, and is preferably in the range of 30° to 45° in relation to the horizontal plane (23). As depicted in Fig. 1 the lower end (19) lies within an inclination plane (24) having the inclination angle (α) with a reference plane (25). This reference plane (25)
25 extends perpendicular to a longitudinal center axis (26) of the valve body (11). In the drawing of Fig. 1 the reference plane (25) extends parallel to the horizontal plane (23). Due to this inclination the lower end (19) shows with respect to the upper end (22)
30 and the body opening (12) a proximal portion (27) and a distal portion (28). The proximal portion (27) of the lower end (19) is arranged closer to the upper end (22) than the distal portion (28) of the lower end (19). The at least one ejection opening (13, 13') is provided in
35 the distal portion (28) of the lower end (19).

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Furthermore, the at least one ejection opening (13, 13') is arranged at the lower end (19) excentric with respect of the longitudinal center axis (26) of the valve body (11). It is also clear, that the distal
5 protion (28) with the at least one ejection opening (13, 13') is at the lowest position of the valve body (11), when the valve (10) is in its mounted state, preferably when the valve (10) is mounted to said air filter.

10 [017] Associated with the ejection opening (13, 13') at the lower end (19) of the valve body (11) there is provided a diaphragm (14) to block the ejection opening (13, 13'), and thereby provide a means of blocking and controlled releasing of the contaminants
15 building up inside the body (11). The diaphragm (14) is preferably made of a resilient elastomer material, such rubber, and it can have a pin (17) which is mounted in another opening (18) provided in the body (11) proper, or a conventional and already known installation. Of
20 course, other means of fixation and other materials can be provided for the diaphragm (14), as long as it performs the function of a diaphragm, which is, within a definition of the mechanics, that of a valve which allows emptying in only one direction. The diaphragm
25 (14) is arranged at an outside (29) of the lower end (19), said outside (29) turned away from the interior (31), or from the upper end (22), or from the body opening (12), respectively.

30 [018] In order to allow the adequate installation of the body (11) in the housing of the filtering element, the latter may have means of fitting (15, 15') to a means of pressing (20), such as a ring, which can likewise comprise corresponding means of fitting (21,
35 21') to the means of fitting (15, 15') of the valve

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body (11), such as a "click" type lock, as shown in the figures. Obviously, other suitable fitting means can be provided. In addition, a sealing element (30) can be provided between the body (11) and the pressing means
5 (20), in order to guarantee tightness of the whole. Said sealing element (30) can be in the form of a ring of elastomer material, such as rubber or a suitable polymer.

10 [019] A fixation element (40), such as a clip or clamp, can be used to provide the fixation of the valve (10) to the housing of the air filter (not shown), together with the means of pressing and sealing, as can be seen in greater detail in the sectional view of Fig.
15 1.

[020] The valve (10) can additionally contain a receptacle (50) to hold the contaminants ejected and, at the same time, prevent solids from reaching the
20 valve (10) and damaging it. In this regard, the receptacle (50) can comprise one or more openings (51) to enable the exiting of contaminants and, if contaminants of larger size build up that cannot pass through this one or more openings (51), the receptacle
25 (50) can be designed to be removable. In this regard, the receptacle (50) can also be fixed to the valve body (11) via other fittings (16, 16') of the valve body (11) corresponding to fitting means (52, 52') provided at the receptacle (50). Such fitting means (52, 52')
30 can be, for example, "click" type locks, as are shown in the figures. Of course, other means of fitting and/or fixation can be provided besides those described here, such as clips, screws, etc, it being understood that the fitting means used are not relevant to the
35 scope of the invention.

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[021] The aforementioned means of fitting (15, 15') for attaching said means of pressing (20) to the valve body (11) form first fitting means (15, 15'), wherein said means of fitting (16, 16') for attaching said receptacle (50) to the valve body (11) form second fitting means (16, 16'). The first fitting means (15, 15') and the second fitting means (16, 16') both are arranged at the outside of the upper end (22) of the valve body (11). Furthermore, the first and second fitting means (15, 15'; 16, 16') are arranged alternately in the circumferential direction (32) at the upper end (22) of the valve body (11).

[022] In this preferred embodiment depicted in the figures the first fitting means (15, 15') form a first clip lock connection (33) having a first clipping direction (34) which extends parallel to the longitudinal center axis (26) and in which the means of pressing (20) and the valve body (11) are plugged together for activating the first clip lock connection (33). As it can be seen in Fig. 2 the first clipping direction (34) is directed from the upper end (22) to the lower end (19). The second fitting means (16, 16') form a second clip lock connection (35) having a second clipping direction (36) which extends parallel to the longitudinal center axis (26) and in which the receptacle (50) and the valve body (11) are plugged together for activating the second clip lock connection (35). As it can be seen in Fig. 2 the second clipping direction (36) is directed from the lower end (19) to the upper end (22). Therefore, first and second clipping directions (34, 36) are oriented in opposing directions and towards each other.

[023] The means of pressing (20) is also provided with protectors (37) protecting and securing the second fitting means (16, 16') against releasing the

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connection between receptacle (50) and valve body (11). In the depicted example the respective protector (37) axially overlaps the respective second fitting means (16, 16') in such a way, that the fitting means (52, 52') provided at the receptacle (50) cannot be reached and therefore cannot be manipulated for releasing the fitting means (52, 52') of the receptacle (50) from the fitting means (16, 16') provided at the valve body (11).

10

[024] In its operation, the valve (10) designed as mentioned is installed with its upper body opening (12) in fluid communication with an opening provided in the housing of a filtering element, such as an air filter of an internal combustion engine. As is already known to the skilled person, the air filter is in fluid communication with the intake manifold of an internal combustion engine and generally works in negative pressure, that is, a vacuum is created inside the filter for the intake of air, which moves through the filtering element before entering the intake manifold, and this air is mixed with the fuel to accomplish burning in the combustion chamber. The opening provided in the housing and where the valve (10) is installed is generally positioned upstream from the inlet of the air filter, so that the contaminants will build up and be directed to the valve (10) before entering the air filter, thereby preventing damage to the filtering element. Since the pressure inside the housing of the filtering element is generally negative, the diaphragm (14) will function as a means of closing the opening (13, 13') of the valve (10), allowing the contaminants to build up inside the valve body (11). However, due to the resonance existing in the intake manifold, as an effect of the change in rotation of the engine, for

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example, upon changing gears, it may happen that the pressure inside the intake manifold and, consequently, inside the housing of the filtering element is substantially neutral or slightly positive, so that the contaminants built up inside the valve (10) are released through the diaphragm (14), either by gravity or by the action of the positive pressure. In this way, the diaphragm (14) both performs a function of preventing the contaminants from returning to the housing of the filtering element and thereby preventing the contaminants from entering the air filter, and allows said contaminants to be ejected in controlled fashion and in frequent manner. In this regard, with respect to the valves of the prior art, the valve (10) herein proposed by the invention described here allows the contaminants to be ejected in more frequent and efficient manner, preventing the build-up of contaminants in the housing.

[025] It should be understood that, although the present invention has been described with regard to a specific embodiment, the skilled person will be able to make a series of changes of shape and/or structure of the valve (10), without thereby leaving the teachings presented herein. The enclosed claims should therefore be interpreted to cover each and every equivalent embodiment.

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Claims

1. Contaminant ejection valve (10), which valve (10) is intended in particular to be installed in a housing of an air filter, characterized in comprising:
- 5
- a valve body (11) comprising an upper end (22) and a lower end (19), the upper end (22) comprising a body opening (12) which is intended to be installed in and in fluid communication with a housing of a filtering element, the lower end (19) being inclined and comprising at least one ejection opening (13) for the ejecting of contaminants; and
 - 10
 - a diaphragm (14) installed at said at least one ejection opening (13), arranged at the lower end (19) of said valve body (11), to enable the controlled ejection of contaminants when there is a neutral and/or positive pressure inside the housing of the filtering element.
 - 15
 - 20
- 25 2. Valve according to Claim 1, characterized in that said valve body (11) comprises a truncated cone format.
- 30 3. Valve according to Claim 1 or 2, characterized in that said valve (10) additionally contains a sealing means (30).
4. Valve according to Claim 3, characterized in that said valve (10) additionally contains a means of

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pressing (20) said valve body (11) against said sealing means (30).

- 5 5. Valve according to Claim 4, characterized in that said valve body (11) additionally contains means of fitting (15, 15') for attaching the valve body (11) to said means of pressing (20).
- 10 6. Valve according to Claim 5, characterized in that said means of fitting (15, 15') are arranged at the upper end (22) of the valve body (11).
- 15 7. Valve according to any one of Claims 1 to 6, characterized in that said valve (10) additionally contains a receptacle (50) to hold the contaminants ejected.
- 20 8. Valve according to Claim 7, characterized in that said receptacle (50) comprises means of fitting (52, 52') intended to be fitted to means of fitting (16, 16') provided at said valve body (11).
- 25 9. Valve according to Claims 4 and 8, characterized in that said means of pressing (20) is provided with protectors (37) adapted for protecting the fitted state of said means of fitting (52, 52') of the receptacle (50) and said means of fitting (16, 16') of the valve body (11).
- 30 10. Valve according to Claim 8 or 9, characterized in that said means of fitting (16, 16') are arranged at the upper end (22) of the valve body (11).

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11. Valve according to Claims 6 and 10, characterized in that said means of fitting (15, 15') for attaching said means of pressing (20) to the valve body (11), and said means of fitting (16, 16') for attaching said receptacle (50) to the valve body (11) are arranged alternately in the circumferential direction (32) at the upper end (22) of the valve body (11).
12. Valve according to Claim 11, characterized in that said means of fitting (15, 15') for attaching said means of pressing (20) to the valve body (11) form a first clip lock connection having a first clipping direction, and said means of fitting (16, 16') for attaching said receptacle (50) to the valve body (11) form a second clip lock connection having a second clipping direction, wherein the first and second clipping directions are orientated towards each other.
13. Valve according to any one of Claims 1 to 12, characterized in that said inclined lower end (19) has an inclination angle (α) in the range of 30° to 45° in relation to the horizontal plane (23).
14. Valve according to any one of Claims 1 to 13, characterized in that the inclined lower end (19) has a proximal portion (27) and a distal portion (28), said proximal portion (27) being closer to the upper end (22) than the distal portion (28), wherein the at least one ejection opening (13, 13') is arranged in the distal portion (28).
15. Valve according to any one of Claims 1 to 14, characterized in that the at least one ejection

- 15 -

opening (13, 13') is arranged excentrically to a longitudinal center axis (26) of the valve body (11).

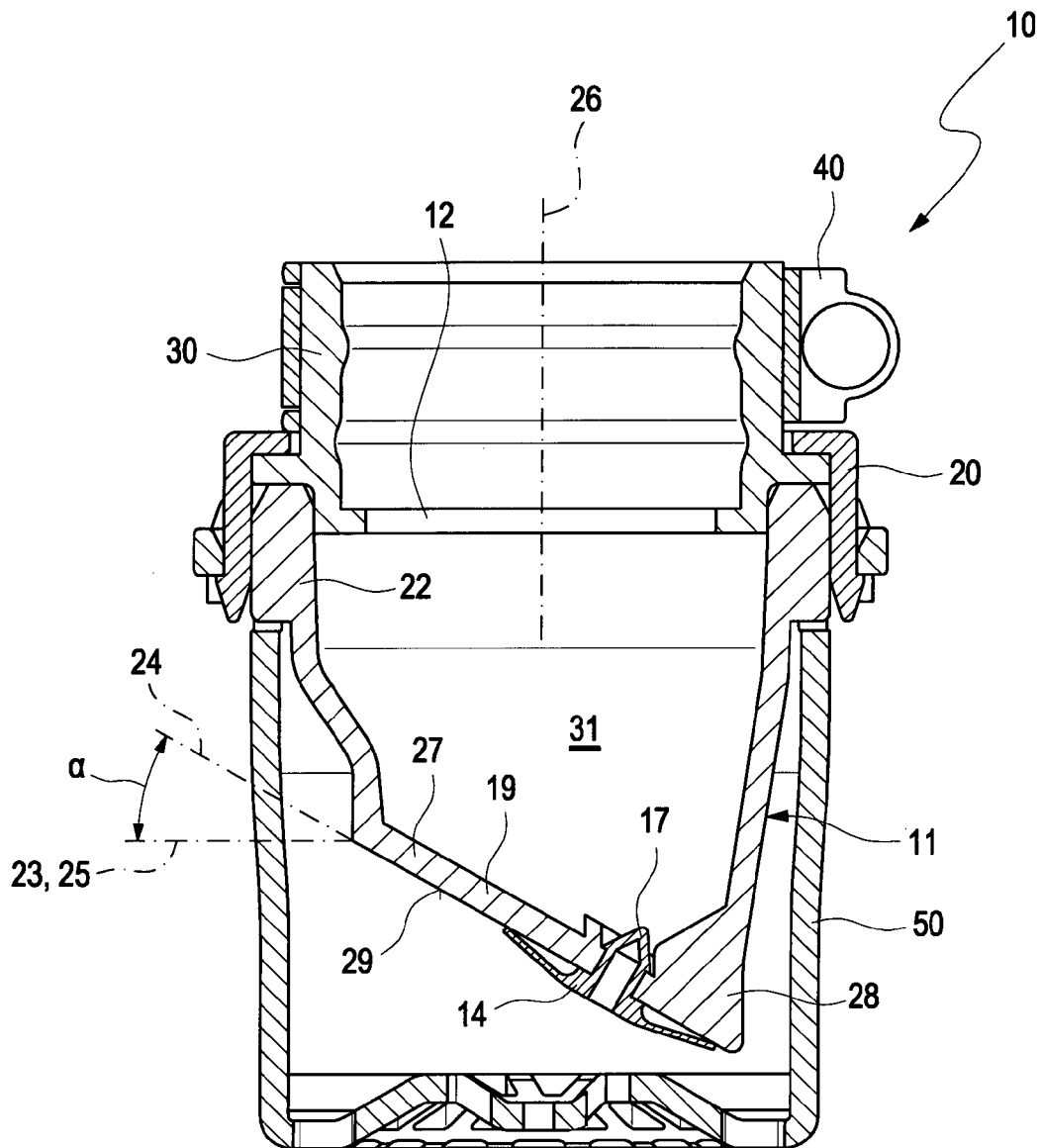


Fig. 1

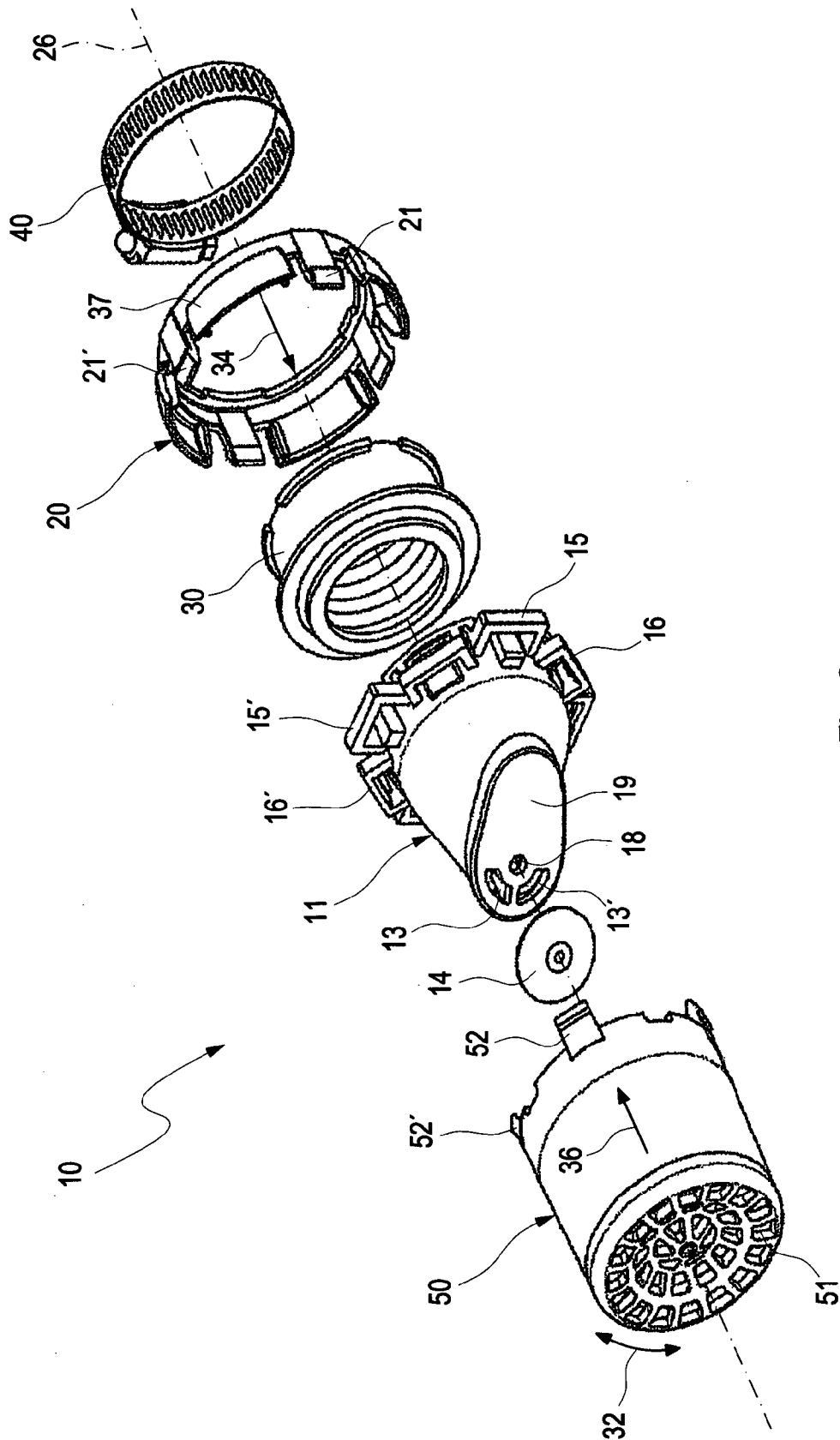


Fig. 2

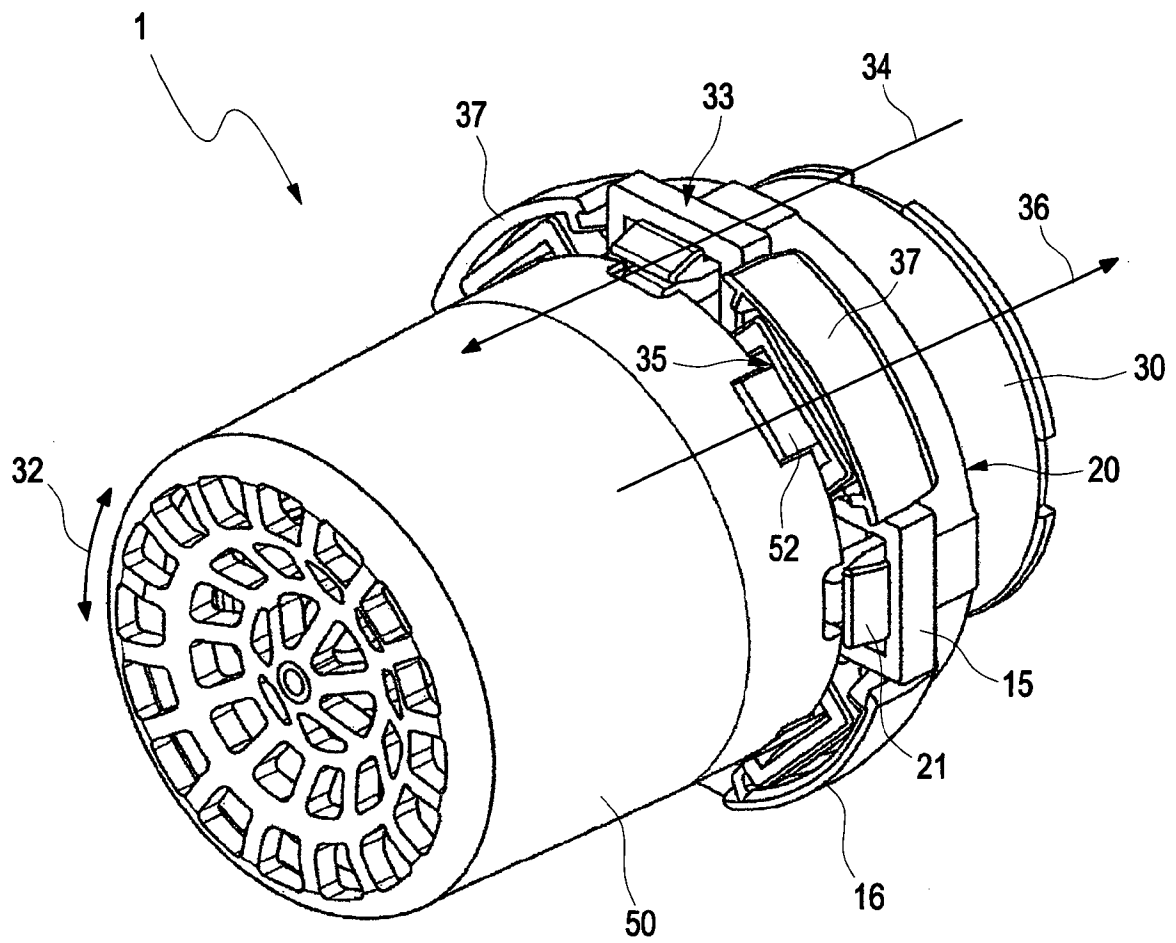


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2015/081030

A. CLASSIFICATION OF SUBJECT MATTER

INV. B01D46/48 F02M35/08
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B01D F02M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	column 3, line 34 - line 37; figures 1,2	2,7-13
Y	----- CN 103 590 935 A (SHANGHAI FLEETGUARD FILTER CO LTD) 19 February 2014 (2014-02-19) abstract; figures 5-7	7-13
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A	column 2, line 65 - column 4, line 45; figures 1, 4, 5	1,3-15
A	----- CN 103 775 261 A (ANHUI JIANGHUAI AUTOMOBILE CO) 7 May 2014 (2014-05-07) abstract; figures 4-6	1-15
	----- -/-	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2015/081030

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2015/081030

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