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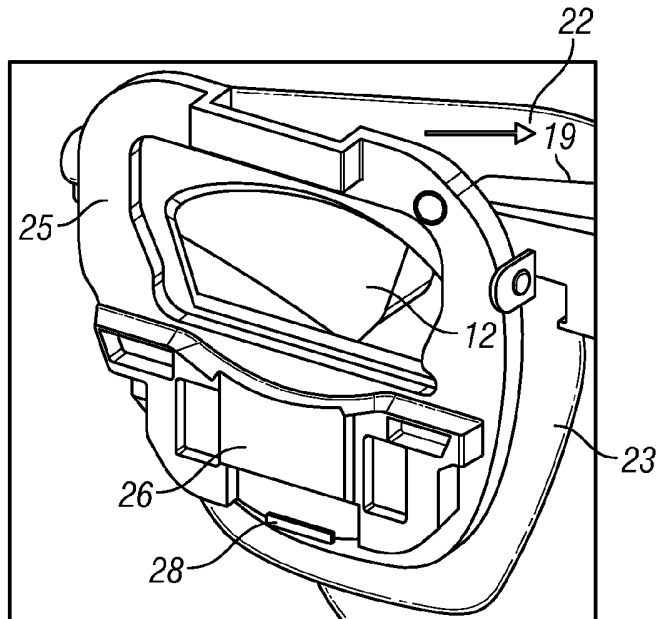
Remarks:

Claims 16 to 33 are deemed to be abandoned due to non-payment of the claims fees (Rule 45(3) EPC).

(54) **Hand-held vacuum cleaner**

(57) A hand-held vacuum cleaner comprises a housing having a flap 14 on its underside which forms the bottom wall of a dust collection chamber 15. In use, the flap 14 can be released to empty the chamber 15 of accumulated dirt and dust. The flap 14 acts as a chute to

help convey the dust to a suitable disposal receptacle. A filter 17 inside the collection chamber 15 separates dirt and dust from the induced airflow. The filter 17 can be cleaned occasionally by operating a motor 36 which causes rotation of the filter 17 relative to a brush 39 disposed in engagement with the exterior of the filter 17.



**FIG. 4**

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## Description

**[0001]** This invention relates to a hand-held vacuum cleaner.

**[0002]** Hand-held vacuum cleaners are well known small lightweight vacuum cleaners that are usually powered by a rechargeable battery. Typically such vacuum cleaners comprise a body, incorporating a handle and enclosing a battery and motor-fan unit, a dust collection chamber disposed in front of the body and having a suction inlet at its distal end for dirty air. Conventionally, a hollow filter projects forwardly from the body into the collection chamber. Dust-laden air entering the inlet is drawn radially inwardly through the filter, with the cleaned air being drawn out of the hollow interior of the filter by the fan. Coarse dirt separated from the airflow by the filter is retained upstream of the filter in the collection chamber, which must be emptied periodically.

**[0003]** Conventionally, the entire forward end portion of the housing of the cleaner forms the walls of the collection chamber, the portion being detachable from the rest of the cleaner to enable the accumulated dirt to be carried to a suitable waste receptacle where it can be tipped out for disposal. The forward end portion of the housing of the cleaner must then be replaced on the cleaner. A hand-held cleaner of this general form is disclosed in EP1631181.

**[0004]** A disadvantage of this arrangement is that it can be difficult, time consuming and messy to remove and re-fit the forward end portion of the housing.

**[0005]** EP0914795 discloses a hand-held vacuum cleaner which attempts to overcome this problem by drawing the dirt-laden air entering the cleaner into the interior of a forwardly facing filter receptacle disposed upstream of the body. The filter receptacle is enclosed in a central portion of the housing of the cleaner, the housing having a forward end portion which is pivoted along its lower rearmost edge to the lower front edge of the central portion. The upper side wall of the central portion of the housing is integrally formed with the forward end portion.

**[0006]** In order to empty the filter receptacle, a catch holding the forward end portion in position can be released to allow the forward end portion to pivot downwardly through approximately 180 degrees. In this position, the upper side wall of the housing forms a chute onto which the accumulated dirt can be tipped to facilitate disposal into a suitable waste receptacle.

**[0007]** A disadvantage of this arrangement in practice is that the cleaner almost has to be tilted to point vertically downwards before any accumulated dirt falls from the filter receptacle. The configuration of the filter receptacle also means that a user will have to use their hand or an object to fully remove all of the dirt.

**[0008]** We have now devised a hand-held vacuum cleaner which alleviates the above-mentioned problems.

**[0009]** In accordance with the present invention, as seen from as first aspect, there is provided a hand-held

vacuum cleaner comprising a generally elongate body having a handle at its rearward end and a dirty air inlet at its forward end, and a housing enclosing a dirt collection chamber disposed rearwardly of the inlet and forwardly of a motor and fan unit arranged to draw air from the chamber through a filter which projects into the chamber, wherein the housing comprises a releasable bottom portion which forms the bottom wall of the collection chamber and which is pivoted at its rearward end to the body portion.

**[0010]** In use dirt is collected in the collection chamber where it is retained in-situ by the bottom portion of the housing. In order to empty the cleaner, the bottom portion of the housing can simply be released to allow the dirt or dust to fall directly out of the chamber under gravity and without having to tilt the cleaner from a generally horizontal position.

**[0011]** Another disadvantage of the cleaner disclosed in EP0914795 is that the chute becomes redundant when the cleaner is tilted vertically during emptying and the dirt simply falls in an uncontrolled manner towards the waste receptacle. In the present invention, the angle through which the bottom portion of the housing can pivot when it is released is preferably limited, preferably to an angle in the range of preferably 10 to 60 degrees and most preferably 22 degrees. When released, the bottom portion of the housing forms a chute which guides the accumulated dirt retained thereby towards a suitable waste receptacle.

**[0012]** Preferably a damper is provided for controlling the speed at which the bottom portion of the housing moves from the closed to open positions. The bottom portion of the housing may be biased into the open position.

**[0013]** Preferably the bottom portion of the housing comprises upstanding side walls which define at least portions of respective opposite side walls of the dirt collection chamber. This arrangement has the advantage of exposing more of the chamber when the portion is opened and, when open, the side walls further serve to laterally constrain the dirt on the chute.

**[0014]** In order facilitate access to the filter e.g. for cleaning, the bottom portion of the housing is preferably pivotable beyond the above-mentioned angle, preferably to an angle of between 60 and 90 degrees. Preferably means are provided for arresting the bottom portion of the housing at the first-mentioned angle.

**[0015]** Preferably the bottom portion of the housing is retained in its closed position during use by a catch having an actuator disposed adjacent the handle. The location of the actuator adjacent the handle facilitates single-handed emptying of the cleaner.

**[0016]** Preferably the catch comprises a catch member arranged to engage the forward end of the bottom portion of the housing.

**[0017]** Preferably the catch member is connected to the actuator by a cable.

**[0018]** Preferably the dirty air inlet comprises an open-

ing formed in the body portion of the cleaner at the forward end thereof.

**[0019]** Preferably the opening is formed in a front wall of the chamber.

**[0020]** Preferably the catch member is mounted on the front wall on a lower edge thereof.

**[0021]** Preferably the catch member is connected to the cable via a linkage which causes rearward movement of the cable to operate the catch member to release the bottom portion of the housing when the actuator is actuated.

**[0022]** Preferably said bottom portion of the housing extends forwardly from the motor and fan unit and passes under the filter, preferably terminating at the front end of the collection chamber.

**[0023]** The filter of a hand-held vacuum cleaner is generally of the re-usable type. Whilst this saves the cost and effort of replacing the filter, a disadvantage of such re-usable filters is that they can become clogged with dirt and dust over time with the result that suction force becomes reduced. In order to overcome this problem, the filter preferably comprises an axis and an external porous surface which is a solid of rotation about said axis, a cleaning member extending axially of said surface and in contact therewith, means being provided to cause relative rotation of the filter and cleaning member about said axis. In this manner periodic cleaning of the upstream surface of the filter can be effected.

**[0024]** Preferably said means for causing relative rotation comprises an actuator, which is preferably disposed adjacent the handle. The location of the actuator adjacent the handle facilitates single-handed cleaning of the filter.

**[0025]** Preferably said axis extends generally longitudinally of the housing.

**[0026]** Preferably the filter is rotated relative to the cleaning member.

**[0027]** Preferably the filter projects forwardly into the chamber from a portion of the housing which houses the motor and fan unit.

**[0028]** Preferably the filter is rotatably mounted to said portion of the housing which houses the motor and fan unit. Preferably said means for causing relative rotation of the filter and cleaning member comprises a motor which engages the rearward end of the filter.

**[0029]** Preferably the rearward end of the filter comprises a set of circumferentially-extending teeth which are engaged by a toothed wheel of the motor.

**[0030]** Also in accordance with the present invention, as seen from a first aspect, there is provided a vacuum cleaner having a filter for separating dirt and dust from an airflow induced through the cleaner, the filter having an axis and an external porous surface which is a solid of rotation about said axis, wherein a cleaning member extends axially of said surface and in contact therewith, means being provided to cause relative rotation of the filter and cleaning member about said axis.

**[0031]** Preferably said means for causing relative ro-

tation comprises an actuator, which is preferably disposed adjacent a handle of the cleaner.

**[0032]** Preferably said axis extends generally longitudinally of a housing of the cleaner.

**[0033]** Preferably the filter is rotated relative to the cleaning member.

**[0034]** Preferably the filter projects forwardly into a dirt collection chamber of the cleaner from a portion of the housing which houses a motor and fan unit of the cleaner.

**[0035]** Preferably the filter is rotatably mounted to said portion of the housing which houses the motor and fan unit. Preferably said means for causing relative rotation of the filter and cleaning member comprises a motor which engages the rearward end of the filter.

**[0036]** Preferably the rearward end of the filter comprises a set of circumferentially-extending teeth which are engaged by a toothed wheel of the motor.

**[0037]** Preferably the cleaning member comprises a brush having bristles which extend radially inwardly against the filter.

**[0038]** In one embodiment, the cleaning member is mounted to a portion of the housing which houses a motor and fan unit of the cleaner.

**[0039]** In an alternative embodiment, the cleaning member is disposed inside a pre-filter which surrounds the aforementioned filter and which acts to filter coarse dirt.

**[0040]** An embodiment of this invention will now be described by way of an example only and with reference to the accompanying drawings in which:

Figure 1 is a side view of an embodiment of hand-held vacuum cleaner in accordance with this invention;

Figure 2 is a bottom view of the hand-held vacuum cleaner of Figure 1;

Figure 3 is a side view of the body of the hand-held vacuum cleaner of Figure 1, with some parts shown removed;

Figure 4 is a front view of the body of Figure 3; and

Figure 5 is an exploded view illustrating a filter and cleaning assembly of the hand-held vacuum cleaner of Figure 1.

**[0041]** Referring to Figures 1 to 4 of the accompanying drawings, there is shown a hand-held vacuum cleaner comprising a generally elongate body portion 10 having a handle 11 at its rearward end and a dirty air inlet 12 at its forward end. An external aesthetically-shaped housing 13 of the cleaner encloses a dirt collection chamber 15 disposed rearwardly of the inlet 12 and forwardly of a motor and fan unit 16 arranged to draw air from the chamber 15 through a filter 17 which projects into the chamber 15.

**[0042]** The cleaner further comprises a chute portion 14 formed by a flap region of the housing 13 which forms the bottom wall of the collection chamber 15. The chute 14 is u-section in shape and is pivoted at its rearward end to the body 10 of the cleaner by pivot members 18. A seal 20 is provided on the body 10 for sealing against the edges of the chute 14 when the latter is closed.

**[0043]** The motor and fan unit 16 is arranged in the body 10 at the rearward end thereof adjacent the handle 11. The motor and fan unit 16 is separated from the dirt collection chamber 15 by an internal dividing wall 21 from which the filter 17 projects forwardly into the chamber 15.

**[0044]** The body 10 further comprises a chassis 22 which projects forwardly from the internal dividing wall 21 and passes over the filter 17. The collection chamber 15 comprises a front wall 23 which depends from the forward end of the chassis 22. A portion of the inlet 12 extends through the front wall 23.

**[0045]** An actuator lever 24 projects upwardly into the aperture of the handle 11 from the body 10. The lever 24 is connected to the rearward end of an elongate flexible cable 19 which extends forwardly along the chassis 22. The forward end of the cable 19 is connected to the upper end of a first arm 25, which is pivotally mounted intermediate its opposite ends to the front face of the front wall 23. The lower end of the arm 25 is engaged with the upper end of a second arm 26, which also is pivotally mounted intermediate its opposite ends to the front face of the front wall 23. A spring (not shown) is mounted behind the lower end of the second arm 26 to bias it forwardly. The lower end of the second arm 26 is provided with a forwardly-projecting finger 28.

**[0046]** When the chute 14 is closed the finger 28 engages with a forwardly projecting tab 27 on the front edge of the chute 14 to hold the latter in its closed position. In order to open the chute 14, the lever 24 is pulled upwardly using a finger of the hand which holds the handle 11: this pulls the cable 19 rearwardly, which in turn pulls the upper end of the first arm 25 rearwardly. The lower end of the first arm 25 thus moves forwardly and pushes the upper end of the second arm 26 in the same direction. The lower end of the second arm 26 then moves rearwardly against the spring bias and pulls the finger 28 out of engagement with the tab 27. The chute 14 then pivots downwardly under the influence of gravity to its open position (shown in outline in Figure 1). Alternatively means may be provided for biasing the chute 14 into the open position. A damper may be provided for controlling the speed at which the chute 14 opens.

**[0047]** In use, when the cleaner is energised, the motor and fan unit 16 draws air through the inlet 12 into the collection chamber 15, where any dirt or dust entrained in the airflow is separated by the filter 17. The separated dirt and dust is collected in the collection chamber 15, where it is retained by chute 14 which defines the bottom wall of the chamber. In order to empty the cleaner, the chute 14 can simply be released to allow the accumulated dirt and dust to fall out of the chamber 15 against the

chute. The angle through which the chute 14 can pivot to its open position is limited to 22 degrees and thus the chute 14 acts to guide the accumulated dirt and dust retained thereby towards a suitable waste receptacle. The side walls of the chute confine the dirt and dust against falling sideways.

**[0048]** In order facilitate access to the filter 17 e.g. for cleaning, the chute 15 is pivotable beyond the open position to an angle of 63 degrees. A detent or other stop member (not shown) is provided on or adjacent the pivots 18 to normally arrest the chute 14 at the open angle of 22 degrees: the user then has to grasp the chute 15 to move it to the greater angle for cleaning of the filter 17.

**[0049]** Referring to Figure 5 of the accompanying drawings, the filter 17 comprises a generally frusto-conical side wall which is formed a porous filter material 31 supported by a frame 32 having a solid end wall 33 which forms the outer end wall of the filter 17. The interior of the filter 17 is hollow and the filter 17 comprises an open rear end which engages an apertured disc 34 that is rotatably mounted against the front face of the internal dividing wall 21. An externally toothed annular wheel 35 is rotatably mounted against the rear face of the internal dividing wall 21, the wheel 35 being connected to the disc 34 through an enlarged opening in the wall 21. A motor 36 has a toothed rotary shaft in engagement with the toothed wheel 35.

**[0050]** The filter 17 is rotatably held in-situ against the front face of the internal dividing wall 21 by an annular collar 37, which is releasably held in non-rotational engagement with the front face of the internal dividing wall 21. An elongate arm 38 extends forwardly from the collar 37 and axially of the filter 17 at a position disposed radially outwardly of the filter 17. An elongate brush 39 is mounted longitudinally of the arm 38 and comprises bristles which extend radially inwardly and which engage the external surface of the filter 17.

**[0051]** When energised, the motor and fan unit 16 (mounted behind the wheel 35) draws filtered air out of the interior of the filter through the apertured disc 34. The cleaned air is subsequently exhausted.

**[0052]** The filter 17 is of the re-usable type and, in order to avoid the risk of clogging, the user can periodically clean the filter 17 by pressing an actuator button 30 mounted adjacent the handle 11: this energises the motor 36 to rotate the wheel 35, which then causes rotation of the disc 34 and hence rotation of the filter 17 about its axis. The brush 39 is statically mounted relative to the filter 17 and thus brushes external surface of the rotating filter 17 to effect cleaning. The dislodged dirt and dust falls into the collection chamber 15 for subsequent disposal.

**[0053]** The first aspect of the present invention provides a hand-held vacuum cleaner which comprises a housing having a flap 14 on its underside which forms the bottom wall of a dust collection chamber 15. In use, the flap 14 can be released to empty the chamber 15 of accumulated dirt and dust. The flap 14 acts as a chute

to help convey the dust to a suitable disposal receptacle.

**[0054]** The second aspect of the present invention provides a filter 17 inside the collection chamber 15, to separate dirt and dust from the induced airflow. The filter 17 can be cleaned occasionally by operating a motor 36 which causes rotation of the filter 17 relative to a brush 39 disposed in engagement with the exterior of the filter 17.

### Claims

1. A hand-held vacuum cleaner comprising a generally elongate body having a handle at its rearward end and a dirty air inlet at its forward end; and a housing enclosing a dirt collection chamber disposed rearwardly of the inlet and forwardly of a motor and fan unit arranged to draw air from the chamber through a filter which projects into the chamber, wherein the housing comprises a releasable bottom portion which forms the bottom wall of the collection chamber and which is pivoted at its rearward end to the body portion. 5
2. A hand-held vacuum cleaner as claimed in claim 1, in which the angle through which the bottom portion of the housing can pivot is limited. 10
3. A hand-held vacuum cleaner as claimed in claim 2, in which the angle through which the bottom portion of the housing can pivot is limited to an angle in the range of 10 to 60 degrees. 15
4. A hand-held vacuum cleaner as claimed in any preceding claim, in which the bottom portion of the housing comprises upstanding side walls. 20
5. A hand-held vacuum cleaner as claimed in claim 4, in which the upstanding side walls define portions of respective opposite side walls of the collection chamber. 25
6. A hand-held vacuum cleaner as claimed in any preceding claim, in which the bottom portion of the housing is retained in its closed position during use by a catch having an actuator disposed adjacent the handle. 30
7. A hand-held vacuum cleaner as claimed in any claim 6, in which the catch comprises a catch member arranged to engage the forward end of the bottom portion of the housing. 35
8. A hand-held vacuum cleaner as claimed in any claim 7, in which the catch member is connected to the actuator by a cable. 40
9. A hand-held vacuum cleaner as claimed in claim 7 or claim 8, in which the dirty air inlet comprises an opening formed in a front wall of the chamber, the catch member being mounted on the front wall. 45
10. A hand-held vacuum cleaner as claimed in claim 8, in which the catch member is connected to the cable via a linkage which causes rearward movement of the cable to operate the catch member to release the bottom portion of the housing when the actuator is actuated. 50
11. A hand-held vacuum cleaner as claimed in any preceding claim, in which said bottom portion of the housing extends forwardly from the motor and fan unit and passes under the filter. 55
12. A hand-held vacuum cleaner as claimed in claim 11, in which said bottom portion of the housing terminates at the front end of the collection chamber.
13. A hand-held vacuum cleaner as claimed in any preceding claim, in which the filter comprises an axis and an external porous surface which is a solid of rotation about said axis, a cleaning member extending axially of said surface and in contact therewith, means being provided to cause relative rotation of the filter and cleaning member about said axis.
14. A hand-held vacuum cleaner as claimed in claim 13, in which said means for causing relative rotation comprises an actuator.
15. A hand-held vacuum cleaner as claimed in claims 13 or 14, in which said filter axis extends generally longitudinally of the body.
16. A hand-held vacuum cleaner as claimed in any of claims 13 to 15, in which the filter is rotated relative to the cleaning member.
17. A hand-held vacuum cleaner as claimed in any of claims 13 to 16, in which the filter projects forwardly into the chamber from a portion of the body which houses the motor and fan unit.
18. A hand-held vacuum cleaner as claimed in claim 17, in which the filter is rotatably mounted to said portion of the body which houses the motor and fan unit.
19. A hand-held vacuum cleaner as claimed in any of claims 13 to 18, in which said means for causing relative rotation of the filter and cleaning member comprises a motor which engages the rearward end of the filter.
20. A hand-held vacuum cleaner as claimed in claim 19, in which the rearward end of the filter comprises a set of circumferentially-extending teeth which are

engaged by a toothed wheel of the motor.

- 21.** A hand-held vacuum cleaner substantially as herein described with reference to the accompanying drawings. 5
- 22.** A vacuum cleaner having a filter for separating dirt and dust from an airflow induced through the cleaner, the filter having an axis and an external porous surface which is a solid of rotation about said axis, wherein a cleaning member extends axially of said surface and in contact therewith, means being provided to cause relative rotation of the filter and cleaning member about said axis. 10  
15
- 23.** A vacuum cleaner as claimed in claim 22, in which said means for causing relative rotation comprises an actuator. 15
- 24.** A vacuum cleaner as claimed in claim 23, in which said actuator is disposed adjacent a handle of the cleaner. 20
- 25.** A vacuum cleaner as claimed in any of claims 22 to 24, in which said filter axis extends generally longitudinally of a housing of the cleaner. 25
- 26.** A vacuum cleaner as claimed in any of claims 22 to 25, in which the filter is rotated relative to the cleaning member. 30
- 27.** A vacuum cleaner as claimed in any of claims 22 to 26, in which the filter projects forwardly into a dirt collection chamber of the cleaner from a portion of the housing which houses a motor and fan unit of the cleaner. 35
- 28.** A vacuum cleaner as claimed in claim 27, in which the filter is rotatably mounted to said portion of the housing which houses the motor and fan unit. 40
- 29.** A vacuum cleaner as claimed in any of claims 22 to 28, in which said means for causing relative rotation of the filter and cleaning member comprises a motor which engages the rearward end of the filter. 45
- 30.** A vacuum cleaner as claimed in claim 29, in which the rearward end of the filter comprises a set of circumferentially-extending teeth which are engaged by a toothed shaft of the motor. 50
- 31.** A vacuum cleaner as claimed in any of claims 22 to 30, in which the cleaning member comprises a brush having bristles which extend radially inwardly against the filter. 55
- 32.** A vacuum cleaner as claimed in any of claims 22 to 31, in which the cleaning member is mounted to a

portion of the housing which houses a motor and fan unit of the cleaner.

- 33.** A vacuum cleaner as claimed in any of claims 22 to 30, in which the cleaning member is disposed inside a pre-filter which surrounds said filter.

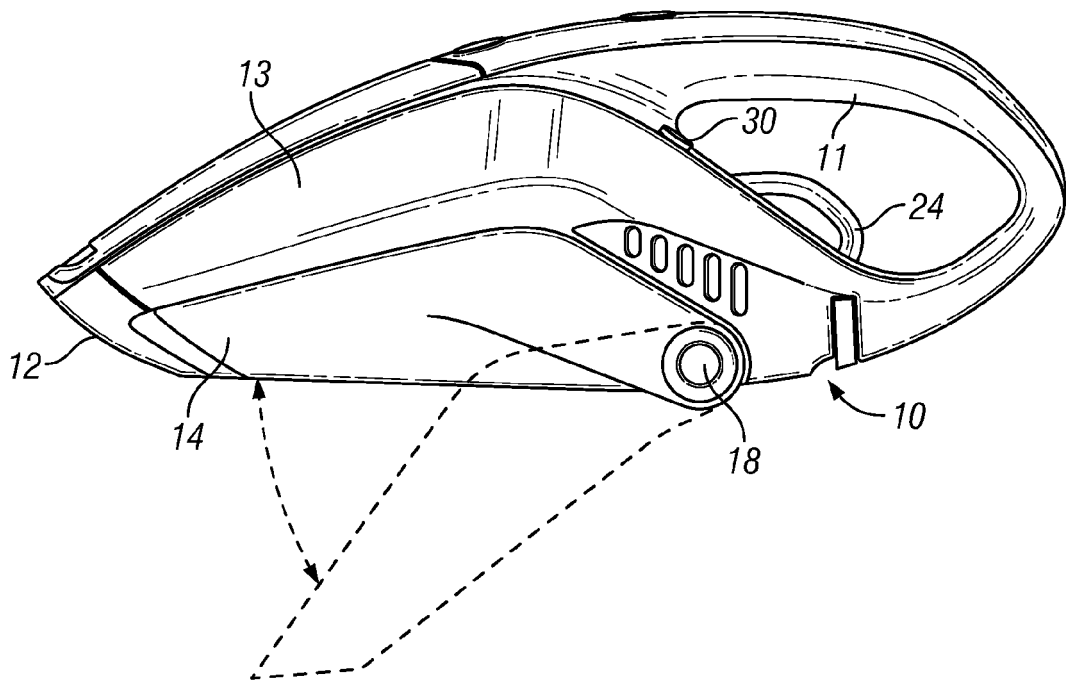


FIG. 1

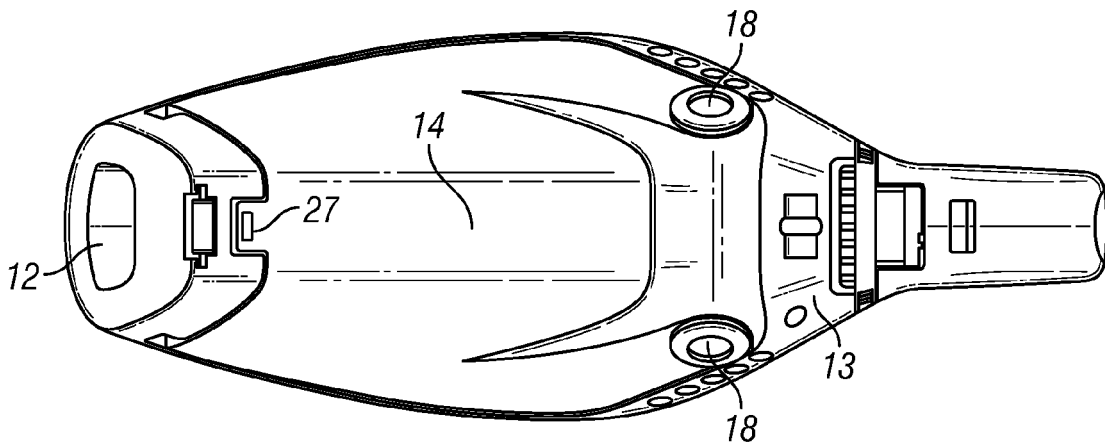
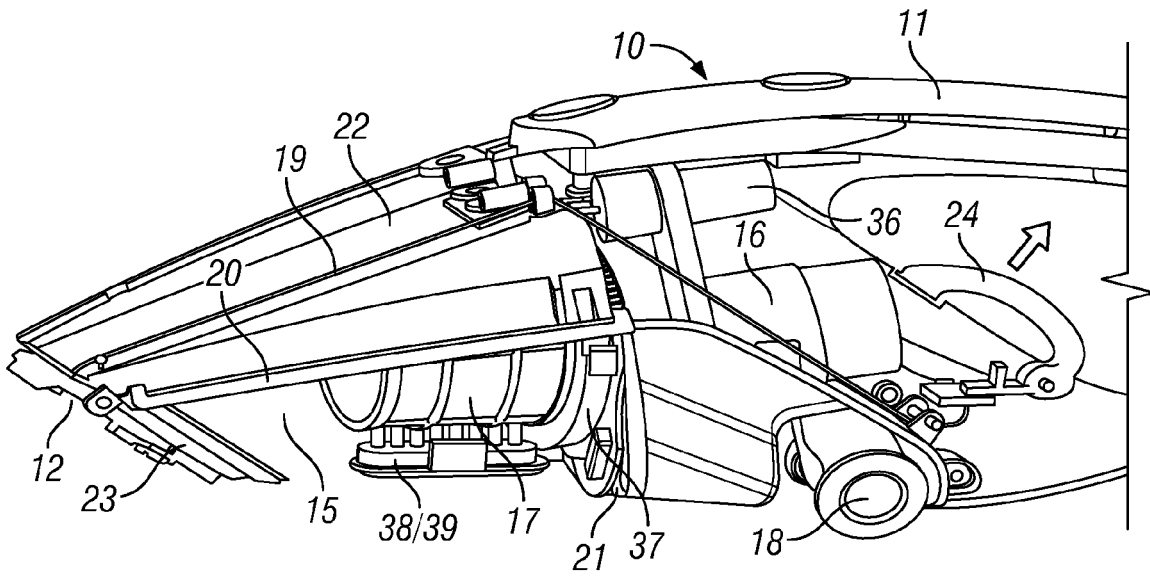
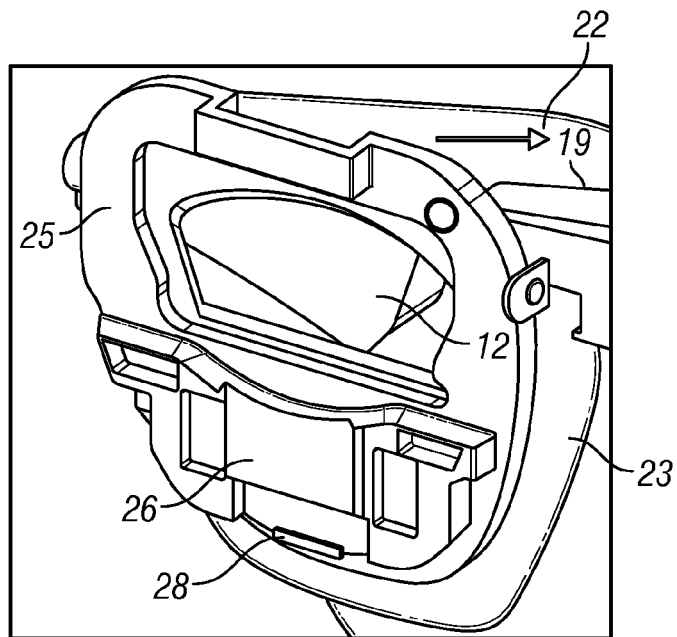


FIG. 2



**FIG. 3**



**FIG. 4**



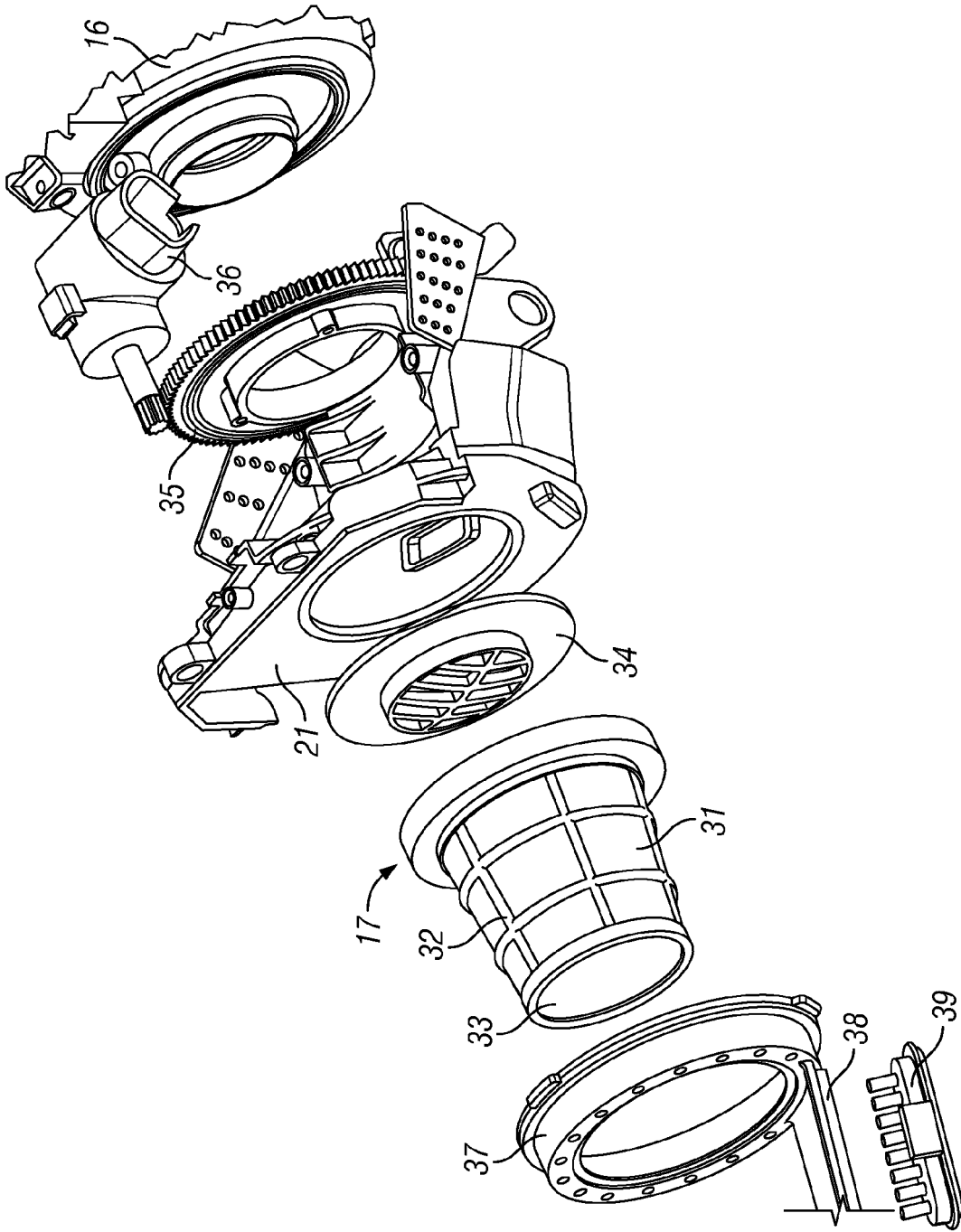


FIG. 5

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

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