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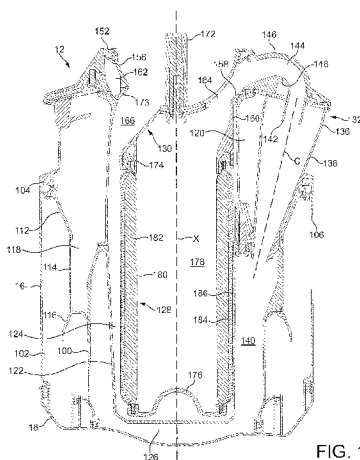


FIG. 14(b)

(57) Abstract: A cleaning appliance comprises separating apparatus (12) for separating dirt from a dirt-bearing air flow and a main body (20) housing means for drawing the air flow through the separating apparatus. The separating apparatus comprises cyclonic separating unit (102, 132) comprising at least one cyclone, a filter unit (128) located downstream of the cyclonic separating unit, and a duct assembly (130) mounted within the cyclonic separating unit. The duct assembly comprises a body (154) comprising at least one inlet duct (164) for conveying the air flow from the cyclonic separating unit towards the filter unit and at least one outlet duct (166) for conveying the air flow from the filter unit towards the main body.



A Cleaning Appliance

The present invention relates to a cleaning appliance.

5 Cleaning appliances such as vacuum cleaners are well known. The majority of vacuum cleaners are either of the “upright” type or of the “cylinder” type (called canister or barrel machines in some countries). Cylinder vacuum cleaners generally comprise a main body which contains a motor-driven fan unit for drawing a dirt-bearing fluid flow into the vacuum cleaner, and separating apparatus, such as a cyclonic separator or a bag,
10 for separating dirt and dust from the fluid flow. The dirt-bearing fluid flow is introduced to the main body through a suction hose and wand assembly which is connected to the main body. The main body of the vacuum cleaner is dragged along by the hose as a user moves around a room. A cleaning tool is attached to the remote end of the hose and wand assembly. The main body of the cleaner typically comprises a pair of wheels rotatably mounted on the main body which rotate as the vacuum cleaner
15 is dragged over the floor surface.

Irrespective of the type of separating apparatus used, there may be a risk of a small amount of dirt and dust passing through the separating apparatus and being carried to
20 the motor-driven fan unit. It is undesirable for dirt and dust particles to pass through the fan of a motor and fan unit because the fan may become damaged or may operate less efficiently. In order to reduce this problem, some vacuum cleaners include a fine filter in an air flow path between the separating apparatus and the airflow generator. This filter is commonly known as a pre-motor filter and is used to extract any fine dirt and
25 dust particles remaining in the air flow after it has passed through the separating apparatus.

It is also known to provide a filter in an air flow path downstream of the air flow generator in order to extract any remaining dirt and dust particles prior to the air flow
30 exiting the appliance. This type of filter is known as a post-motor filter. The post-motor filter also captures particles produced by the brushes of the motor.

Filter assemblies for removing dust or debris from the air stream of a vacuum cleaner or other dust retaining appliances are therefore common. Such filter assemblies generally comprise at least one filter located in a filter housing.

5 During normal operation of a vacuum cleaner, dirt and dust may be deposited on a filter and, after a period of time, it could become blocked. Blockages reduce the efficiency at which a vacuum cleaner operates. Therefore, a typical filter will occasionally need to be replaced or cleaned in order to maintain the performance of the vacuum cleaner. In order to allow cleaning or replacement of the filter, it is common for such filters to be
10 removable from a vacuum cleaner. Re-useable filters can reduce filter maintenance costs. US 4,902,306, for example, discloses an air filter assembly including electrostatic filter elements and a foam filter that can be cleaned by washing.

Another type of known filter assembly is that used on the Dyson range of vacuum
15 cleaners, for example, on model numbers DC04, DC07, DC12, DC14 and DC15. The principle by which filter assemblies of this type operate is described in GB 2349105 and EP 1239760B.

In a first aspect the present invention provides a cleaning appliance comprising
20 separating apparatus for separating dirt from a dirt-bearing air flow and a main body housing means for drawing the air flow through the separating apparatus, the separating apparatus comprising a cyclonic separating unit, a filter unit located downstream of the separating unit, and a duct assembly located within the separating unit, the duct assembly comprising a body, the body comprising at least one inlet duct for conveying
25 the air flow from the cyclonic separating unit towards the filter unit and at least one outlet duct for conveying the air flow from the filter unit towards the main body.

The arrangement of the duct assembly within the cyclonic separating unit can channel the air flow towards the filter unit efficiently and reduce the flow path and route over
30 which the fluid travels. This can lead to a reduction in noise generation and losses in the system. Preferably, the air flow exiting the cyclonic separating unit enters a manifold

part of the cyclone arrangement and a series of manifold fingers channel the air flow towards the filter unit. The manifold part preferably comprises a continuous outer surface and the manifold fingers are preferably arranged at an angle to the filter unit to direct the air flow downwardly and at an angle matched to an inlet of the filter unit. The manifold fingers may comprise a separate portion of the separating apparatus or they may be moulded within the separating unit.

The arrangement provides for a particularly compact separation system and cleaning appliance configuration, allowing smaller, more compact appliances to be manufactured.

Preferably, the said at least one inlet duct and said at least one outlet duct are arranged to convey the air flow in substantially opposite directions. The route taken by the air flow is a feature of the orientation and provision of the ducts in the body of the duct assembly. The arrangement allows air flow from the separation unit to be directed towards the filter unit, and cleaner air to be directed away from the filter unit.

In the preferred embodiment the duct assembly comprises an annular fluid inlet for receiving the air flow from the cyclonic separating unit, and then at least one inlet duct arranged to receive the air flow from the fluid inlet. This can provide an unrestricted fluid flow of air towards the filter unit, leading to efficient separation of any dirt or debris from the air flow. Preferably, each inlet duct has a generally circular cross-section and the transition between the cross-section of the annular fluid inlet and the cross-section of each inlet duct is gradual. A circular duct cross section and a smoothly changing cross section from one region of ducting to another help to minimise losses in the air flow path and maintain separation efficiency.

Preferably the duct assembly comprises a fluid outlet for receiving the air flow from at least one outlet duct, wherein the fluid outlet of the duct assembly is located on an upper surface of the separating apparatus. Locating the outlet on the upper surface can reduce the route traveled by the air flow exiting the duct assembly and the filter unit, leading to

a reduction in noise and flow path complexity. More preferably, the fluid inlet surrounds the fluid outlet, allowing for further simplification and miniaturization of the separating apparatus and the overall cleaning appliance.

- 5 Preferably, the duct assembly comprises means for isolating the fluid inlet from the fluid outlet. More preferably, the means for isolating the fluid inlet from the fluid outlet comprises a cup-shaped portion of the duct assembly. Isolating the fluid inlet from the fluid outlet inhibits cleaned air exiting the filter unit recirculating back to the inlet and also prevents any air flow passing to the fluid outlet before being cleaned by the filter
- 10 unit, thus preserving the efficiency of the separation apparatus. Without the cup-shaped portion the efficiency of the cleaning appliance may be degraded due to losses and contamination of the air flow. The cup-shaped portion of the duct assembly is preferably flexible, and is preferably connected to the upper surface of the body.
- 15 The cup-shaped portion preferably seals against a ball joint of a duct of the appliance. The duct provides a passage for conveying air from the separating apparatus to the main body, and is preferably separable from the separating apparatus. The duct is preferably pivotably connected to the main body for movement between a lowered position, in which the duct engages the fluid outlet, and a raised position in which the fluid outlet is
- 20 exposed. Preferably the cup-shaped portion comprises a graspable pillar and a plurality of support members, preferably lugs. The graspable pillar is preferably arranged to upstand from an inner surface of the cup-shaped portion to allow a user to manually access the duct assembly and pull the duct assembly from the separating apparatus.
- 25 The at least one inlet duct preferably has an inlet located on an upper surface of the body, and an outlet located on a lower surface of the body. In the preferred embodiment, the at least one outlet duct has an inlet located on the side wall of the body. Preferably, the said at least one inlet duct comprises a plurality of inlet ducts, preferably in the range from 2 to 10 inlet ducts. Preferably, said at least one outlet duct
- 30 comprises a plurality of outlet ducts, preferably in the range from 2 to 10 outlet ducts. The number and arrangement of the ducts in the duct assembly facilitates efficient air

flow from the separating unit into the filter assembly and out of the filter assembly back towards the main body for then exhausting from the cleaning appliance. The number of inlet ducts is preferably the same as the number of outlet ducts.

- 5 Preferably, the plurality of inlet ducts is arranged in an annular formation and in which the inlet ducts are evenly spaced. Preferably, the plurality of inlet ducts is angularly offset relative to the inlet ducts, more preferably by an angle of around 45 degrees.

10 In the preferred embodiment the cyclonic separating unit comprises a further cyclonic separating unit including a plurality of cyclones arranged in parallel. Preferably, the plurality of cyclones of the further cyclonic separating unit is arranged around the duct assembly. This arrangement can increase the separation efficiency of the separating apparatus whilst retaining a compact appliance.

15 It is preferred that the filter unit is removable from the separating apparatus. Preferably, the filter unit can be washable. The filter unit is preferably attached to the duct assembly, avoiding the filter unit and the duct assembly becoming detached and separated by a user during a washing operation, which could lead to one or other being lost or misplaced.

20 Preferably, the filter unit comprises a plurality of filter members held adjacent one another in a cylindrical shape. Preferably, the plurality of filter members are held in a cylindrical shape by a deformable rim formed around an upper end of the filter unit. More preferably, the plurality of filter members is held in a cylindrical shape closed by
25 a base member. This arrangement provides a robust filter unit that can be positioned within the separating apparatus by a user and handled and manipulated with ease for cleaning and washing.

30 Preferably, the duct assembly comprises a means manually accessible by a user to remove the filter unit from the appliance. The means manually accessible by a user may be a pillar, a tab or tag. The means may comprise a grippable or graspable portion to

facilitate removal of the filter unit by a user. Simplifying the removal of the filter unit from the separating apparatus can promote frequent cleaning or replacement of the filter unit, thus avoiding unnecessary strain or overloading on the filter unit which could, in turn, lead to dirt and dust passing through the filter and, in the case of a pre-motor filter, passing onto the motor and fan unit, leading to damage to motor and fan components.

In a second aspect the present invention provides a filter assembly for a cleaning appliance, the filter assembly being in the form of a cartridge removably insertable within the appliance, and comprising a filter unit and a duct assembly connected to the filter unit, the duct assembly comprising a fluid inlet, a fluid outlet, and a body having at least one inlet duct for conveying an air flow from the fluid inlet towards the filter unit and at least one outlet duct for conveying the air flow from the filter unit to the fluid outlet.

Preferably, the duct assembly comprises means for isolating the fluid inlet from the fluid outlet. Preferably, said means for isolating the fluid inlet from the fluid outlet comprises a flexible portion of the duct assembly. A flexible portion of the duct assembly can provide an air tight seal between the fluid inlet and the fluid outlet and can inhibit contamination of the inlet and outlet air flows.

Preferably, the flexible portion of the duct assembly is connected to the upper surface of the body, and wherein said at least one inlet duct has an inlet located on an upper surface of the body and an outlet located on a lower surface of the body. More preferably, said at least one outlet duct has an inlet located on the side wall of the body.

In the preferred embodiment the filter assembly is washable. Preferably, at least one inlet duct comprises a plurality of inlet ducts, preferably in the range from 2 to 10 inlet ducts. Preferably, at least one outlet duct comprises a plurality of outlet ducts, preferably in the range from 2 to 10 outlet ducts.

In a third aspect the present invention provides a cleaning appliance having an airflow path and at least one filter assembly as aforementioned removably located in the airflow path. The appliance preferably comprises a motor for causing the air to flow along the airflow path, with the filter assembly being positioned upstream of the motor.

5

Features described above in connection with the first aspect of the invention are equally applicable to any of the second and third aspects of the invention, and vice versa.

An embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

10

Figure 1 is a perspective view of a vacuum cleaner;

Figure 2 is a side view of the vacuum cleaner of Figure 1;

15

Figure 3 is an underside view of the vacuum cleaner of Figure 1;

Figure 4 is a top view of the vacuum cleaner of Figure 1;

20 Figure 5 is a sectional view taken along line F-F in Figure 2;

Figure 6 is a sectional view taken along line G-G in Figure 4;

Figure 7 is a perspective view of the vacuum cleaner of Figure 1, with the chassis articulated in one direction;

25

Figure 8 is an underside view of the vacuum cleaner of Figure 1, with the chassis articulated in one direction and the separating apparatus removed;

30 Figure 9 is a top view of the vacuum cleaner of Figure 1, with the chassis articulated in one direction and the separating apparatus removed;

Figure 10 is a front view of the vacuum cleaner of Figure 1, with the separating apparatus removed;

- 5 Figure 11 is a perspective view of the vacuum cleaner of Figure 1, with the separating apparatus removed;

Figure 12 is a top view of the separating apparatus of the vacuum cleaner of Figure 1;

- 10 Figure 13 is a rear view of the separating apparatus of Figure 12;

Figure 14(a) is top view of a portion of the separating apparatus of Figure 12;

Figure 14(b) is a sectional view through line I-I in Figure 12;

15

Figure 14(c) is a perspective view of the cross-over duct assembly of the separating apparatus of Figure 12;

Figure 15 is a side view of a filter of the separating apparatus of Figure 12;

20

Figure 16 is a side view of the separating apparatus of Figure 12, with the filter of Figure 15 partially removed therefrom;

Figure 17 is a side view of the separating apparatus of Figure 12, with the filter of

- 25 Figure 15 fully inserted thereinto and with a handle of the separating apparatus in a stowed position;

Figure 18 is a side view of the separating apparatus of Figure 12, with the filter of Figure 15 fully inserted thereinto and with the handle of the separating apparatus in a

- 30 deployed position;

Figure 19 is a sectional view of the handle of the separating apparatus of Figure 12 in its stowed position;

Figure 20 is a sectional view of the handle of the separating apparatus of Figure 12 in its
5 deployed position;

Figure 21(a) is a side view of the vacuum cleaner of Figure 1, with a duct extending from the separating apparatus to the main body in a raised position;

10 Figure 21(b) is a side sectional view taken along line J-J of Figure 4;

Figure 22 is an enlarged side view of the main body of the vacuum cleaner of Figure 1; and

15 Figure 23 is a sectional view taken along line F-F in Figure 22.

Figures 1 to 4 illustrate external views of a cleaning appliance in the form of a vacuum cleaner 10. The vacuum cleaner 10 is of the cylinder, or canister, type. In overview, the vacuum cleaner 10 comprises separating apparatus 12 for separating dirt and dust from
20 an airflow. The separating apparatus 12 is preferably in the form of cyclonic separating apparatus, and comprises an outer bin 14 having an outer wall 16 which is substantially cylindrical in shape. The lower end of the outer bin 14 is closed by curved base 18 which is pivotably attached to the outer wall 16. A motor-driven fan unit for generating suction for drawing dirt laden air into the separating apparatus 12 is housed within a
25 rolling assembly 20 located behind the separating apparatus 12. The rolling assembly 20 comprises a main body 22 and two wheels 24, 26 rotatably connected to the main body 22 for engaging a floor surface. An inlet duct 28 located beneath the separating apparatus 12 conveys dirt-bearing air into the separating apparatus 12, and an outlet duct 30 conveys air exhausted from the separating apparatus 12 into the rolling
30 assembly 20. A steering mechanism 32 steers the vacuum cleaner 10 as it is manoeuvred across a floor surface to be cleaned.

The steering mechanism 32 comprises a chassis 34 connected to the main body 22 of the rolling assembly 20. The chassis 34 is generally arrow-shaped, and comprises an elongate body 36 connected at the rear end thereof to the main body 22 of the rolling assembly 20, and a pair of side portions 38 each extending rearwardly from the front end of the elongate body 36 and inclined to the elongate body 36. The inclination of the front walls of the side portions 38 of the chassis 34 can assist in manoeuvring the vacuum cleaner 10 around corners, furniture or other items upstanding from the floor surface, as upon contact with such an item these front walls of the slide portions 38 of the chassis 34 tend to slide against the upstanding item to guide the rolling assembly 20 around the upstanding item.

The steering mechanism 32 further comprises a pair of wheel assemblies 40 for engaging the floor surface, and a control mechanism for controlling the orientation of the wheel assemblies 40 relative to the chassis 34, thereby controlling the direction in which the vacuum cleaner 10 moves over the floor surface. The wheel assemblies 40 are located behind the side portions 38 of the chassis 34, and in front of the wheels 24, 26 of the rolling assembly 20. The wheel assemblies 40 may be considered as articulated front wheels of the vacuum cleaner 10, whereas the wheels 24, 26 of the rolling assembly 20 may be considered as the rear wheels of the vacuum cleaner 10.

In addition to steering the vacuum cleaner 10 over a floor surface, the wheel assemblies 40 form support members for supporting the rolling assembly 20 as it is manoeuvred over a floor surface, restricting rotation of the rolling assembly 20 about an axis which is orthogonal to the rotational axes of the wheel assemblies 40, and substantially parallel to the floor surface over which the vacuum cleaner 10 is being manoeuvred. The distance between the points of contact of the wheel assemblies 40 with the floor surface is greater than that between the points of contact of the wheels 24, 26 of the rolling assembly 20 with that floor surface. In this example, the distance between the points of contact of the wheel assemblies 40 with the floor surface is approximately twice the

distance between the points of contact of the wheels 24, 26 of the rolling assembly 20 with that floor surface.

The control mechanism comprises a pair of steering arms 42 each connecting a
5 respective wheel assembly 40 to the chassis 34. Each steering arm 42 is substantially L-shaped so as to curve around its respective wheel assembly 40. Each steering arm 42 is pivotably connected at a first end thereof to the end of a respective side portion 38 of the chassis 34 for pivoting movement about a respective hub axis H. Each hub axis H is substantially orthogonal to the axes of rotation of the wheel assemblies 40. The second
10 end of each steering arm 42 is connected to a respective wheel assembly 40 so that the wheel assembly 40 is free to rotate as the vacuum cleaner 10 is moved over the floor surface. As shown, for example, in Figure 3, the outer surfaces of the steering arms 42 have a similar inclination to the front walls of the side portions 38 of the chassis 34 so that if a side portion 38 of the chassis 34 comes into contact with an upstanding item,
15 the steering arm 42 connected to that side portion 38 can also assist in guiding the rolling assembly 20 and the wheel assemblies 40 around the upstanding item.

The control mechanism also comprises an elongate track control arm 44 for controlling the pivoting movement of the steering arms 42 about their hub axes H, thereby
20 controlling the direction in which the vacuum cleaner 10 moves over the floor surface. With reference also to Figures 5 and 6, the chassis 34 comprises a lower chassis section 46 which is connected to the main body 22 of the rolling assembly 20, and an upper chassis section 48 connected to the lower chassis section 46. Each chassis section 46, 48 may be formed from one or more component parts. The upper chassis section 48
25 comprises a generally flat lower portion 50 which forms, with the lower chassis section 46, the body 36 and the side portions 38 of the chassis 34. The upper chassis section 48 also comprises an end wall 52 upstanding from the lower portion 50, and a profiled upper portion 54 connected to the end wall 52 and extending over part of the lower portion 50. The middle of the track control arm 44 is retained between the lower
30 portion 50 and the upper portion 54 of the upper chassis section 48. The track control arm 44 is oriented relative to the chassis 32 so as to be substantially orthogonal to the

body 36 of the chassis 34 when the vacuum cleaner 10 is moving forwards over the floor surface. Each end of the track control arm 44 is connected to the second end of a respective steering arm 42 so that movement of the track control arm 44 relative to the chassis 34 causes each steering arm 42 to pivot about its hub axis H. This in turn causes
5 each wheel assembly 40 to orbit about the end of its respective side portion 38 of the chassis 34 to change the direction of the movement of the vacuum cleaner 10 over the floor surface.

With reference to Figure 6, the lower chassis section 46 comprises a spindle 56
10 extending substantially orthogonally upward therefrom, and which passes through an aperture formed in the lower portion 50 of the upper casing section 48. The upper portion 54 of the upper casing section 48 comprises a recess for receiving the upper end of the spindle 56. The longitudinal axis of the spindle 56 defines a main pivot axis P of the steering mechanism 32. Pivot axis P is substantially parallel to the hub axes H.

15 The inlet duct 28 for conveying dirt-bearing air into the separating apparatus 12 is pivotably connected to the chassis 34. The inlet duct 28 comprises a rearwardly extending arm 58 which is also retained between the lower portion 50 and the upper portion 54 of the upper chassis section 48. The arm 58 comprises an aperture for
20 receiving the spindle 56 of the lower chassis section 46 so that the arm 58 is pivotable about axis P. The arm 58 also comprises a slot 60 for receiving a pin 62 connected to the track control arm 44, and within which the pin 62 is moveable as the arm 58 pivots about the axis P. The engagement between the slot 60 and the pin 62 causes the track control arm 44 to move relative to the chassis 34 as the arm 58 pivots about axis P.
25 The arm 58, and therefore the inlet duct 28, may be considered to form part of the steering mechanism 32 for steering the vacuum cleaner 10 over a floor surface.

Returning to Figures 1 to 5, the inlet duct 28 comprises a relatively flexible inlet section and a relatively rigid outlet section to which the arm 58 is connected. The inlet section
30 of the inlet duct 28 comprises a flexible hose 64 connected at one end thereof to the outlet section of the inlet duct 28 and at the other end thereof to a coupling 66 for

connection to a wand and hose assembly (not shown) for conveying the duct-bearing airflow to the inlet duct 28. The wand and hose assembly is connected to a cleaner head (not shown) comprising a suction opening through which a dirt-bearing airflow is drawn into the vacuum cleaner 10. The hose 64 is omitted from Figures 6 to 10 for clarity purposes only. The steering mechanism 32 comprises a yoke 68 for supporting the hose 64 and the coupling 66, and for connecting the coupling 66 to the chassis 34. The yoke 68 comprises a front section extending forwardly from the front of the chassis 34, and a rear section which is located between the lower chassis section 46 and the upper chassis section 48. The rear section of the yoke 68 is connected to the chassis 34 for pivoting movement about a yoke pivot axis Y. Axis Y is spaced from, and substantially parallel to, axis P. The chassis 34 is shaped to define an opening 70 through which the yoke 68 protrudes from the chassis 34, and which restricts the pivoting movement of the yoke 68 relative to the chassis 34 to within a range of $\pm 65^\circ$. The yoke 68 comprises a floor engaging rolling element 72 for supporting the yoke 68 on the floor surface, and which has a rotational axis which is substantially orthogonal to axis Y.

The vacuum cleaner 10 comprises a support 74 upon which the separating apparatus 12 is removably mounted. The support 74 is connected to the outlet section of the inlet duct 28 for movement therewith as the arm 58 pivots about axis P. With particular reference to Figures 6, 9 and 11, in this example the support 74 comprises a sleeve 76 which extends about an inclined section 78 of the outlet section of the inlet duct 28, and a platform 80 which extends forwardly, and generally horizontally, from the sleeve 76. The platform 80 has a curved rear wall 82 which is connected to the sleeve 76, and which has a radius of curvature which is substantially the same as that of the outer wall 16 of the outer bin 14 of the separating apparatus 12 to assist with the location of the separating apparatus 12 on the support 74. A spigot 84 extends upwardly from the platform 80 for location within a recess 86 formed on the base 18 of the outer bin 14.

The support 74 is preferably biased in an upward direction so that the separating apparatus 12 is biased toward the outlet duct 30 of the vacuum cleaner 10. This assists in maintaining an air-tight seal between the separating apparatus 12 and the outlet duct

30. For example, a resilient element 88, preferably a helical spring, is located within a housing formed at the rear of the inlet duct 28 for engaging the support 74 to urge the support 74 upwardly in a direction which is preferably substantially parallel to the longitudinal axis of the outer bin 14 when the separating apparatus 12 is mounted on the support 74.

When the separating apparatus 12 is mounted on the support 74, the longitudinal axis of the outer bin 14 is inclined to the axis P, in this example by an angle in the range from 30 to 40°. Consequently, pivoting movement of the inlet duct 28 about axis P during a cleaning operation causes the separating apparatus 12 to pivot, or swing, about axis P, relative to the chassis 34, the rolling assembly 20 and the outlet duct 30.

The inclined section 78 of the inlet duct 28 extends alongside the outer wall 16 of the outer bin 14 of the separating apparatus 12, and is substantially parallel to the longitudinal axis of the outer bin 14 when the separating apparatus 12 is mounted on the support 74. The arm 58 is preferably connected to the rear of the inclined section 78 of the inlet duct 28. The outlet section of the inlet duct 28 also comprises a horizontal section 90 located beneath the platform 80 for receiving the dirt-bearing airflow from the hose 64 and conveying the airflow to the inclined section 78. The outlet section of the inlet duct 28 further comprises an outlet 92 from which the dust-bearing airflow enters the separating apparatus 12.

To manoeuvre the vacuum cleaner 10 over the floor surface, the user pulls the hose of the hose and wand assembly connected to the coupling 66 to drag the vacuum cleaner 10 over the floor surface, which in turn causes the wheels 24, 26 of the rolling assembly 20, the wheel assemblies 40 and the rolling element 72 to rotate and move the vacuum cleaner 10 over the floor surface. With reference also to Figures 7 to 9, to steer the vacuum cleaner 10 to the left, for example, as it is moving across the floor surface, the user pulls the hose of the hose and wand assembly to the left so that the coupling 66 and the yoke 68 connected thereto pivot to the left about axis Y. This pivoting movement of the yoke 68 about axis Y causes the hose 64 to flex and exert a force on the horizontal

section 90 of the outlet section of the inlet duct 28. This force causes the inclined section 78 and the arm 58 attached thereto to pivot to the left about axis P. With particular reference to Figure 9, due to the flexibility of the hose 64, the amount by which the yoke 68 pivots about axis Y is greater than the amount by which the inlet duct 28 pivots about axis P. For example, when the yoke 68 is pivoted about axis Y by an angle of 65° the inlet duct 28 is pivoted about axis P by an angle of around 25°. As the arm 58 pivots about axis P, the pin 62 connected to the track control arm 44 moves with and within the slot 60 of the arm 58, causing the track control arm 44 to move relative to the chassis 34. With particular reference to Figures 8 and 9, the movement of the track control arm 44 causes each steering arm 42 to pivot about its respective hub axis H so that the wheel assemblies 40 turn to the left, thereby changing the direction in which the vacuum cleaner 10 moves over the floor surface. The control mechanism is preferably arranged so that movement of the track control arm 44 relative to the chassis 34 causes each wheel assembly 40 to turn by a respective different amount relative to the chassis 34.

The separating apparatus 12 will now be described with reference to Figures 6, 12 to 14 and Figures 16 to 18. The specific overall shape of the separating apparatus 12 can be varied according to the size and type of vacuum cleaner in which the separating apparatus 12 is to be used. For example, the overall length of the separating apparatus 12 can be increased or decreased with respect to the diameter of the apparatus, or the shape of the base 18 can be altered.

As mentioned above, the separating apparatus 12 comprises an outer bin 14 which has an outer wall 16 which is substantially cylindrical in shape. The lower end of the outer bin 14 is closed by a curved base 18 which is pivotably attached to the outer wall 16 by means of a pivot 94 and held in a closed position by a catch 96 which engages a lip 98 located on the outer wall 16. In the closed position, the base 18 is sealed against the lower end of the outer wall 16. The catch 96 is resiliently deformable so that, in the event that downward pressure is applied to the uppermost portion of the catch 96, the

catch 96 will move away from the lip 98 and become disengaged therefrom. In this event, the base 18 will drop away from the outer wall 16.

5 With particular reference to Figure 14(b), the separating apparatus further comprises a second cylindrical wall 100. The second cylindrical wall 100 is located radially inwardly of the outer wall 16 and spaced therefrom so as to form an annular chamber 102 therebetween. The second cylindrical wall 100 meets the base 18 (when the base 18 is in the closed position) and is sealed thereagainst. The annular chamber 102 is delimited generally by the outer wall 16, the second cylindrical wall 100, the base 18
10 and an upper wall 104 positioned at the upper end of the outer bin 14.

A dirty air inlet 106 is provided at the upper end of the outer bin 14 below the upper wall 104 for receiving an air flow from the outlet 92 of the inlet duct 28. The dirty air inlet 106 is arranged tangentially to the outer bin 14 (as shown in Figure 6) so as to
15 ensure that incoming dirty air is forced to follow a helical path around the annular chamber 102. The dirty air inlet 106 receives the air flow from a conduit 108 connected to the outer wall 16 of the outer bin 14, for example by welding. The conduit 108 has an inlet 110 which is substantially the same size as the outlet 92 of the inlet duct 28, and which is located over the outlet 92 when the separating apparatus 12 is mounted on the
20 support 74.

A fluid outlet is provided in the outer bin 14 in the form of a shroud. The shroud has an upper portion 112 formed in a frusto-conical shape, a lower cylindrical wall 114 and a skirt portion 116 depending therefrom. The skirt portion 116 tapers outwardly from the
25 lower cylindrical wall 114 in a direction towards the outer wall 16. A large number of perforations are formed in the upper portion 112 of the shroud and in the cylindrical wall 114 of the shroud. The only fluid outlet from the outer bin 14 is formed by the perforations in the shroud. A passage 118 is formed between the shroud and the second cylindrical wall 100. The passage 118 communicates with a plenum chamber 120. The
30 plenum chamber 120 is arranged radially outwardly of the shroud and located above the upper portion 112 of the shroud.

A third, generally cylindrical, wall 122 extends from adjacent the base 18 to a portion of the outer wall of the plenum chamber 120 and forms a generally cylindrical chamber 124. The lower end of the cylindrical chamber 124 is closed by an end wall 126. The cylindrical chamber 124 is shaped to accommodate a removable filter assembly 128 comprising a cross-over duct assembly 130, which are described in more detail below. The filter assembly 128 is removably received within the cylindrical chamber 124 so that there is no relative rotation of the filter assembly 128 relative to the remainder of the separating apparatus 12 during use of the vacuum cleaner 10. For example, the separating apparatus 12 may be provided with one or more slots which receive formations formed on the filter assembly 128 as the filter assembly 128 is inserted into the separating apparatus 12.

Arranged circumferentially around the plenum chamber 120 is a plurality of cyclones 132 arranged in parallel with one another. Referring to Figures 14(a) and 14(b), each cyclone 132 has a tangential inlet 134 which communicates with the plenum chamber 120. Each cyclone 132 is identical to the other cyclones 132 and comprises a cylindrical upper portion 136 and a tapering portion 138 depending therefrom. The tapering portion 138 of each cyclone 132 is frusto-conical in shape and terminates in a cone opening. The cyclone 132 extends into and communicates with an annular region 140 which is formed between the second and third cylindrical walls 100, 122. A vortex finder 142 is provided at the upper end of each cyclone 132 to allow air to exit the cyclone 132. Each vortex finder 142 communicates with a manifold finger 144 located above the cyclone 132. In the preferred embodiment there are twelve cyclones 132 and twelve manifold fingers 144. The twelve cyclones 132 are arranged in a ring which is centred on a longitudinal axis X of the outer bin 14. Each cyclone 132 has an axis C which is inclined downwardly and towards the axis X. The axes C are all inclined to the axis X at the same angle. The twelve cyclones 132 can be considered to form a second cyclonic separating unit, with the annular chamber 102 forming the first cyclonic separating unit.

In the second cyclonic separating unit, each cyclone 132 has a smaller diameter than the annular chamber 102 and so the second cyclonic separating unit is capable of separating finer dirt and dust particles than the first cyclonic separating unit. It also has the added advantage of being challenged with an airflow which has already been cleaned by the first cyclonic separating unit and so the quantity and average size of entrained particles is smaller than would otherwise have been the case. The separation efficiency of the second cyclonic separating unit is higher than that of the first cyclonic separating unit.

Each manifold finger 144 is a generally inverted U shape and is bounded by an upper wall 146 and lower wall 148 of a manifold 150 of the second cyclonic separating unit. The manifold finger 144 extends from the upper end of each cyclone 132 to the cross-over duct assembly 130.

With particular reference to Figure 14(c), the cross-over duct assembly 130 comprises an annular seal 152 and a cross-over duct 154. The removable filter assembly 128 is located below the cross-over duct 154, within the cylindrical chamber 124. In the preferred embodiment the seal 152 is rubber, and is secured around the outer surface of the cross-over duct 154 with a friction fit. The cross-over duct 154 comprises an upper portion and a lower portion. The seal 152 is located on the upper portion of the cross-over duct 154. The upper portion of the cross-over duct 154 comprises a generally cup shaped portion 156 which provides a fluid outlet from the separating apparatus 12, and which has a convex outer surface, preferably of spherical curvature. The lower portion of the cross-over duct 154 comprises a lip 158 and a generally cylindrical outer housing 160 shaped to correspond to the size and shape of the cylindrical chamber 124. The lip 158 is shaped to have a diameter slightly larger than that of the cylindrical outer housing 160 and is located towards the upper end of the cylindrical outer housing 160. An inlet chamber 162 is formed between the upper portion and the lower portion of the cross-over duct 154. The inlet chamber 162 is bounded by the lower surface of the cup shaped portion 156, the upper surface of the cylindrical outer housing 160 and the lip 158. With reference to Figure 14(b), the outlet of each manifold finger 144 terminates at the inlet chamber 162 of the cross-over duct assembly 130.

The cross-over duct 154 comprises a first set of ducts in which air passes in a first direction through the cross-over duct 154, and a second set of ducts in which air passes in a second direction, different from the first direction, through the cross-over duct 154.

5 In this embodiment, eight ducts are located within the cylindrical outer housing 160 of the cross-over duct 154. These ducts comprise a first set of four filter inlet ducts 164, and a second set of four filter outlet ducts 166. The filter inlet ducts 164 are arranged in an annular formation which is centred on the axis X and in which the filter inlet ducts 164 are evenly spaced. The filter outlet ducts 166 are similarly evenly arranged and
10 spaced about the axis X, but are located between the filter inlet ducts 164, preferably being angularly offset from the filter inlet ducts 164 by an angle of around 45 degrees.

Each filter inlet duct 164 has an inlet opening located towards the upper surface of the cylindrical outer housing 160 and adjacent the inlet chamber 162, and an outlet opening
15 located towards the base of the cylindrical outer housing 160. Each filter inlet duct 164 thus comprises a passage extending between the inlet opening and the outlet opening. The passage has a smoothly changing cross-section for reducing noise and turbulence in the airflow passing through the cross-over duct 154.

20 Each filter outlet duct 166 comprises an inlet opening 168 in the outer surface of the cylindrical outer housing 160 adjacent the cylindrical chamber 124, and an outlet opening 170 for ducting cleaned air away from the filter assembly 128 and towards the outlet duct 30. Each filter outlet duct 166 thus comprises a passage extending between the inlet opening 168 and the outlet opening 170, and which passes through the
25 cylindrical outer housing 160 from the outer surface of the cylindrical outer housing 160 towards the axis X. Consequently, the outlet opening 170 is located closer to the axis X than the inlet opening 168. The outlet opening 170 is preferably circular in shape.

The cup shaped portion 156 of the cross-over duct 154 comprises a graspable pillar 172
30 for allowing a user to pull the filter assembly 128 from the separating apparatus 12 for cleaning. The graspable pillar 172 is arranged to upstand from the base of the cup

shaped portion 156 along the axis X so that it extends proud of the second cyclonic separating unit. The cross-over duct 154 also comprises a plurality of side lugs 173 arranged to depend from the lower surface of the cup portion 166 and which act to support the upper portion of the cross-over duct 164 on the lower portion.

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Returning to Figure 14(b), and with reference also to Figures 15 and 16, the filter assembly 128 comprises an upper rim 174, a base 176, and four cylindrical filter members located between the rim 174 and the base 176. The filter assembly 128 is generally cylindrical in shape, and comprises an inner chamber 178 bounded by the rim
10 174, the base 176 and an innermost, first filter member 180 of the filter assembly 128. The rim 174 is retained within an annular groove located in the lower portion of the cross-over duct 154.

The filter assembly 128 is constructed such that it is pliable, flexible and resilient. The
15 rim 174 is annular in shape having a width, W, in a direction perpendicular to the axis X. The rim 174 is manufactured from a material with a hardness and deformability that enable a user to deform the rim 174 (and thus the filter assembly 128) by pressing or grasping the rim 174, and twisting or squeezing the filter assembly 128 by hand, in particular during a washing operation. In this embodiment, the rim 174 and base 176
20 are formed from polyurethane.

Each filter member of the filter assembly 128 is manufactured with a rectangular shape. The four filter members are then joined and secured together along their longest edge by stitching, gluing or other suitable technique so as to form a pipe length of filter material
25 having a substantially open cylindrical shape, with a height, H, in the direction of the axis X. An upper end of each cylindrical filter member is then bonded to the rim 174, whilst a lower end of each filter member is bonded to the base 176, preferably by over-moulding the polyurethane material of the rim 174 and base 176 during manufacture of the filter assembly 128. Alternative manufacturing techniques for attaching the filter
30 members include gluing, and spin-casting polyurethane around the upper and lower ends of the filter members. In this way the filter members are encapsulated by

polyurethane during the manufacturing process to produce a strengthened arrangement capable of withstanding manipulation and handling by a user, particularly during washing of the filter assembly 128.

5 The first filter member 180 comprises a layer of scrim or web material having an open weave or mesh structure. A second filter member 182 surrounds the first filter member 180, and is formed from a non-woven filter medium such as fleece. The shape and volume of the second filter member 182 is selected so as to substantially fill the volume delimited by the width W of rim 174 and the height, H , of the filter assembly 128 as
10 measured along the axis X . Therefore, the width of the second filter member 182 is substantially the same as the width W of the rim 174.

A third filter member 184 surrounds the second filter member 182, and comprises an electrostatic filter medium covered on both sides by a protective fabric. The layers are
15 held together in a known manner by stitching or other sealing means. A fourth filter member 186 surrounds the third filter member 184, and comprises a layer of scrim or web material having an open weave or mesh structure.

During manufacture an upper part of the first filter member 180 is bonded to the rim
20 174 and the base 176 immediately adjacent the second filter member 182. An upper part of the third filter member 184 is bonded to the rim 174 and the base 176 immediately adjacent the second filter member 182, and an upper part of the fourth filter member 186 is bonded to the rim 174 and the base 176 immediately adjacent the third filter member 184. In this manner the filter members 180, 182, 184, 186 are held
25 in position in the filter assembly 128 with respect to the rim 174 and the base 176 such that an airflow will impinge first on the first filter member, before impinging, in turn, on the second, third and fourth filter members. For the third filter member 184, comprising an electrostatic filter medium covered on both sides by a protective fabric, it is preferred that all of the layers of the third filter member 184 are bonded to the rim 174 and the
30 base 176 so that the risk of delamination of the second filter member 184 during use is reduced.

The outlet duct 30 will now be described with reference to Figures 6, 21(a) and 21(b). The outlet duct 30 comprises a generally curved arm spanning the separating apparatus 12 and the rolling assembly 20. The outlet duct 30 comprises a fluid inlet in the form of a ball joint 188 having a convex outer surface, and an elongate tube 190 for receiving air from the ball joint 188. The elongate tube 190 provides a passage 192 for conveying air from the separating apparatus 12 to the rolling assembly 20. With reference to Figure 6, the pivot axis P passes through the outlet duct 30, preferably through the ball joint 188 of the outlet duct 30.

The ball joint 188 is generally hemispherical in shape and is removably locatable in the cup portion 156 of the cross-over duct 154, which is exposed through the open upper end of the manifold 150. A ball and socket joint is thus formed between the separating apparatus 12 and the outlet duct 30. The ball joint 188 comprises a flexible annular seal 194 extending thereabout, and which includes a lip 196 for engaging with an inner surface of the cup portion 156 of the cross-over duct 154. This facilitates efficient and robust sealing between the ball joint 188 and the cross-over duct 154. Alternatively the outer surface of the ball joint 188 may include features, such as an outwardly directed ledge, flange or ribs, which engage with the cup portion 156 of the cross-over duct 154. In addition, in the preferred embodiment the seal 152 of the cross-over duct assembly 130 is flexible and shaped such that the diameter of the upper portion of the seal 152 is slightly smaller than the diameter of the ball joint 188 to provide a snug, elastic fit around the outer surface of the ball joint 188. The seal 152 can also seal any gaps between the ball joint 188 and the second cyclonic separating unit.

As described previously, rotation of the inlet duct 28 about axis P during a cleaning operation causes the separating apparatus 12 to swing about axis P relative to the outlet duct 30. As shown in Figure 6, the seal 196 and the fit of the upper rim of the seal 152 with the ball joint 188 facilitate a continuous fluid connection between the (fixed) outlet duct passage 192 and the (moveable) outlet openings 170 of the cross-over duct 154. Consequently, an air tight connection is maintained between the separating apparatus 12

and the outlet duct 30 as the separating apparatus 12 moves relative to the outlet duct 30 during movement of the vacuum cleaner 10 across a floor surface.

The rolling assembly 20 will now be described with reference to Figures 22 and 23.

5 The rolling assembly 20 comprises a main body 22 and two curved wheels 24, 26 rotatably connected to the main body 22 for engaging a floor surface. In this embodiment the main body 22 and the wheels 24, 26 define a substantially spherical rolling assembly 20. The rotational axes of the wheels 24, 26 are inclined upwardly towards the main body 22 with respect to a floor surface upon which the vacuum
10 cleaner 10 is located so that the rims of the wheels 24, 26 engage the floor surface. The angle of the inclination of the rotational axes of the wheels 24, 26 is preferably in the range from 5 to 15°, more preferably in the range from 6 to 10°, and in this embodiment is around 8°. Each of the wheels 24, 26 of the rolling assembly 20 is dome-shaped, and has an outer surface of substantially spherical curvature, so that each wheel 24, 26 is
15 generally hemispherical in shape. In the preferred embodiment, the diameter of the external surface of each wheel 24, 26 is smaller than the diameter of the rolling assembly 20, and is preferably in the range from 80 to 90% of the diameter of the rolling assembly 20.

20 The rolling assembly 20 houses a motor-driven fan unit 200, a cable rewind assembly 202 for retracting and storing within the main body 22 a portion of an electrical cable (not shown) terminating in a plug 203 providing electrical power to, inter alia, the motor of the fan unit 200, and a filter assembly 204. The fan unit 200 comprises a motor, and an impeller driven by the motor to draw the dirt-bearing airflow into and through the
25 vacuum cleaner 10. The fan unit 200 is housed in a motor bucket 206. The motor bucket 206 is connected to the main body 22 so that the fan unit 200 does not rotate as the vacuum cleaner 10 is manoeuvred over a floor surface. The filter assembly 204 is located downstream of the fan unit 200. The filter assembly 204 is cuff shaped and located around a part of the motor bucket 206. A plurality of perforations 207 is formed
30 in a portion of the motor bucket 206 which is surrounded by the filter assembly 204.

A seal 208 separates the cable rewind assembly 202 from the motor bucket 206. The seal 208 facilitates the division of the main body 22 into a first region including the fan unit 200, which will generate heat during use, and a second region accommodating the cable rewind assembly 202, for which heat is detrimental and which may require
5 cooling during use.

The filter assembly 204 may be periodically removed from the rolling assembly 20 to allow the filter assembly 204 to be cleaned. The filter assembly 204 is accessed by removing the wheel 26 of the rolling assembly 20. This wheel 26 may be removed, for
10 example, by the user first twisting an end cap 210 mounted on the wheel 26 to disengage a wheel mounting sleeve 212 located over the end of an axle 214 connected to the motor bucket 206. The wheel mounting sleeve 212 may be located between the axle 214 and a wheel bearing arrangement 216. The wheel 26 may then be pulled from
15 the axle 214 by the user so that the wheel mounting sleeve 212, wheel bearing arrangement 216 and end cap 210 come away from the axle 214 with the wheel 26. The filter assembly 204 may then be removed from the rolling assembly 20 by depressing a catch 218 connecting the filter assembly 204 to the motor bucket 206, and pulling the filter assembly 204 from the rolling assembly 20.

20 The main body 22 of the rolling assembly 20 further comprises a fluid inlet port 220, an annular shaped chamber 222 for receiving air from the inlet port 220, and a passage 224 bounded by the chamber 222. The chamber 222 is shaped such that there is a smooth change in cross sectional area of the airflow passing from the inlet port 220 to the fan unit 200. The chamber 222 facilitates a change in direction of the passage 224 of
25 around 90 degrees. A smooth path and a smooth change in cross sectional area of a passage for airflow can reduce inefficiencies in the system, for example losses through the motor bucket 206. A grille may be located between the inlet port 220 and the motor chamber 222 to protect the fan unit 200 and motor bucket 206 from damage by objects that could otherwise enter, block and/or obstruct the motor chamber 222, for example
30 during removal of the separating apparatus 12 from the main body 22, as described below.

The fan unit 200 comprises a series of exhaust ducts 230 located around the outer circumference of the fan unit 200. In the preferred embodiment four exhaust ducts 230 are arranged around the fan unit 200 and provide communication between the fan unit
5 200 and the motor bucket 206. The filter assembly 204 is located around the motor bucket 206, and the perforations 218 facilitate communication between the motor bucket 206 and the main body 22. The main body 22 further comprises an air exhaust port for exhausting cleaned air from the vacuum cleaner 10. The exhaust port is formed towards the rear of the main body 22. In the preferred embodiment the exhaust port
10 comprises a number of outlet holes 232 located in a lower portion of the main body 22, and which are located so as to present minimum environmental turbulence outside of the vacuum cleaner 10.

A first user-operable switch 234 is provided on the main body and is arranged so that,
15 when it is depressed, the fan unit 200 is energised. The fan unit 200 may also be de-energised by depressing this first switch 234. A second user-operable switch 236 is provided adjacent the first switch 234. The second switch 236 enables a user to activate the cable rewind assembly 202. Circuitry 238 for driving the fan unit 200 and cable
20 rewind assembly 202 is also housed within the rolling assembly 20.

The main body 22 comprises a bleed valve 240 for allowing an airflow to be conveyed to the fan unit 200 in the event of a blockage occurring in, for example, the wand and hose assembly. This prevents the fan unit 200 from overheating or otherwise becoming
25 damaged. The bleed valve 240 comprises a piston chamber 242 housing a piston 244. An aperture 246 is formed at one end of the piston chamber 242 for exposing the piston chamber 242 to the external environment via the outlet holes 232, and a conduit 248 is formed at the other end of the piston chamber 242 for placing the piston chamber 242 in fluid communication with the passage 224.

30 A helical compression spring 250 located in the piston chamber 242 urges the piston 244 towards an annular seat 252 inserted into the piston chamber 242 through the

aperture 246. During use of the vacuum cleaner 10, the force F_1 acting on the piston 242 against the biasing force F_2 of the spring 250, due to the difference in the air pressure acting on each respective side of the piston 244, is lower than the biasing force F_2 of the spring 250, and so the aperture 246 remains closed. In the event of a blockage
5 in the airflow path upstream of the conduit 248, the difference in the air pressure acting on the opposite sides of the piston 242 dramatically increases. The biasing force F_2 of the spring 250 is chosen so that, in this event, the force F_1 becomes greater than the force F_2 , which causes the piston 244 to move away from the seat 252 to open the aperture 246. This allows air to pass through the piston chamber 242 from the external
10 environment and enter the passage 224.

In use, the fan unit 200 is activated by the user, for example by pressing the switch 234, and a dirt-bearing airflow is drawn into the vacuum cleaner 10 through the suction opening in the cleaner head. The dirt-bearing air passes through the hose and wand
15 assembly, and enters the inlet duct 28. The dirt-bearing air passes through the inlet duct 28 and enters the dirty air inlet 106 of the separating apparatus 12. Due to the tangential arrangement of the dirty air inlet 106, the airflow follows a helical path relative to the outer wall 16. Larger dirt and dust particles are deposited by cyclonic action in the annular chamber 102 and collected therein.

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The partially-cleaned airflow exits the annular chamber 102 via the perforations in the shroud and enters the passage 118. The airflow then passes into the plenum chamber 120 and from there into one of the twelve cyclones 132 at inlet 134 wherein further cyclonic separation removes some of the dirt and dust still entrained within the airflow.
25 This dirt and dust is deposited in the annular region 140 whilst the cleaned air exits the cyclones 132 via the vortex finders 142 and enters the manifold fingers 144. The airflow then passes into the cross-over duct 154 via the inlet chamber 162 and enters the four filter inlet ducts 164 of the cross-over duct 154. From the filter inlet ducts 164 the airflow enters the central open chamber 178 of the filter assembly 124.

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The airflow passes through the central open chamber 178, and is forced tangentially outwardly towards the filter members of the filter assembly 124. The airflow enters first the first filter member 180, and then passes sequentially through the second filter member 182, the third filter member 184 and the fourth filter member 186, with dirt and dust being removed from the air flow as it passes through each filter member.

The airflow emitted from the filter assembly 128 passes into the cylindrical chamber 124 and is drawn into the filter outlet ducts 166 of the cross-over duct 154. The airflow passes through the filter outlet ducts 166 and exits the cross-over duct 154 through the four exit ports 190 in the cup portion 156 of the cross-over duct 154. The airflow enters the ball joint 188 of the outlet duct 30, passes along the passage 192 and enters the main body 22 of the rolling assembly 20 through the fluid inlet port 220.

Within the rolling assembly 20, the airflow passes sequentially through the grille and passage 224, and enters the chamber 222. The chamber 222 guides the airflow into the fan unit 200. The airflow is prevented from passing through the cable rewind assembly 202 by the seal 208. The airflow is exhausted from the motor exhaust ducts 230 into the motor bucket 206. The airflow then passes out of the motor bucket 206 in a tangential direction via the perforations 218 and passes through the filter assembly 204. Finally the airflow follows the curvature of the main body 22 to the outlet holes 232 in the main body 22, from which the cleaned airflow is ejected from the vacuum cleaner 10.

The outlet duct 30 is detachable from the separating apparatus 12 to allow the separating apparatus 12 to be removed from the vacuum cleaner 10. The end of the tube 190 remote from the ball joint 188 of the outlet duct 30 is pivotably connected to the main body 22 of the rolling assembly 20 to enable the outlet duct 30 to be moved between a lowered position, shown in Figure 2, in which the outlet duct 30 is in fluid communication with the separating apparatus 12, and a raised position, shown in Figure 21(a), which allows the separating apparatus 12 to be removed from the vacuum cleaner 10.

With reference again to Figures 21(a) and 21(b), and also to Figure 4, the outlet duct 30 is biased towards the raised position by a spring 260 located in the main body 22. The main body 22 also comprises a catch 262 for retaining the outlet duct 30 in the lowered position against the force of the spring 260, and a catch release button 264. The outlet duct 30 comprises a handle 266 to allow the vacuum cleaner 10 to be carried by the user when the outlet duct 30 is retained in its lowered position. In the preferred embodiment the spring 260 is a torsion spring provided in engagement with a portion of the handle 266. The catch 262 is located on the main body 22 proximate the outlet duct 30 and along the line G-G in Figure 4.

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The catch 262 is arranged to co-operate with a flange 268 of the outlet duct 30. The flange 268 depends from the underside of the outlet duct 30 and extends in a direction extending towards the main body 22. The flange 268 is located below a groove 270 shaped to accommodate an engaging member of the catch 262.

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The catch 262 comprises a hook 272 and a rod 274. The rod 274 extends horizontally between the catch release button 264 and the catch 262. The hook 272 is arranged at an angle of 90 degrees to the rod 274, and is connected to an end of the rod 274 which is proximate the outlet duct 30. The hook 272 is sized so as to be accommodated within the groove 270 of the flange 268. The hook and rod assembly of the catch 262 is pivotably mounted on the main body 22 and arranged to rotate about pivot axis Q, which is substantially orthogonal to the pivot axis P of the separating apparatus 12.

The catch release button 264 comprises an upper surface which may be coloured or feature other indications of its function to highlight the catch release button 264 for a user. The catch release button 264 further comprises a pin 276 and a guide channel 278. The pin 276 depends downwardly from the upper surface of the catch release button 264, and is slidably mounted within the guide channel 278. The pin 276 is moveable along the guide channel 278 from an upper deactivation position to a lower activation position. In the activation position the pin 276 extends beyond the guide channel 278 and is arranged to impinge on the rod portion 274 of the catch 262.

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In use, the filter assembly 128 is arranged in the airflow path of the vacuum cleaner 10, as described above. Through use, the filter assembly 128 can become clogged, causing a reduction in the filtration efficiency. In order to alleviate this, the filter assembly 128 will require periodic cleaning or replacement. In the preferred embodiment the filter assembly 128 and all of the filter members are capable of being cleaned by washing. The filter assembly 128 can be accessed by the user for cleaning when the outlet duct 30 is in its raised position. The pillar 172 of the filter assembly 128 extends beyond the manifold 150, and acts to prompt the user as to where the filter assembly 128 is located, thus aiding removal of the filter assembly 128. The user removes the filter assembly 128 from the separating apparatus 12 by the gripping the pillar 172, and pulling the pillar 172 outwardly and upwardly from the cylindrical chamber 124 of the separating apparatus 12. In this way, the user is not required to handle directly the clogged filter members of the filter assembly 128. This makes replacing or cleaning the filter assembly 128 a hygienic task. The filter assembly 128 is washed by rinsing under a household tap in a known manner and allowed to dry. The filter assembly 128 is then re-inserted into the cylindrical chamber 124 of the separating apparatus 12, the outlet duct 30 is moved to its lowered position and use of the vacuum cleaner 10 can continue.

To enable the outlet duct 30 to be moved from its lowered position to its raised position, the user depresses the catch release button 264. The movement of the catch release button 264 and the lowering of the pin 276 within the guide channel 278 causes a lower part of the pin 276 to impinge on the rod 274 of the catch 262. The rod 274 is forced away from the deactivated position and caused to rotate in an anticlockwise direction about pivot axis Q. The hook 272, being connected to the rod 274, is also caused to rotate in an anticlockwise direction about pivot axis Q and moves out of engagement with groove 270 of flange 268. The movement of the hook 272 of the catch 262 away from the flange 294 allows the biasing force of the spring 260 to urge the handle 266, and thus the outlet duct 30, away from the main body 22 and thereby swing the outlet duct 30 away from its lowered position toward its raised position

When the outlet duct 30 is in its raised position, the separating apparatus 12 may be removed from the vacuum cleaner 10 for emptying and cleaning. The separating apparatus 12 comprises a handle 280 for facilitating the removal of the separating apparatus 12 from the vacuum cleaner 10. The handle 280 is positioned on the separating apparatus 12 so as to be located beneath the outlet duct 30 when the outlet duct 30 is in its lowered position. As discussed in more detail below, the handle 280 is moveable relative to the outer bin 14 of the separating apparatus 12 between a stowed position, as illustrated in Figures 17 and 19, and a deployed position, as illustrated in Figures 18 and 20, in which the handle 280 is readily accessible by the user. The extent of the movement of the handle 280 between its stowed and deployed positions is preferably in the range from 10 to 30 mm, and in this preferred embodiment is around 15 mm.

The handle 280 comprises a head 282 attached to an elongate body 284 which is slidably located within a recess 286 formed in the second cyclonic separating unit of the separating apparatus 12. The body 284 is located between two adjacent cyclones 132 of the second cyclonic separating unit, and is inclined at a similar angle to the axis X as the axes C of the cyclones 132. The body 284 comprises an inner portion 284a connected to the head 282, and an outer portion 284b. The head 280 is biased toward its deployed position by a resilient member located within the recess 286. In this embodiment, this resilient member comprises a first helical spring 288. The lower end of the first helical spring 288 engages the lower surface 290 of the recess 286, and the upper end of the first helical spring 288 engages the lower end 292 of the inner portion 284a of the body 284 so that the elastic energy stored in the first helical spring 288 urges the body 284 away from the lower surface 290 of the recess 286.

The handle 280 is urged towards its stowed position by the outlet duct 30. With reference to Figure 21, the outlet duct 30 comprises a flange 294 depending downwardly therefrom for engaging the head 282 of the handle 280. Returning to Figures 17 to 20, the head 282 comprises a groove 296 for receiving the flange 294 of the outlet duct 30. When the outlet duct 30 is moved from its raised position, shown in

Figure 21, to its lowered position, shown in Figure 2, the flange 294 locates within the groove 296 and pushes the handle 280 towards its stowed position against the biasing force of the first helical spring 288. Once the handle 280 has reached its stowed position, any further movement of the outlet duct 30 towards its lowered position urges the separating apparatus 12 against the support 74 to firmly retain the separating apparatus 12 on the chassis 34.

To enable the separating apparatus to be subsequently removed from the vacuum cleaner 10 for emptying, the user depresses the catch release button 264 to move the outlet duct 30 to its raised position. The movement of the flange 294 of the outlet duct 30 away from the separating apparatus 12 allows the biasing force of the first helical spring 288 to urge the lower end 292 of the body 284 of the handle 280 away from the lower surface 290 of the recess 286 and thereby push the handle 280 towards its deployed position. As shown in Figure 21, when the outlet duct 30 is in its raised position, the head 282 is sufficiently proud of the separating apparatus 12 to enable a user to grasp the head 282 of the handle 280 and pull the handle 280 in a generally upward direction so as to pull the base 18 of separating apparatus 12 from the spigot 84 of the support 74. A catch located on the lower end 292 of the body 284 of the handle 280 may engage a shoulder located on the cyclone pack to prevent the handle 280 from becoming fully withdrawn from the recess 286.

The handle 280 comprises a manually operable button 298 for actuating a mechanism for applying a downward pressure to the uppermost portion of the catch 96 to cause the catch 96 deform and disengage from the lip 98 located on the outer wall 16 of the outer bin 14. This enables the base 18 to move away from the outer wall 16 to allow dirt and dust that has been collected in the separating apparatus 12 to be emptied into a dustbin or other receptacle. The button 298 is positioned on the handle 280 so that the button 298 is both located beneath the outlet duct 30 when the outlet duct 30 is in its lowered position and facing the main body 22 of the rolling assembly 20.

The actuating mechanism comprises a lower push member 300, preferably in the form of a rod, slidably mounted on the outer wall 16 of the outer bin 14. The outer wall 16 of the outer bin 14 comprises a plurality of retaining members 302 for retaining the lower push member 300 on the outer bin 14, and which constrain the lower push member 300 to slide towards or away from the catch 96. The lower push member 300 comprises an upper end 304 located adjacent the second cyclonic separating unit of the separating apparatus 12, and a lower end 306 for engaging the catch 96. The lower push member 300 is not biased in any direction.

10 The actuating mechanism further comprises an upper push member 308, preferably also in the form of a rod, slidably located within a recess 310 located between the inner portion 284a and the outer portion 284b of the body 284 of the handle 280. The upper push member 308 comprises a lower body 312 having a lower end 314 for engaging the upper end 304 of the lower push member 300. The lower end 314 protrudes radially outward through an aperture formed in the outer wall of the second cyclonic separating unit. The upper push member 308 further comprises an upper body 316 connected to, and preferably integral with, the lower body 312, and which comprises an outer frame 318 extending about an arm 320. The arm 320 is pivotable relative to the lower body 312, and internally biased towards the inner portion 284a of the body 284 of the handle 280.

The manually operable button 298 is biased in a generally upward direction by a second resilient member. This resilient member is in the form of a second helical spring 322. The lower end of the second helical spring 322 engages the upper end 324 of the inner portion 284a of the body 284, whereas the upper end of the third helical spring 322 engages a lower surface of the button 298 to urge the button 298 upwardly so that the upper surface of the button 298 is substantially flush with the upper surface of the handle 280. The button 298 also comprises a downwardly extending portion 328 which extends into the recess 310 formed in the body 284 of the handle 280.

With particular reference to Figure 19, when the handle 280 is in its retracted position the downwardly extending portion 328 of the button 298 is located between the inner portion 284a of the body 284 and the upper body 316 of the upper push member 308. This prevents the catch 96 from being urged away from the lip 98 by the lower push member 300 in the event that the button 298 is depressed when the handle 280 is in its retracted position. The downwardly extending portion 328 of the button 298 engages and urges the arm 320 of the upper push member 308 away from the inner portion 284a of the body 284. As the handle 280 moves towards its extended position, under the action of the second helical spring 322 the button 298 is forced to move with the handle 280, causing the downwardly extending portion 328 of the button 298 to slide upwardly relative to the upper push member 308 and move beyond the upper end of the arm 320 of the upper push member 308. This allows the arm 320 to move towards the inner portion 284a of the body 284 of the handle 280. As illustrated in Figure 20, when the handle 280 is in its extended position the downwardly extending portion 328 of the button 298 is located above the arm 320.

To enable the collected dirt and dust to be emptied from the separating apparatus 280, the user removes the separating apparatus 12 from the vacuum cleaner 10. While holding the separating apparatus 12 by the handle 280, which is now in its extended position, the user depresses the button 298, which moves downwardly against the biasing force of the second helical spring 322 and abuts the upper end of the arm 320 of the upper push member 308. Continued downward movement of button 298 against the biasing force of the second helical spring 322 pushes the lower end 314 of the upper push member 308 against the upper end 304 of the lower push member 300. This in turn pushes the lower end 306 of the lower push member 300 against the catch 96. The downward pressure thus applied to the catch 96 causes the catch 96 to move away from the lip on the outer wall 16 of the outer bin 14, allowing the base 18 to drop away from the outer wall 16 so that dirt and dust collected within the separating apparatus 12 can be removed therefrom.

When the user releases pressure from the button 298, the third helical spring 322 returns the button 298 respectively to the positions illustrated in Figure 20. As the lower push member 300 is not biased in any direction, the lower push member 300 and the upper push member 308 are not returned to the positions illustrated in Figures 13 and 20 until
5 the base 18 is swung back to re-engage the catch 96 with the lip on the outer wall 16 of the outer bin 14, whereupon the catch 96 pushes the lower push member 300 back to the position illustrated in Figures 13 and 20.

The invention is not limited to the detailed description given above. Variations will be
10 apparent to the person skilled in the art.

For example the shape and size of the filter assembly, the shape and size of the rim or the base of the filter assembly and of the filter members within the assembly may be altered without departing from the scope of the invention. The rim may be formed
15 around part of the filter members or surround the entire boundary of the filter members. The rim may be manufactured by manufacturing methods such as moulding or potting using materials such as plastics, rubber or polyurethane. Alternatively, the rim may be bonded to the filter members by other techniques and manufacturing methods. For example the rim and filter assembly may be manufactured by heat welding, ultra sonic
20 welding, casting, and adhesive.

It will be appreciated that other filter media having different density and thickness, such as foam materials, paper, HEPA filter media, fabric or open cell polyurethane foam could be used in any combination within the filter members and within the filter
25 assembly. The number and/or the order of filter members may be varied. The filter assembly may form the pre-motor filter of a vacuum cleaner or may form the post-motor filter of a vacuum cleaner.

The filter members may or may not be washable. The filter assembly may be housed in
30 a housing or cage, the housing or cage may be capable of being cleaned by washing. It will also be appreciated that the shape of the filter assembly and any filter housing need

not be cylindrical and other shapes will be equally suitable. The means manually accessible by a user can be any suitable material or shape to facilitate removal of the filter assembly from the appliance or a filter housing, for example, the pillar of the cross-over duct assembly may be hook shaped or a type of tab commonly used for
5 textile materials.

CLAIMS

1. A cleaning appliance comprising separating apparatus for separating dirt from a
5 dirt-bearing air flow and a main body housing means for drawing the air flow through
the separating apparatus, the separating apparatus comprising a cyclonic separating unit,
a filter unit located downstream of the separating unit, and a duct assembly located
within the separating unit, the duct assembly comprising a body, the body comprising at
10 least one inlet duct for conveying the air flow from the cyclonic separating unit towards
the filter unit and at least one outlet duct for conveying the air flow from the filter unit
towards the main body.
2. A cleaning appliance as claimed in claim 1, wherein said at least one inlet duct
15 and said at least one outlet duct are arranged to convey the air flow in substantially
opposite directions.
3. A cleaning appliance as claimed in claim 1 or claim 2, wherein the duct
assembly comprises an annular fluid inlet for receiving the air flow from the cyclonic
separating unit, and wherein said at least one inlet duct is arranged to receive the air
20 flow from the fluid inlet.
4. A cleaning appliance as claimed in claim 3, wherein said at least one inlet duct
has a generally circular cross-section, and the transition between the cross-section of the
annular fluid inlet and the cross-section of said at least one inlet duct is gradual.
25
5. A cleaning appliance as claimed in claim 3 or claim 4, wherein the duct
assembly comprises a fluid outlet for receiving the air flow from said at least one outlet
duct, wherein the fluid outlet of the duct assembly is located on an upper surface of the
separating apparatus.
30

6. A cleaning appliance as claimed in claim 5, wherein the fluid inlet surrounds the fluid outlet.
7. A cleaning appliance as claimed in claim 5 or claim 6, wherein the duct assembly comprises means for isolating the fluid inlet from the fluid outlet.
8. A cleaning appliance as claimed in claim 7, wherein said means for isolating the fluid inlet from the fluid outlet comprises a flexible portion of the duct assembly.
9. A cleaning appliance as claimed in claim 8, wherein the flexible portion of the duct assembly is connected to the upper surface of the body.
10. A cleaning appliance as claimed in any of the preceding claims, wherein said at least one inlet duct has an inlet located on an upper surface of the body and an outlet located on a lower surface of the body.
11. A cleaning appliance as claimed in claim 10, wherein said at least one outlet duct has an inlet located on a side wall of the body.
12. A cleaning appliance as claimed in any of the preceding claims, wherein said at least one inlet duct comprises a plurality of inlet ducts, preferably in the range from two to ten.
13. A cleaning appliance as claimed in any of claims 1 to 11, wherein said at least one outlet duct comprises a plurality of outlet ducts, preferably in the range from two to ten.
14. A cleaning appliance as claimed in claim 12, wherein said at least one outlet duct comprises a plurality of outlet ducts, preferably in the range from two to ten.

15. A cleaning appliance as claimed in claim 14, wherein the plurality of inlet ducts is angularly offset relative to the plurality of inlet ducts.

5 16. A cleaning appliance as claimed in any preceding claim, wherein the separating apparatus comprises a further cyclonic separating unit including a plurality of cyclones arranged in parallel.

17. A cleaning appliance as claimed in claim 16, wherein the plurality of cyclones of the further cyclonic separating unit is arranged around the duct assembly.

10

18. A cleaning appliance as claimed in any preceding claim, wherein the filter unit is removable from the separating apparatus.

15 19. A cleaning appliance as claimed in any preceding claim, wherein the filter unit is washable.

20. A cleaning appliance as claimed in any preceding claim, wherein the filter unit is attached to the duct assembly.

20 21. A cleaning appliance as claimed in claim 20, wherein the duct assembly comprises manually accessible means for removing the filter unit from the appliance.

22. A cleaning appliance as claimed in any preceding claim, wherein the filter unit comprises a plurality of filter members held adjacent one another in a cylindrical shape.

25

23. A cleaning appliance as claimed in claim 22, wherein the plurality of filter members are held in a cylindrical shape by a deformable rim formed around an upper end of the filter unit.

30 24. A cleaning appliance as claimed in claim 22 or claim 23, wherein the plurality of filter members are held in a cylindrical shape closed by a base member.

25. A cleaning appliance substantially as herein described with reference to the accompanying drawings.

5 26. A filter assembly for a cleaning appliance, the filter assembly being in the form of a cartridge removably insertable within the appliance, and comprising a filter unit and a duct assembly connected to the filter unit, the duct assembly comprising a fluid inlet, a fluid outlet, and a body having at least one inlet duct for conveying an air flow from the fluid inlet towards the filter unit and at least one outlet duct for conveying the
10 air flow from the filter unit to the fluid outlet.

27. A filter assembly as claimed in claim 26, wherein the duct assembly comprises means for isolating the fluid inlet from the fluid outlet.

15 28. A filter assembly as claimed in claim 27, wherein said means for isolating the fluid inlet from the fluid outlet comprises a flexible portion of the duct assembly.

29. A filter assembly as claimed in claim 28, wherein the flexible portion of the duct assembly is connected to the upper surface of the body.

20

30. A filter assembly as claimed in any of claims 26 to 29, wherein said at least one inlet duct has an inlet located on an upper surface of the body and an outlet located on a lower surface of the body.

25 31. A filter assembly as claimed in claim 30, wherein said at least one outlet duct has an inlet located on the side wall of the body.

32. A filter assembly as claimed in any of claims 26 to 31, wherein the filter assembly is washable.

30

33. A filter assembly as claimed in any of claims 26 to 32, wherein said at least one inlet duct comprises a plurality of inlet ducts, preferably in the range from two to ten.

34. A filter assembly as claimed in any of claims 26 to 33, wherein said at least one outlet duct comprises a plurality of outlet ducts, preferably in the range from two to ten.

35. A cleaning appliance having an airflow path and at least one filter assembly as claimed in any of claims 26 to 34 removably located in the airflow path.

36. A cleaning appliance as claimed in claim 35, comprising a motor for causing air to flow along the airflow path, wherein the filter assembly is positioned upstream of the motor.

37. A filter assembly substantially as herein described with reference to the accompanying drawings.

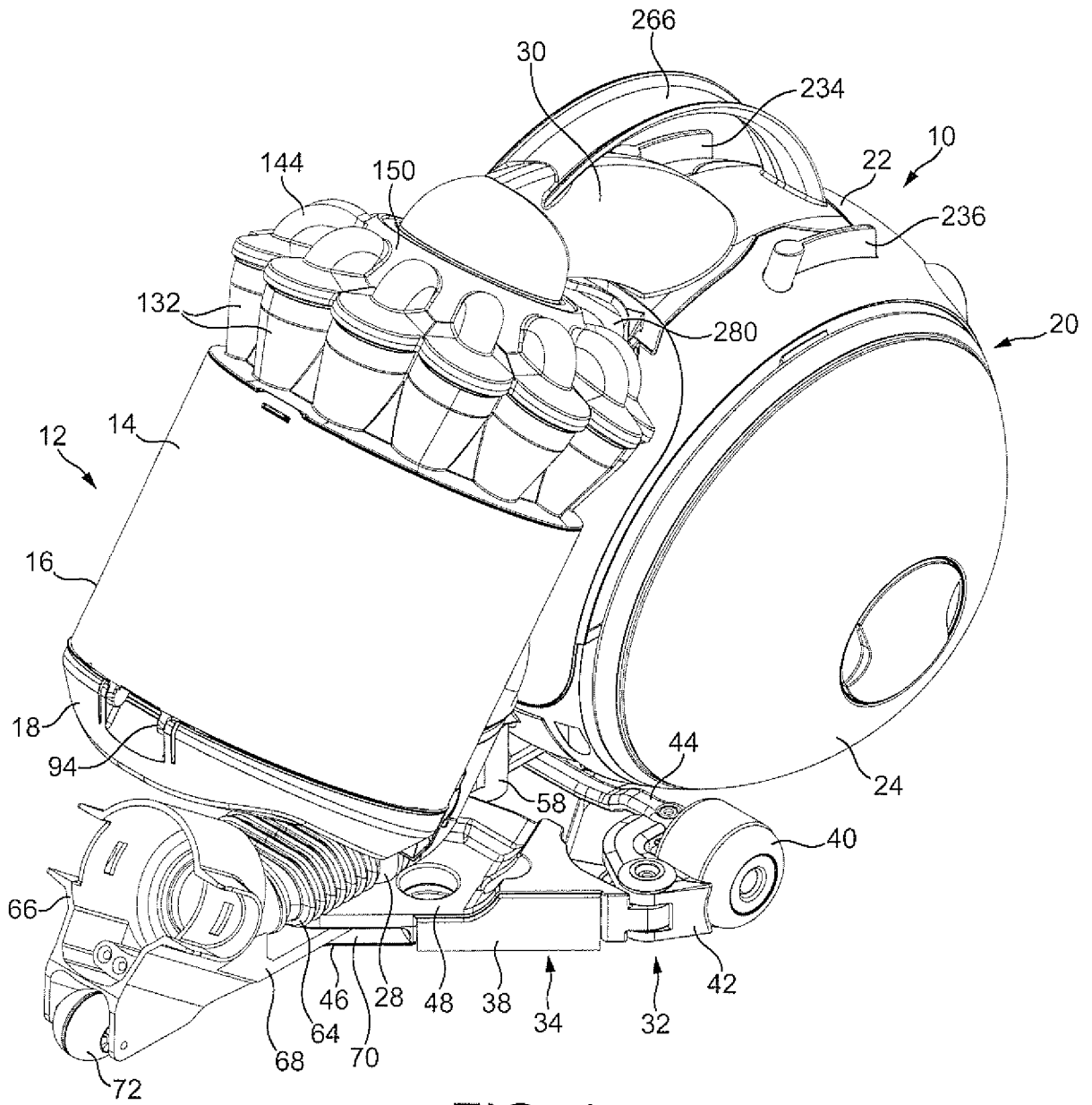


FIG. 1

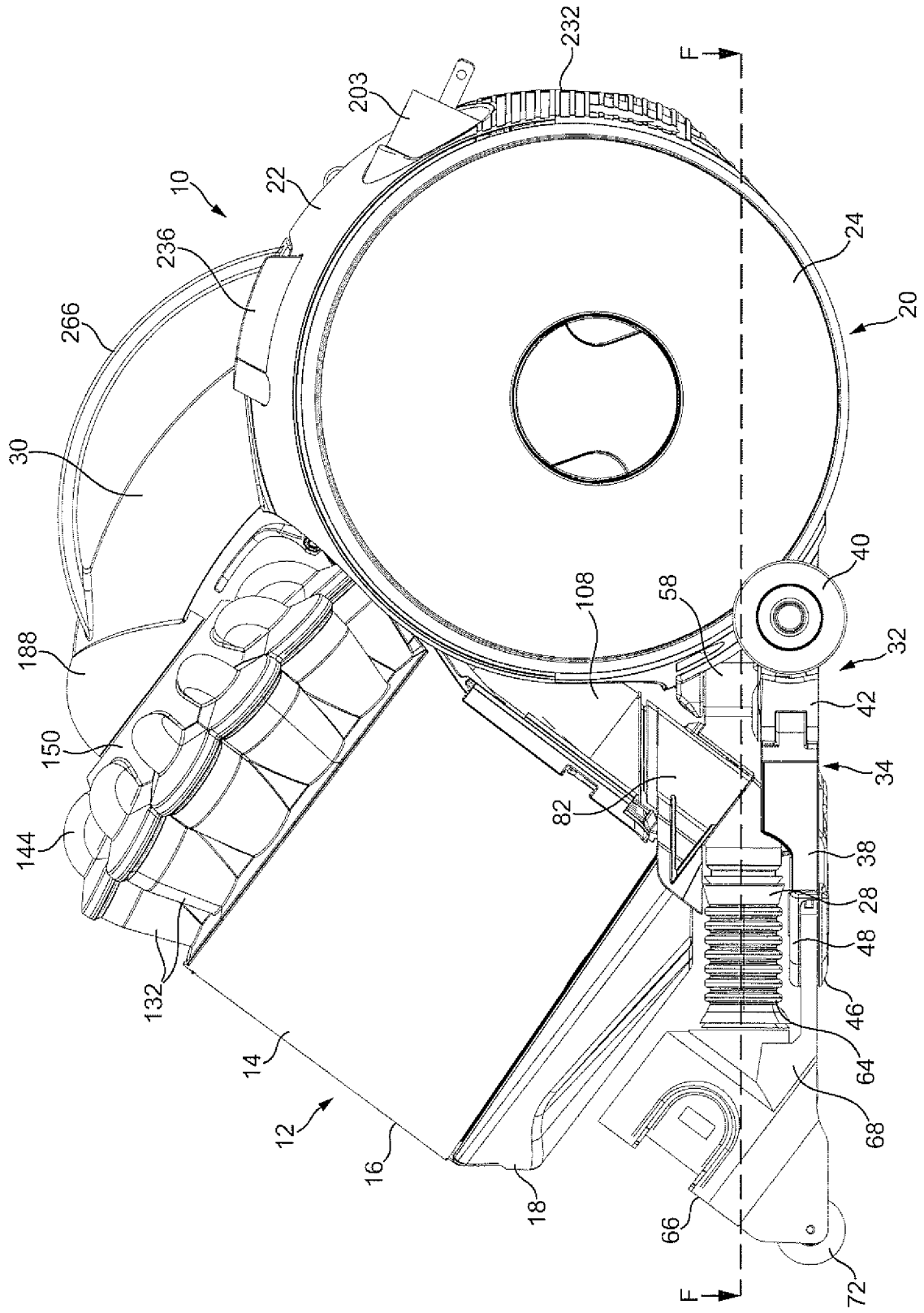


FIG. 2

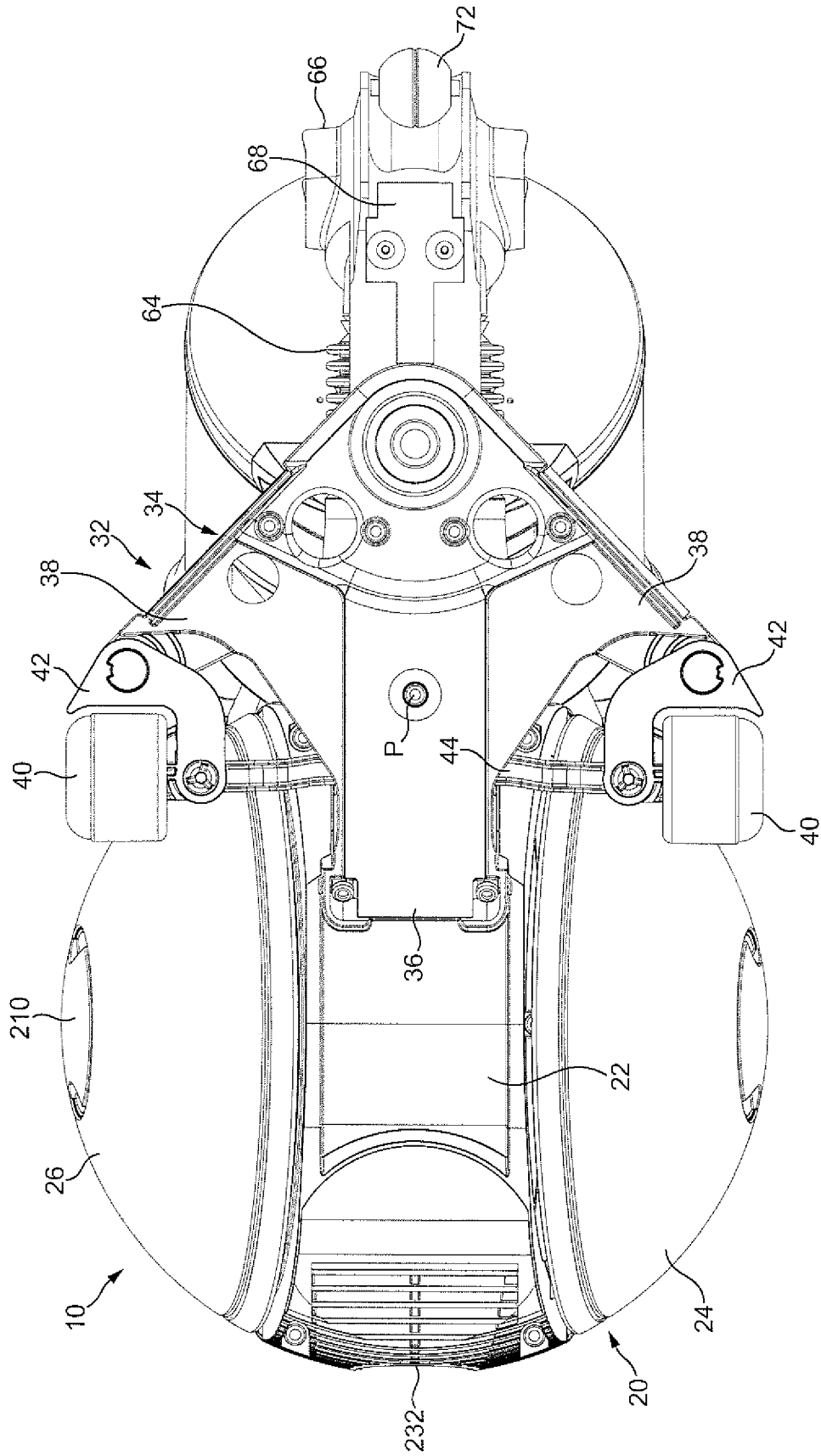


FIG. 3

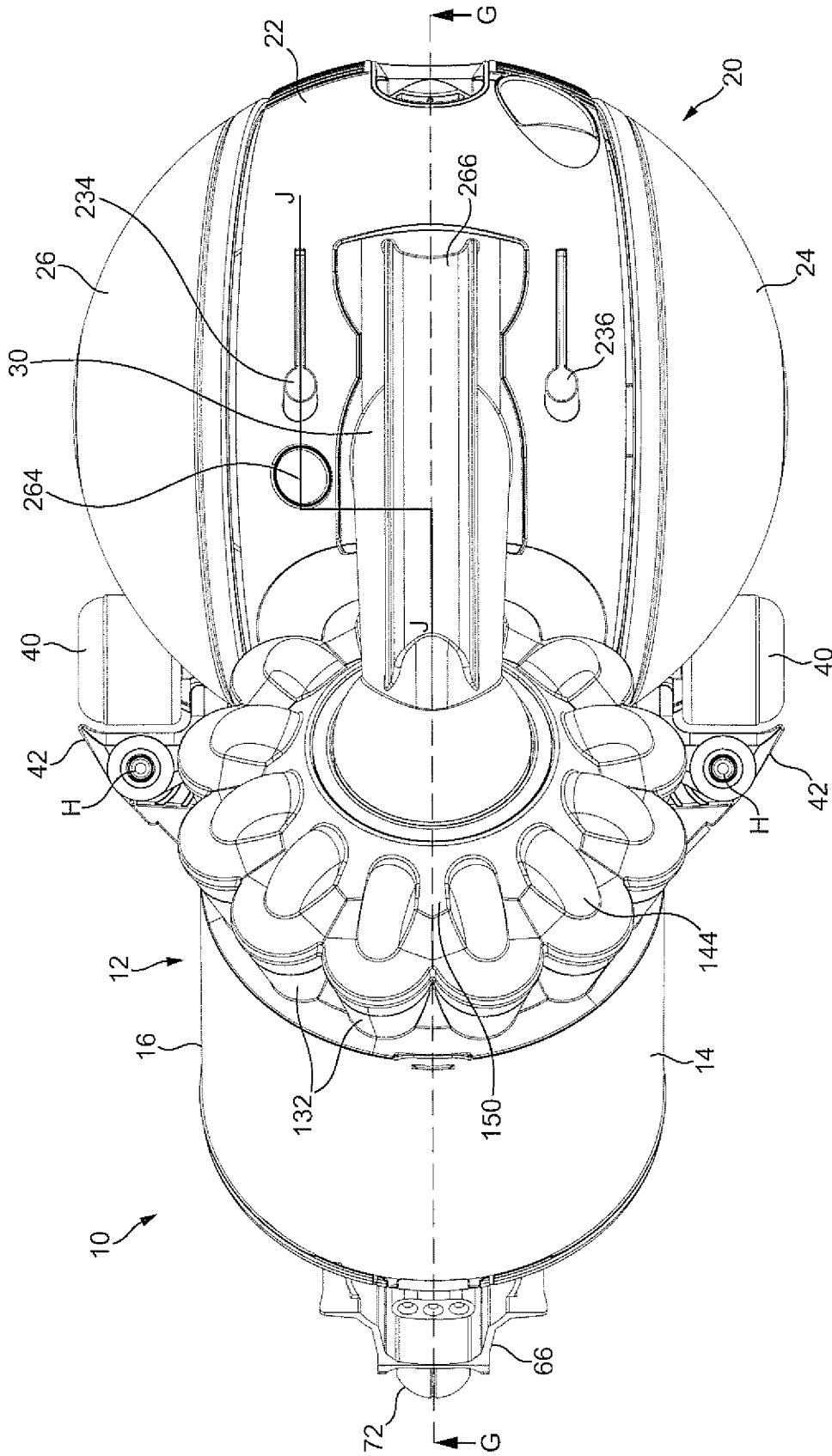


FIG. 4

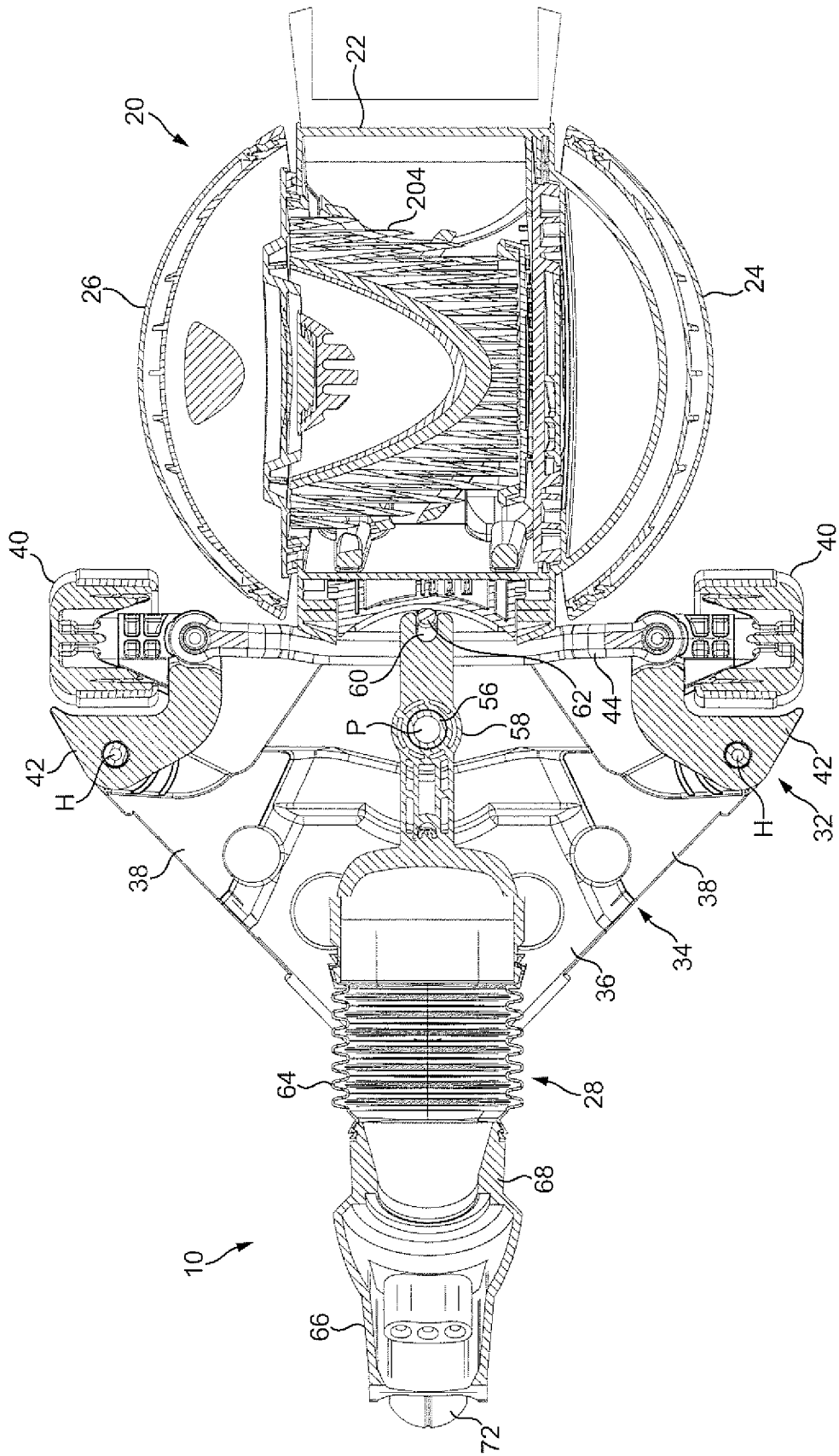


FIG. 5

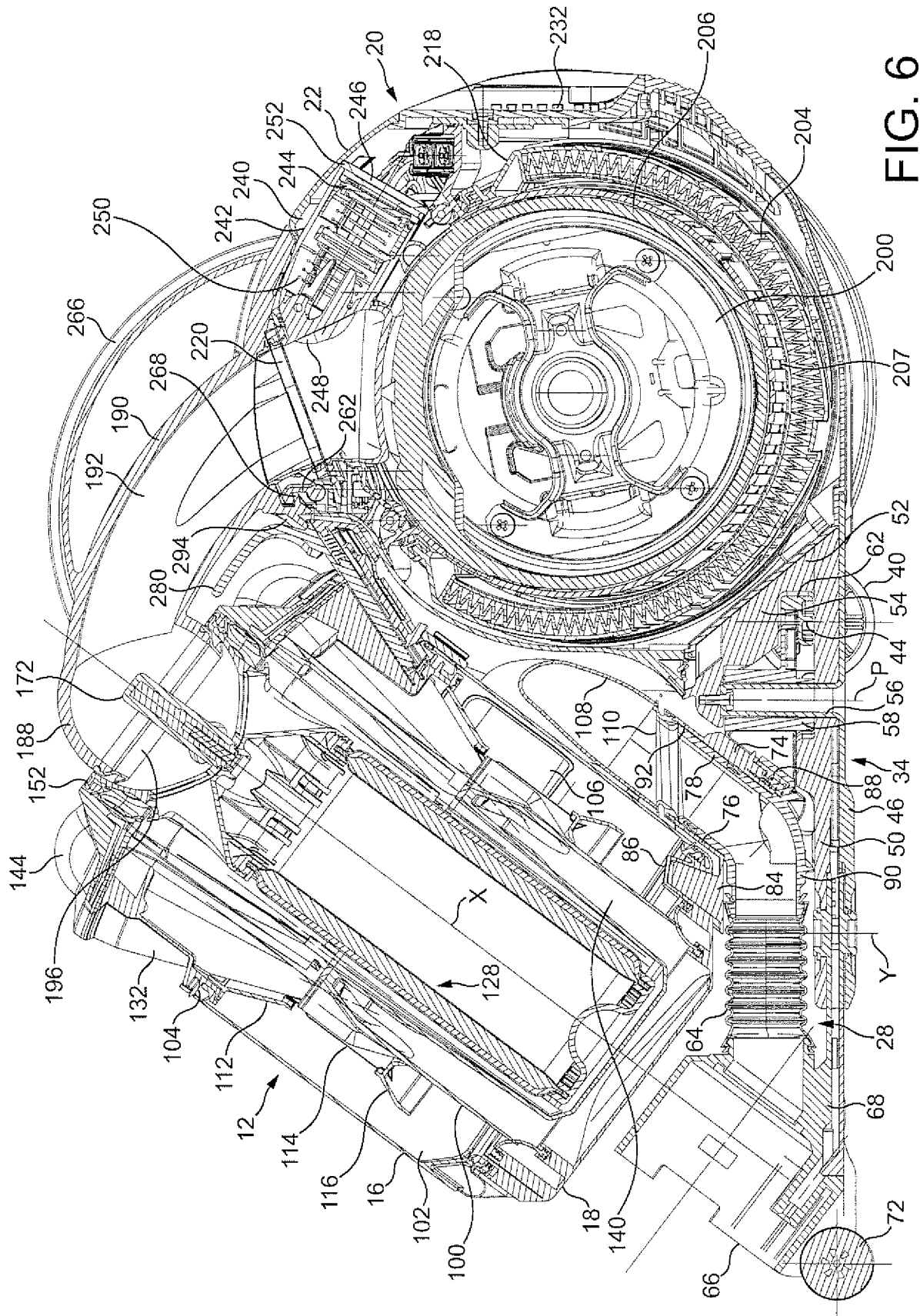


FIG. 6

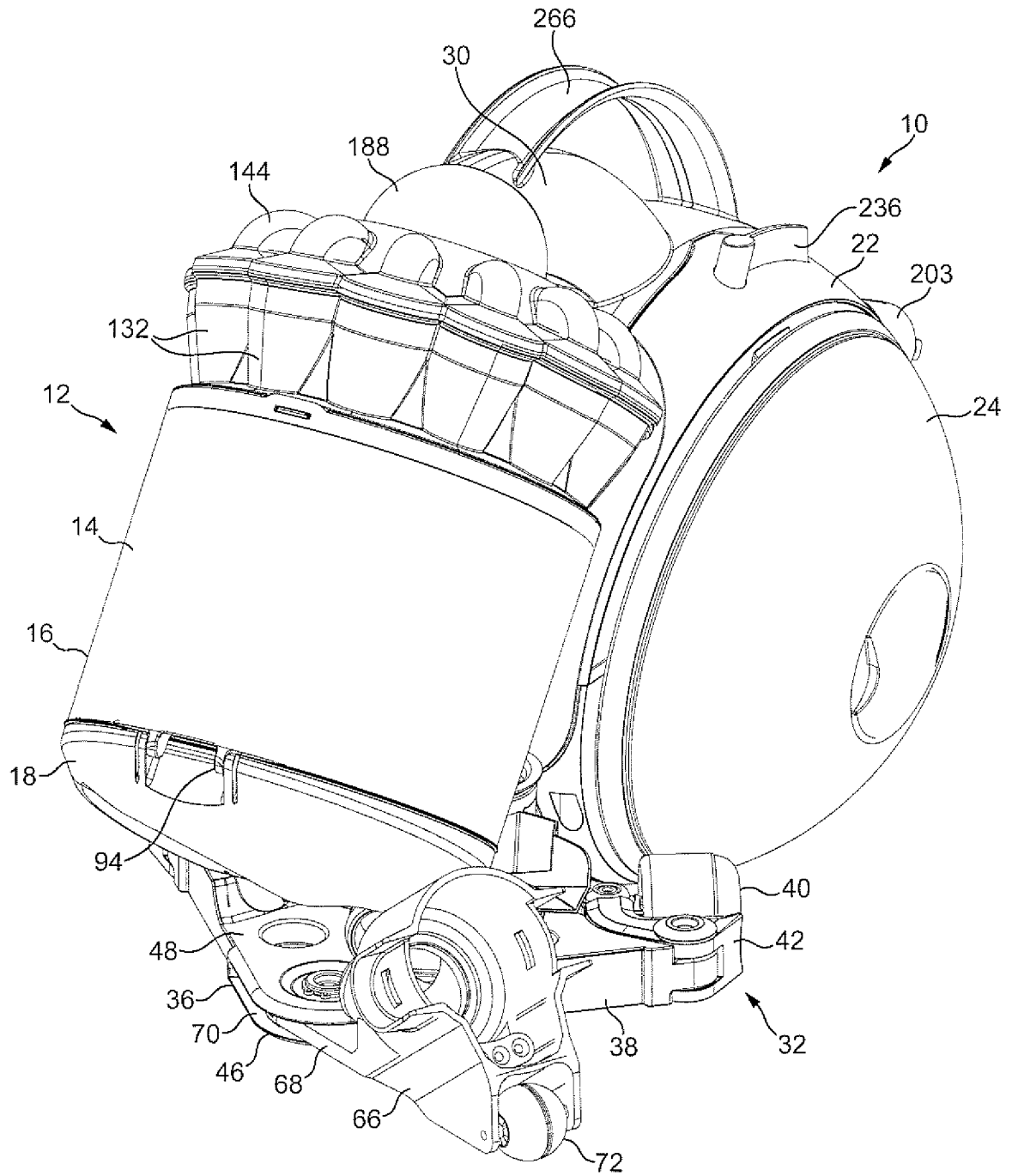


FIG. 7

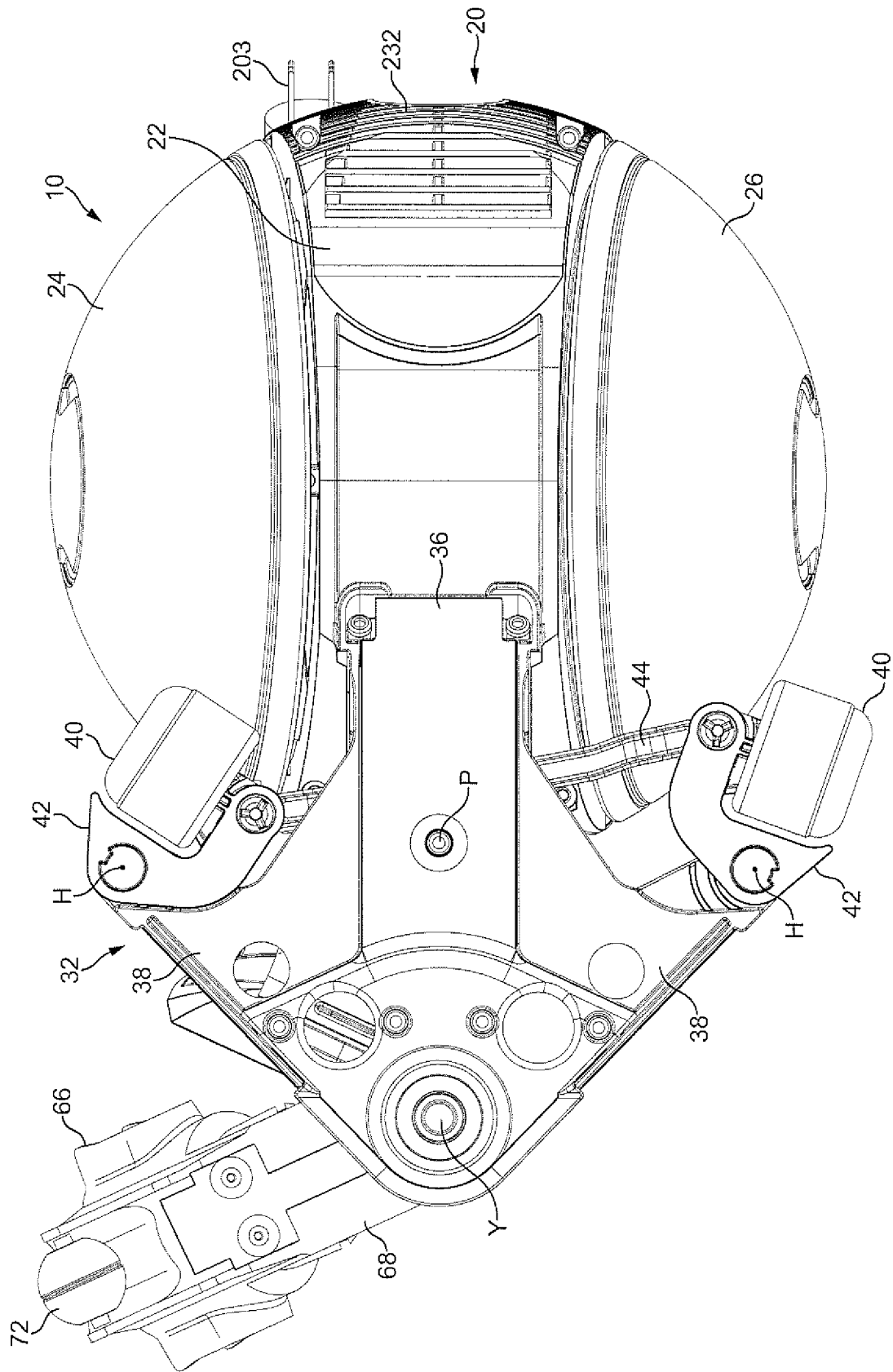


FIG. 8

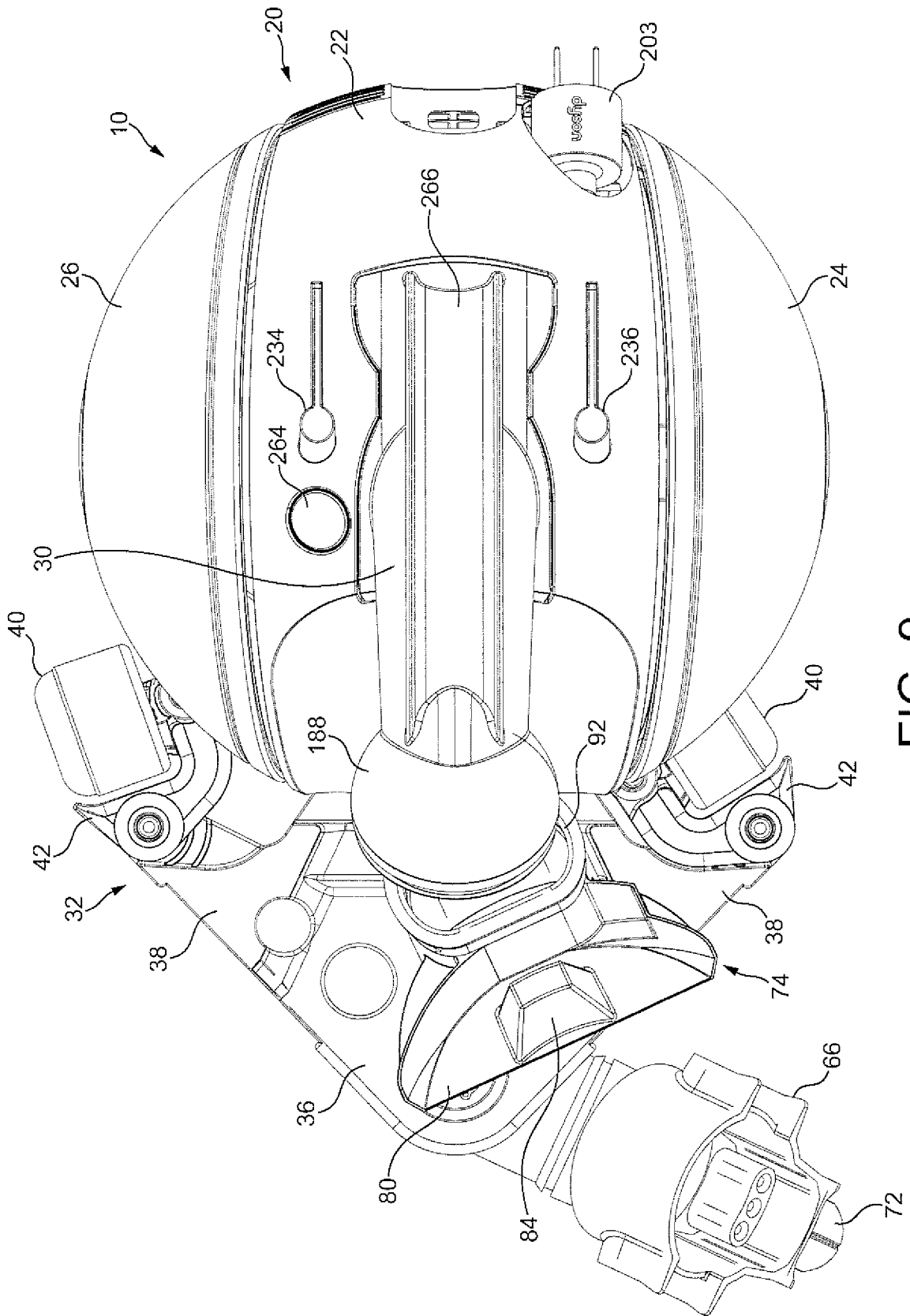


FIG. 9

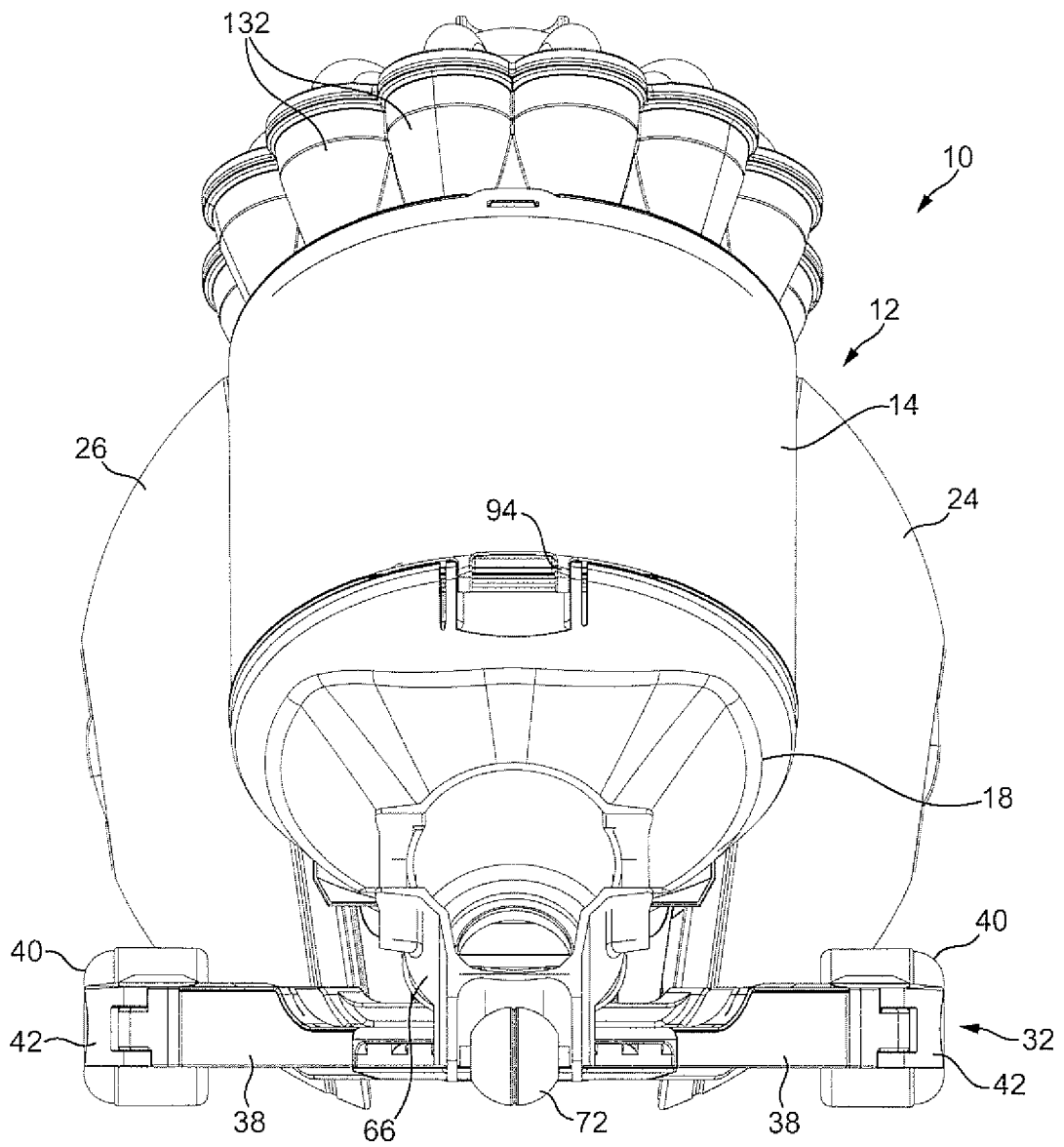


FIG. 10

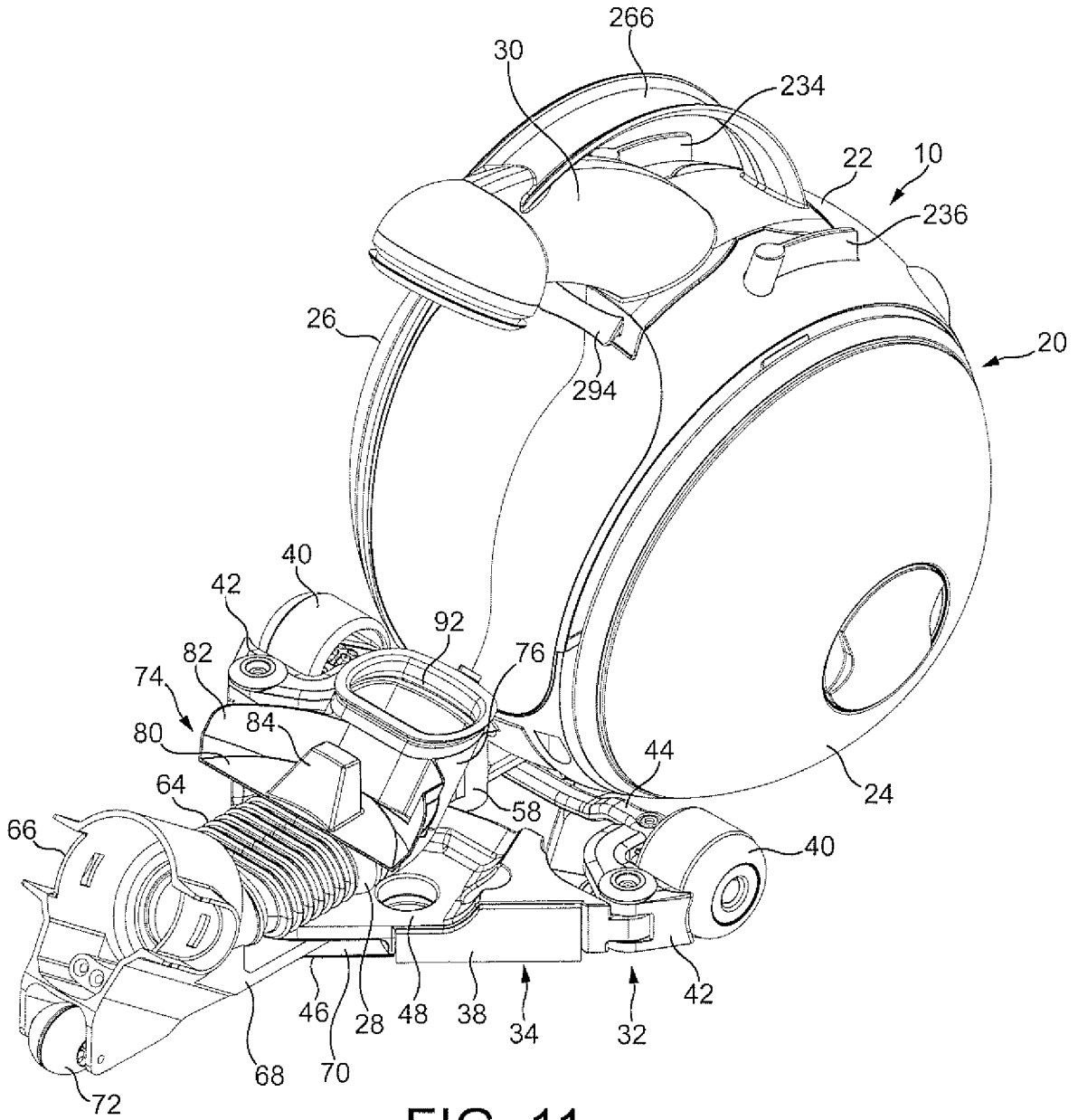


FIG. 11

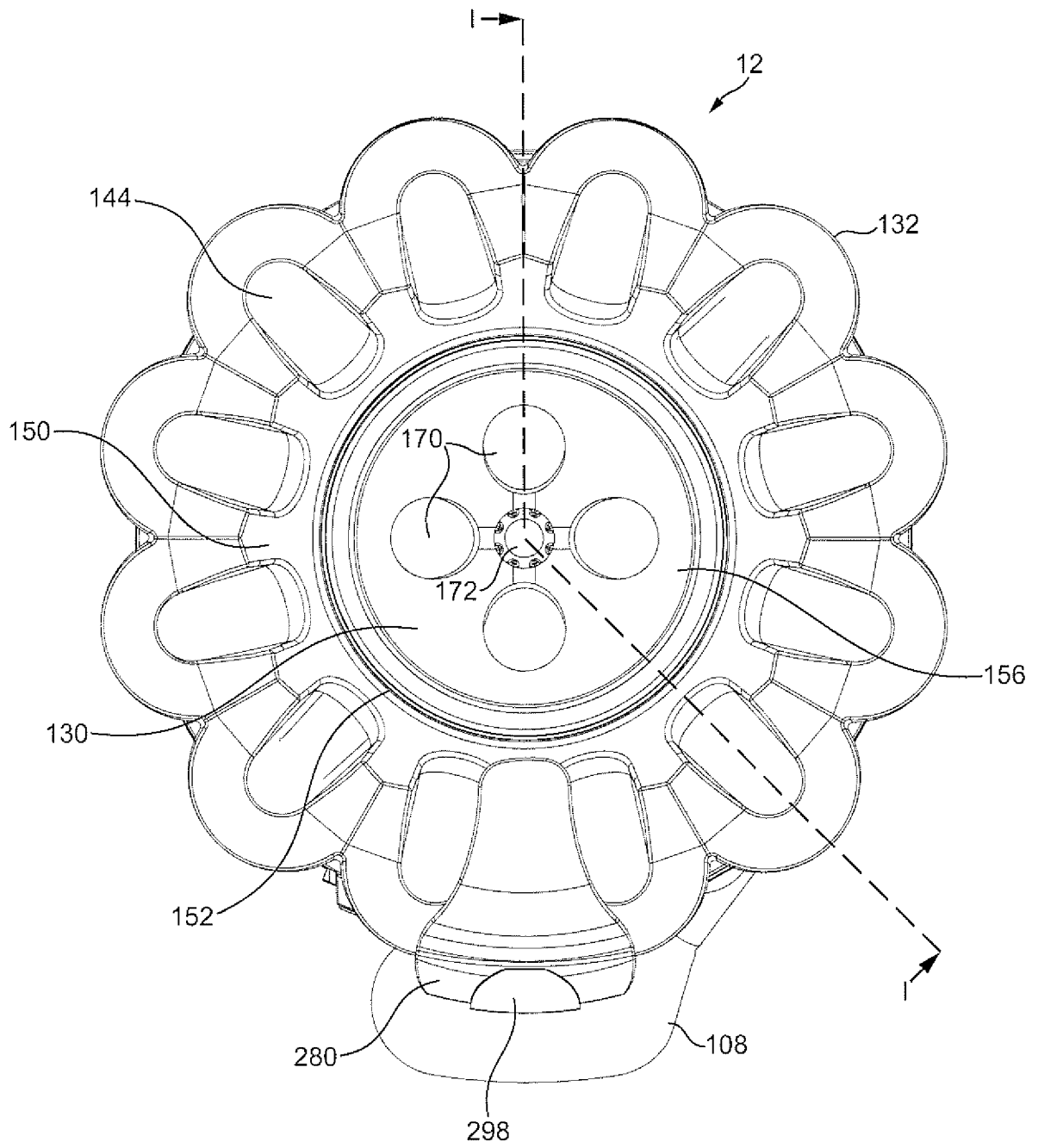


FIG. 12

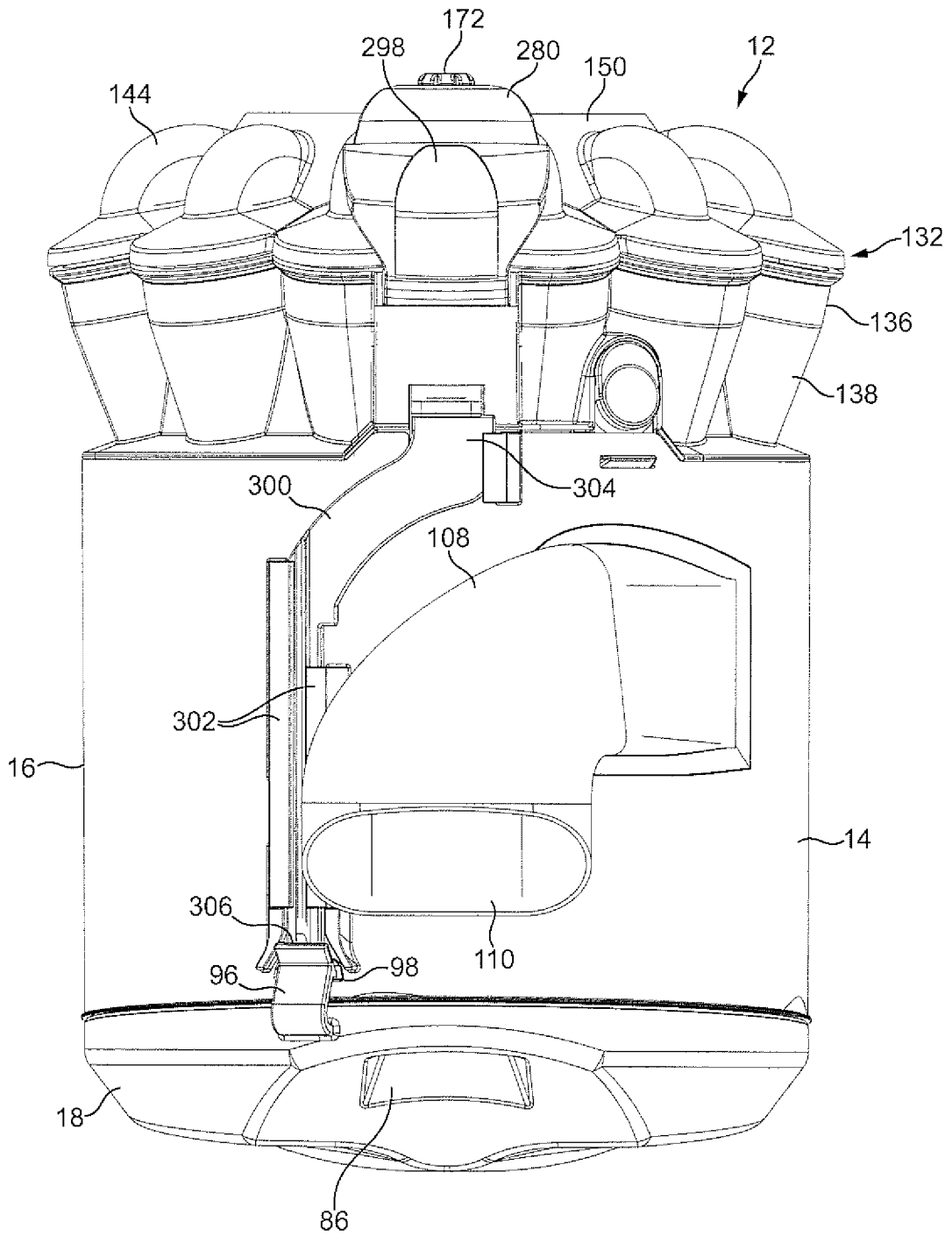


FIG. 13

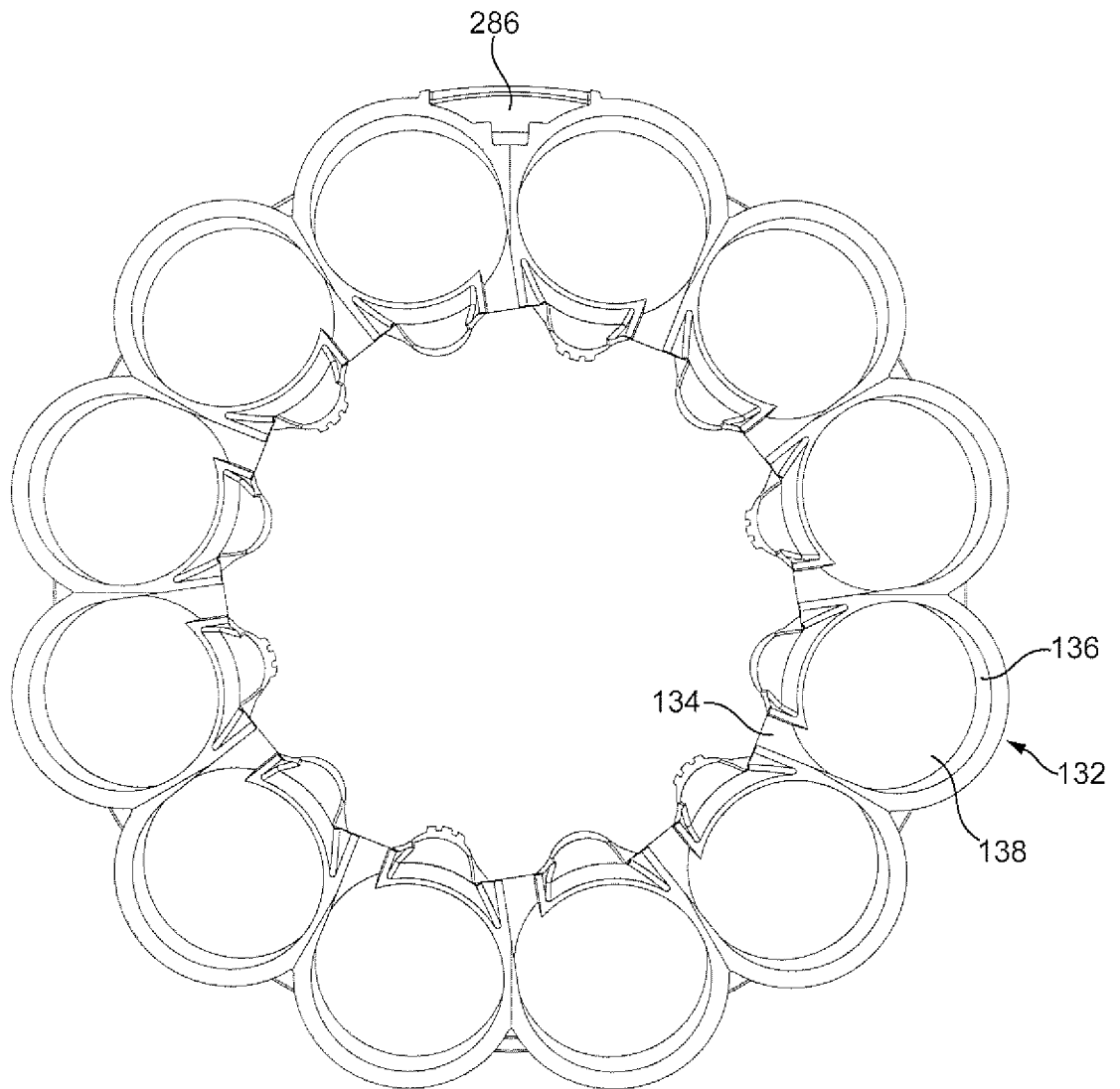


FIG. 14(a)

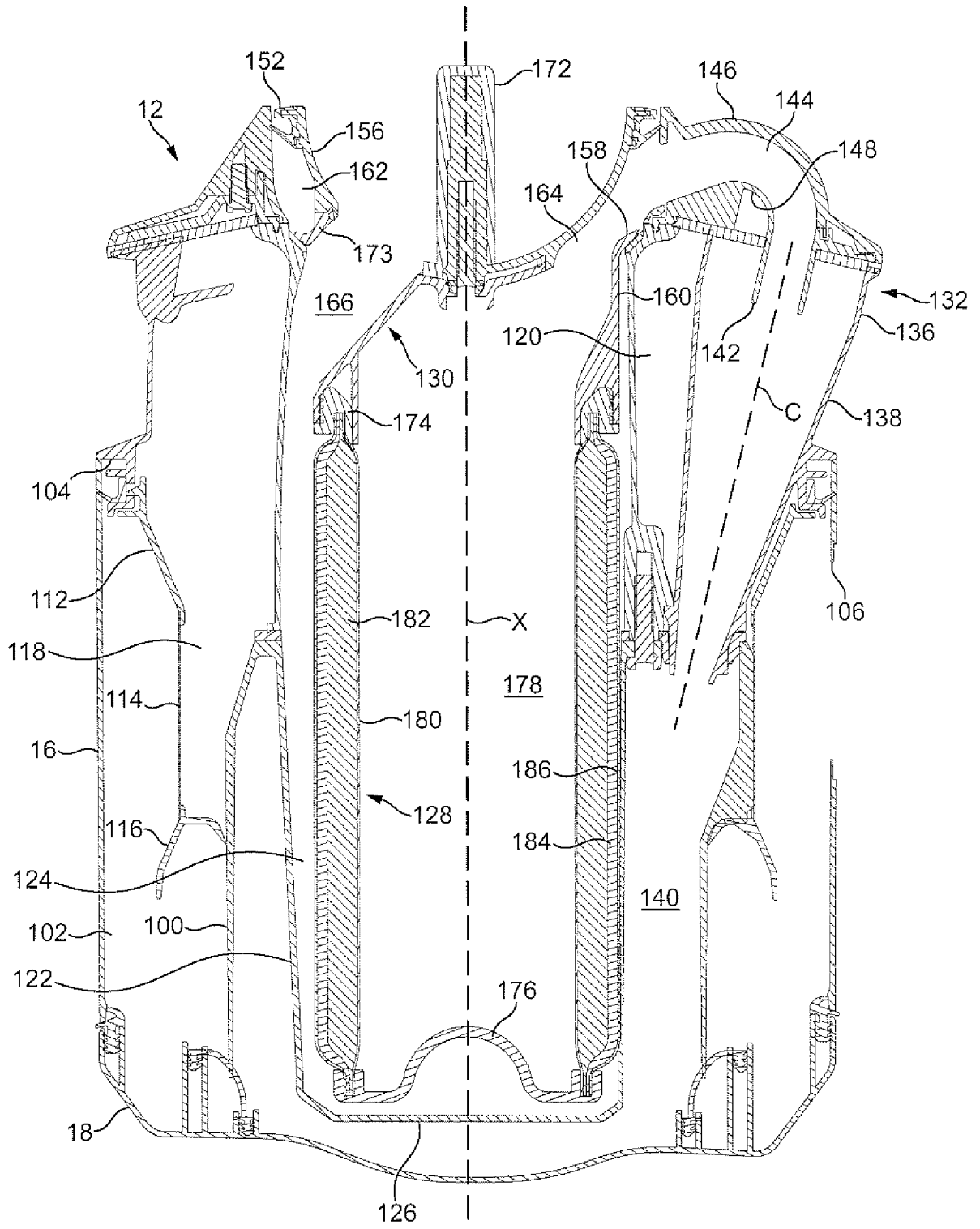


FIG. 14(b)

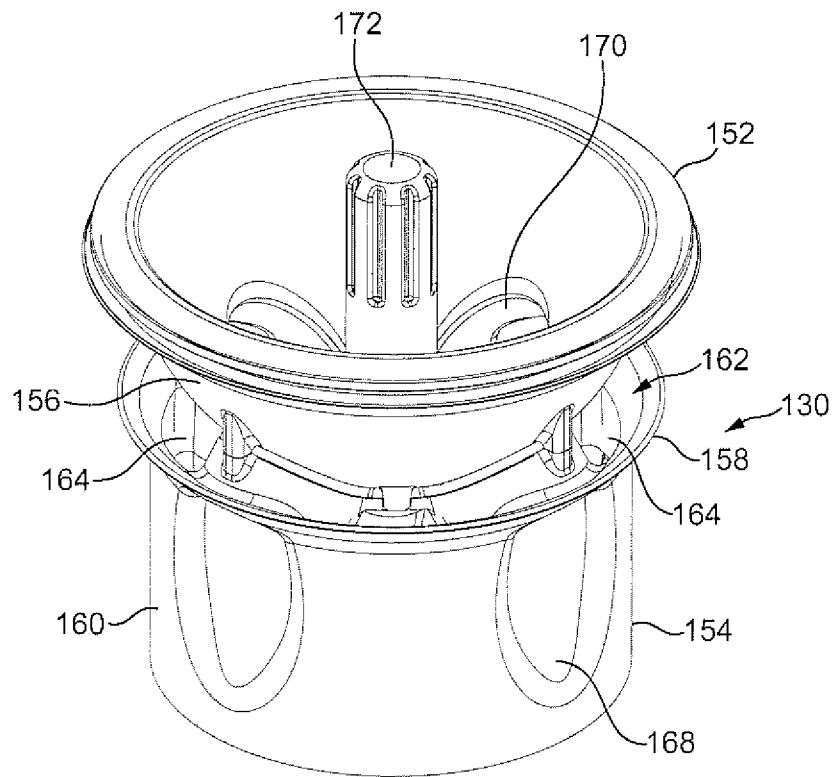


FIG. 14(c)

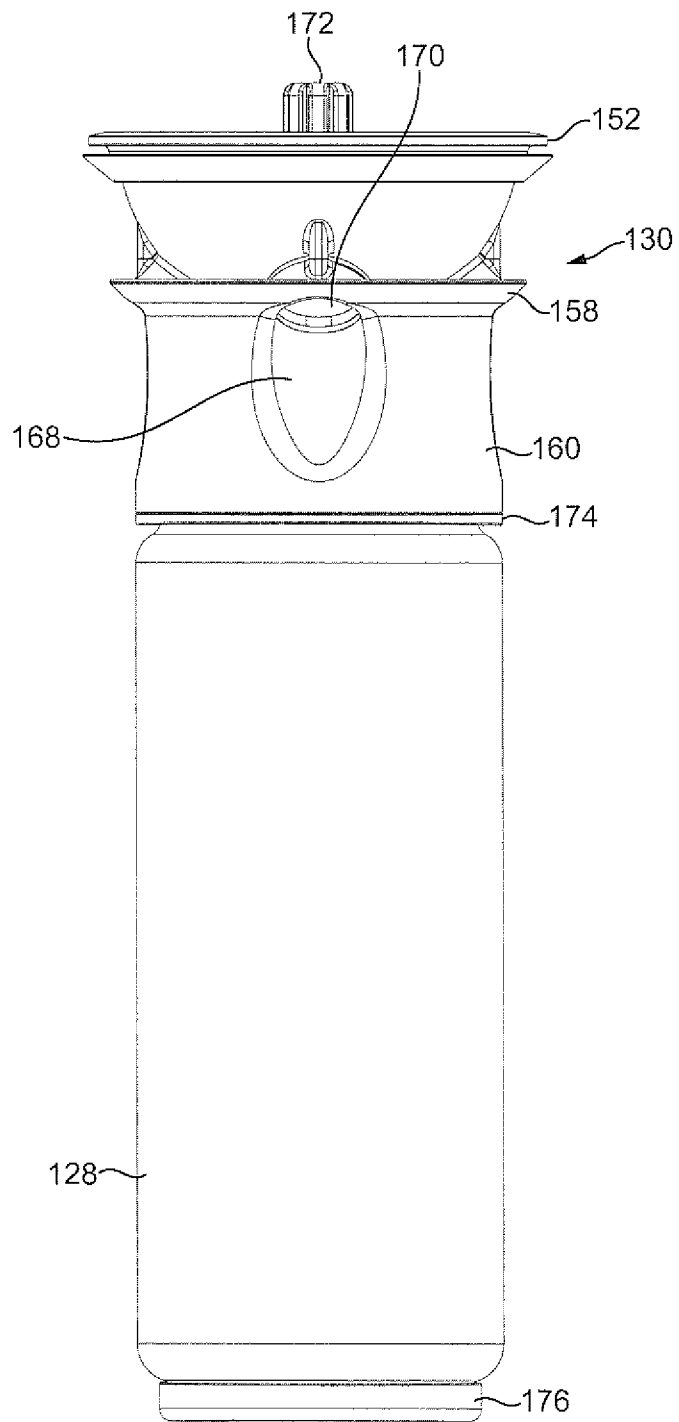


FIG. 15

18 / 26

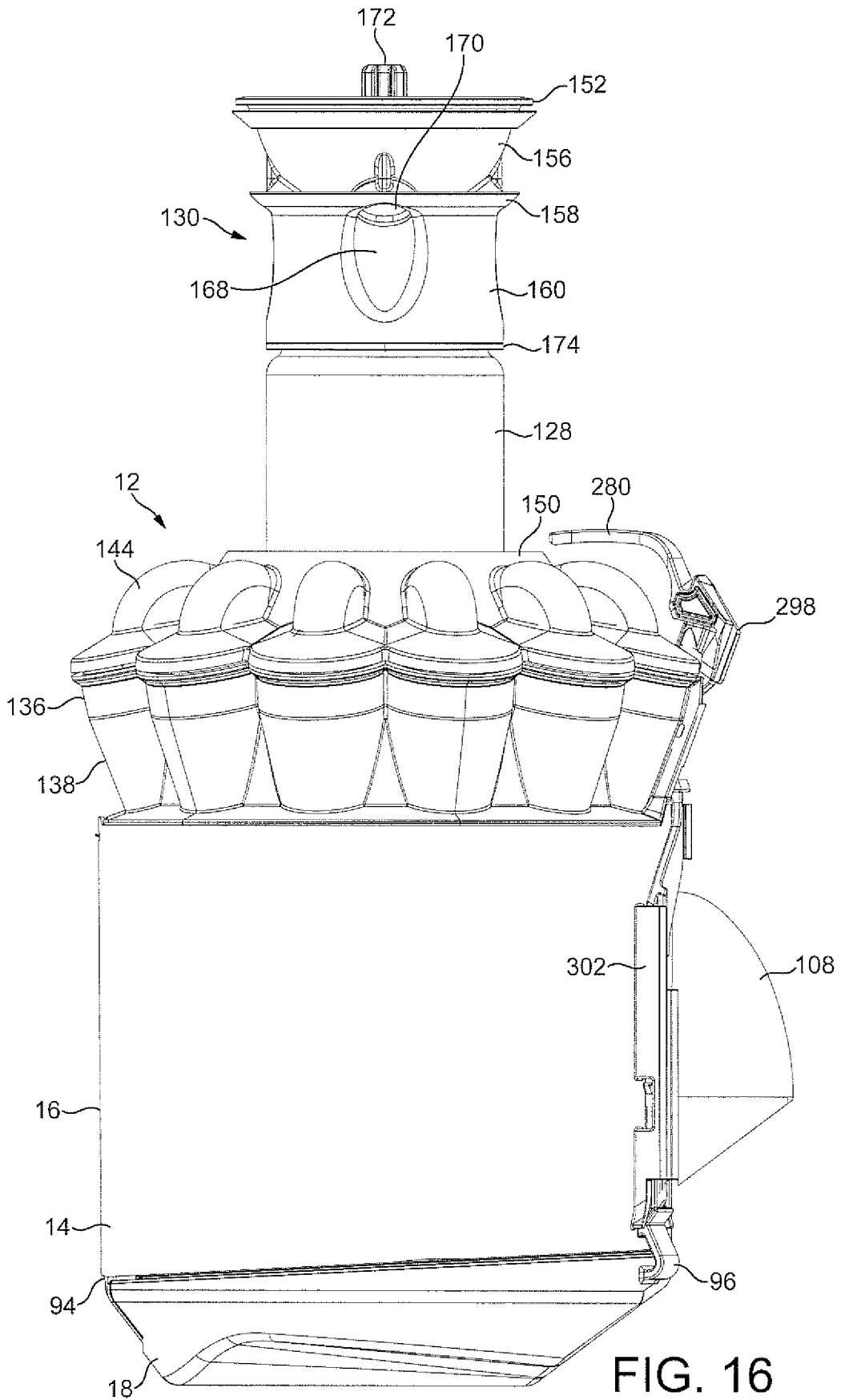


FIG. 16

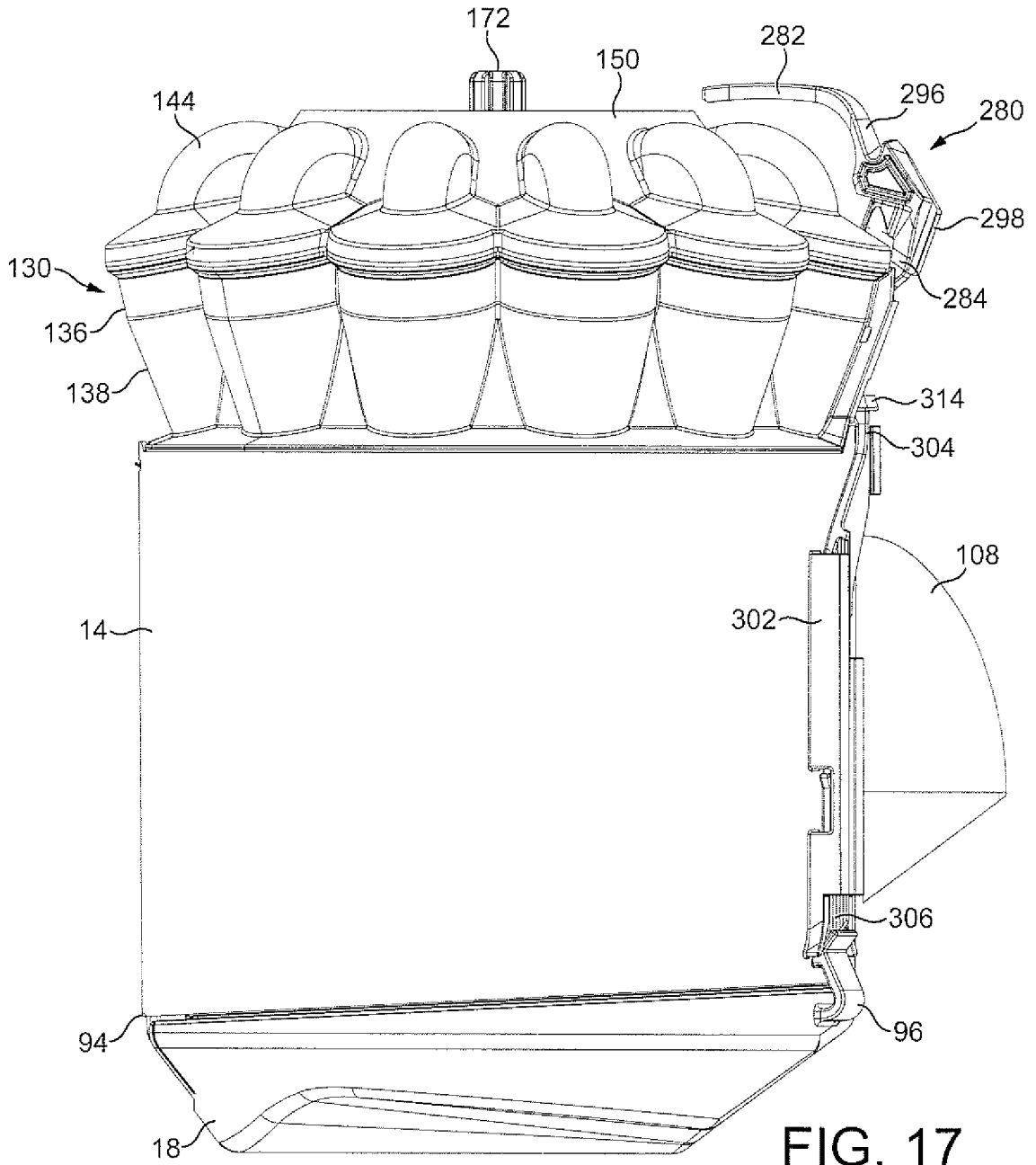


FIG. 17

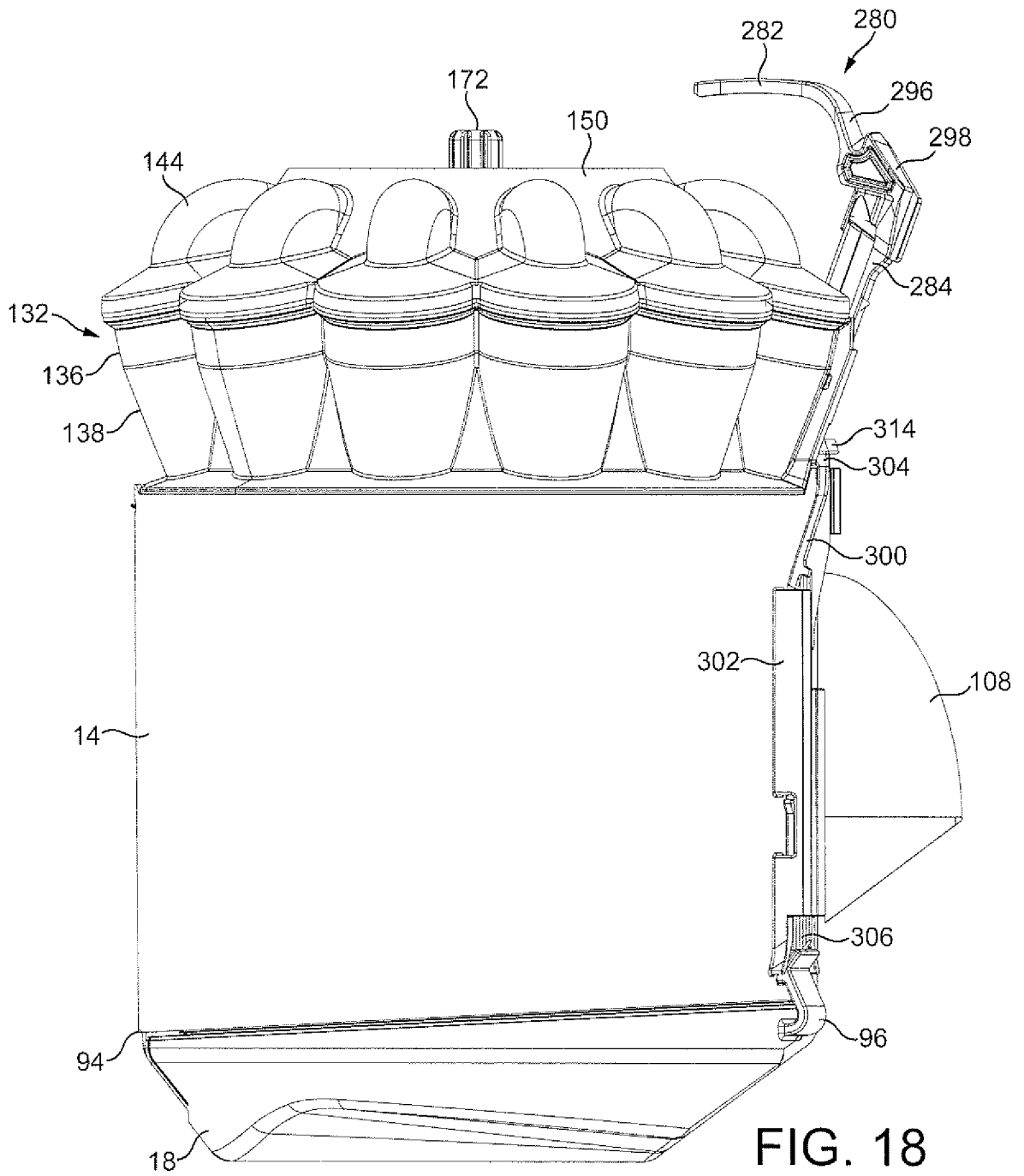


FIG. 18

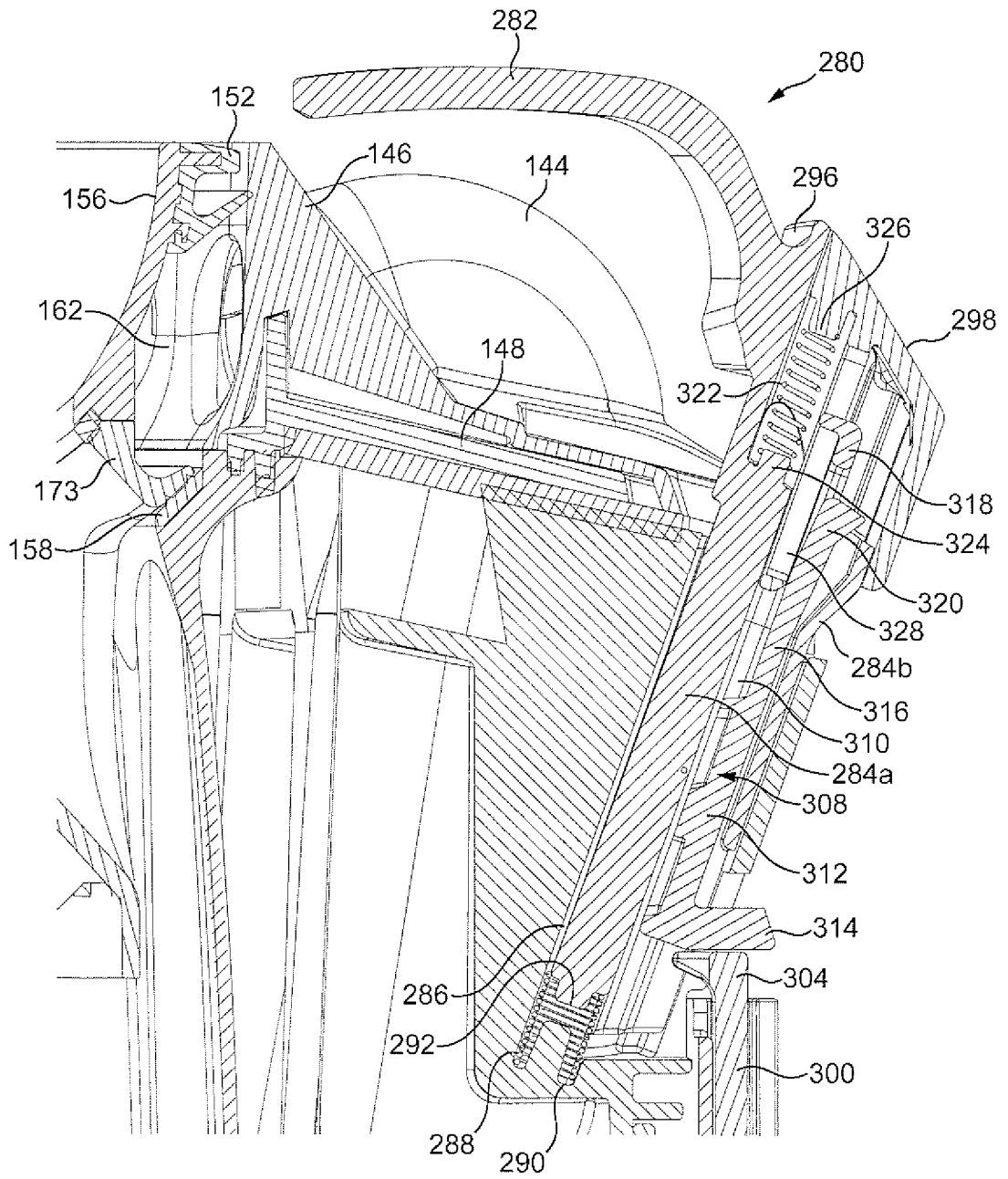


FIG. 19

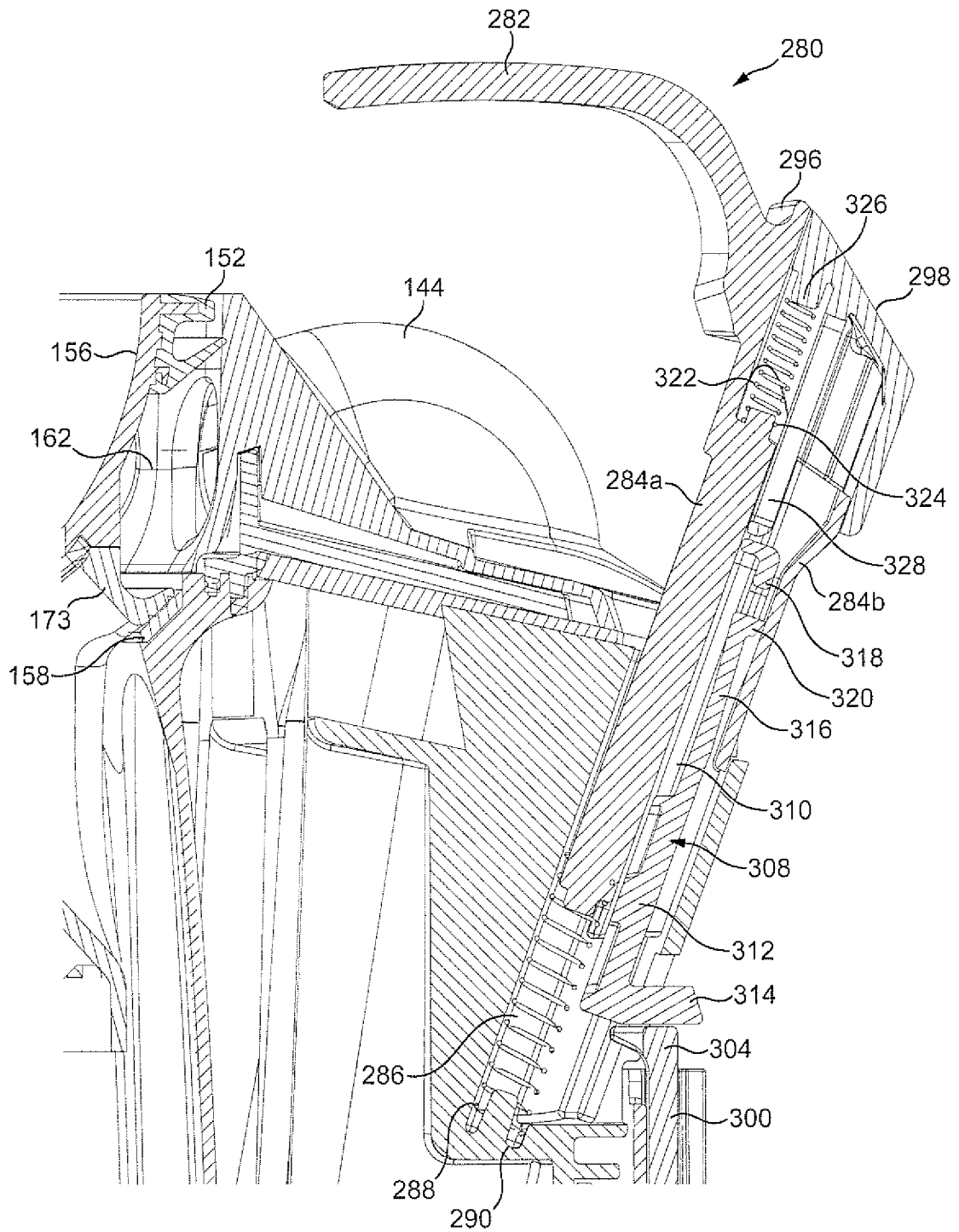


FIG. 20

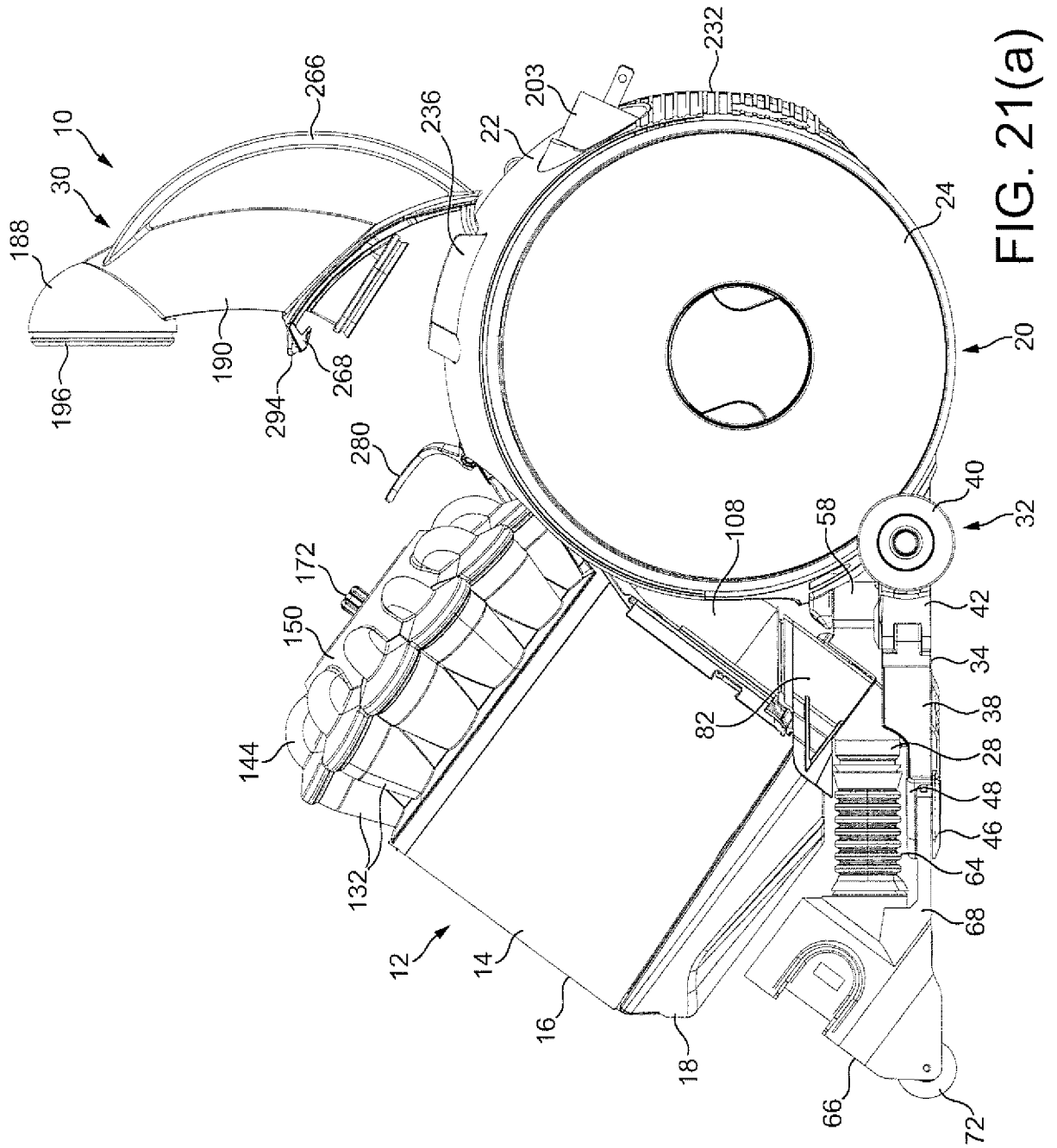


FIG. 21(a)

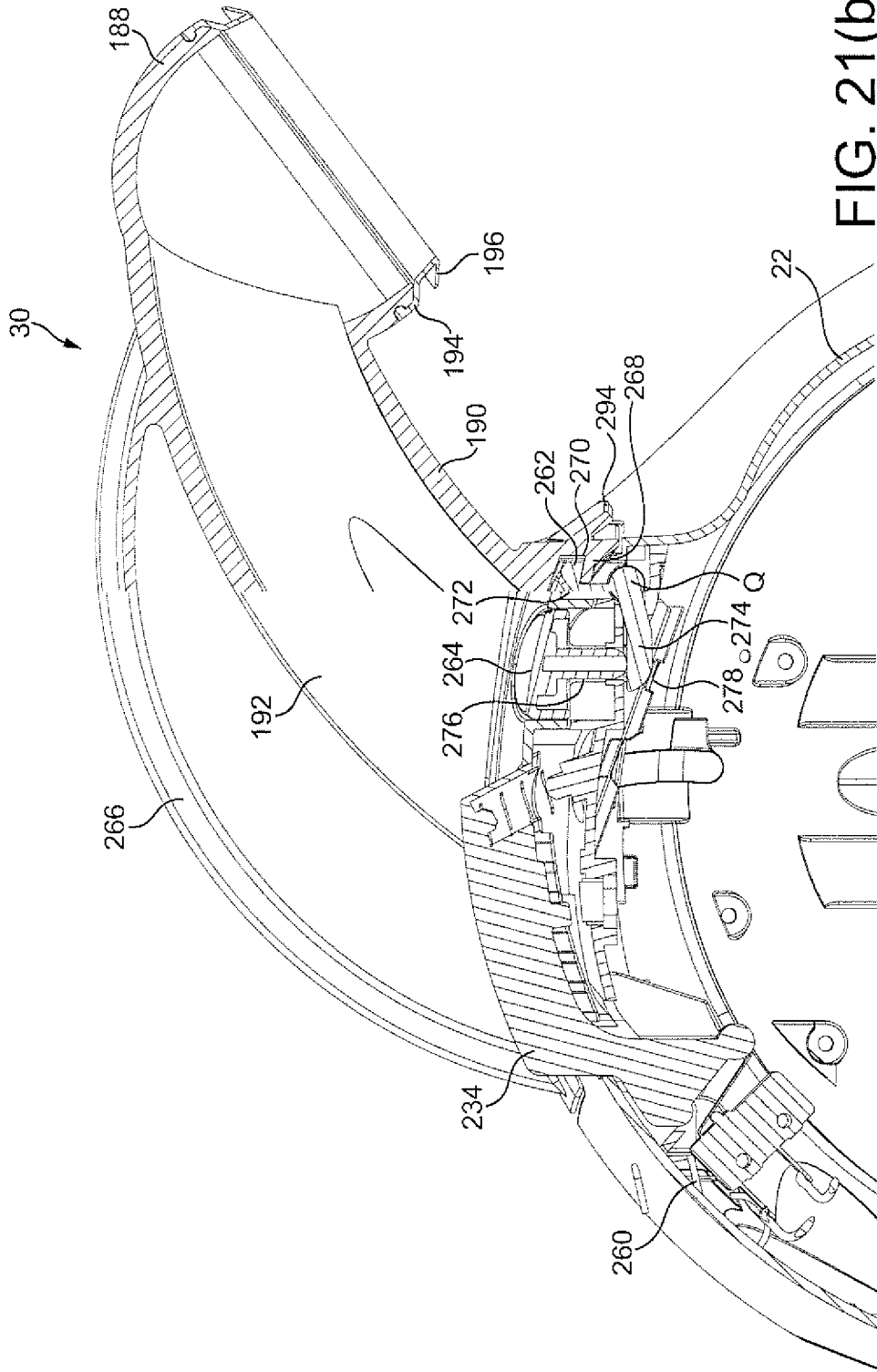


FIG. 21(b)

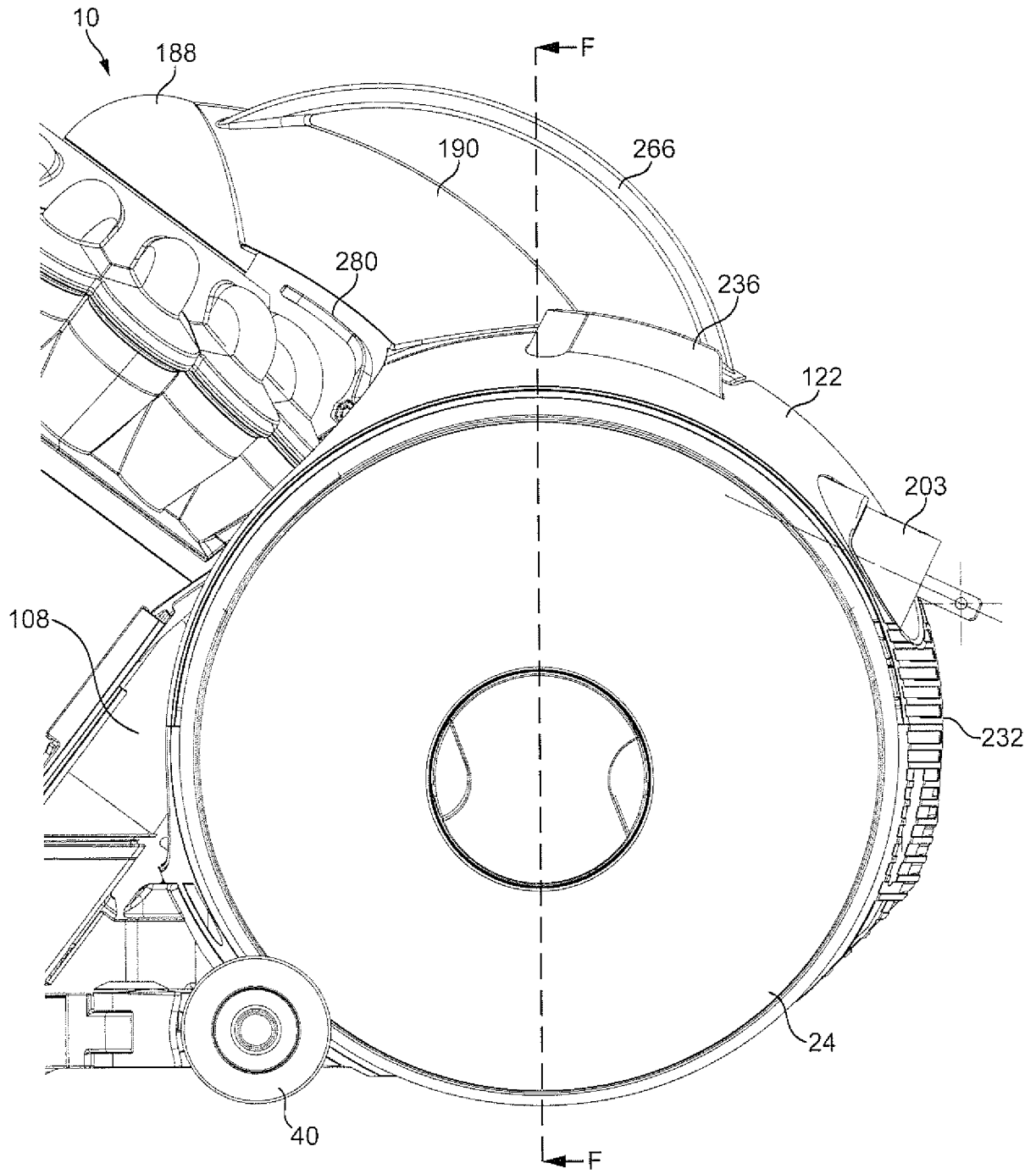


FIG. 22

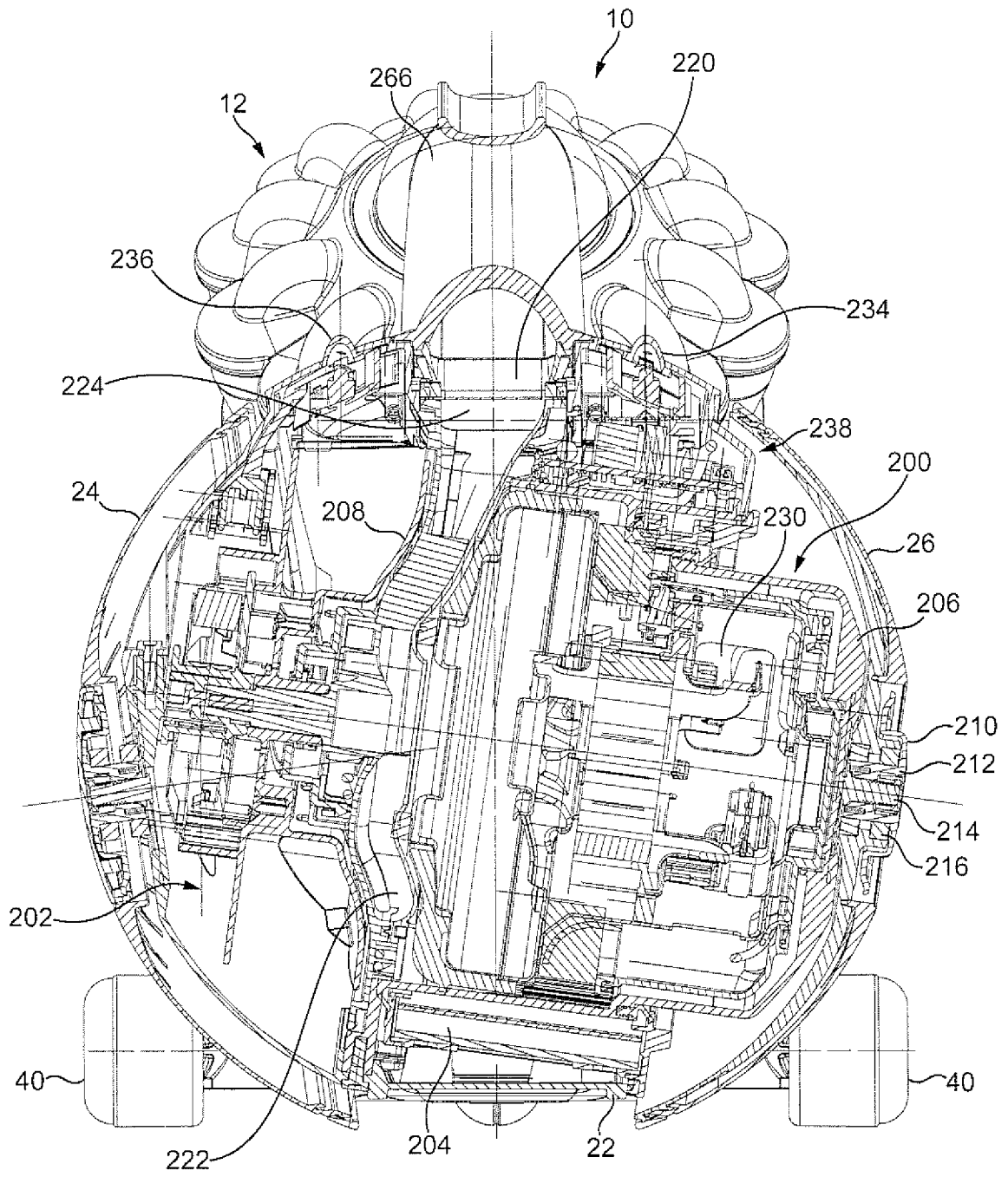


FIG. 23

INTERNATIONAL SEARCH REPORT

International application No PCT/GB2010/050423

A. CLASSIFICATION OF SUBJECT MATTER
 INV. A47L9/12 A47L9/16 B01D45/12 B01D50/00

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)
 A47L B01D

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 practical, search terms used)
 EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/125939 A1 (HANSEN SAMUEL N [US] ET AL) 16 June 2005 (2005-06-16) paragraph [0095] - paragraph [0096]; figures 16-20	1,2
X	WO 02/069778 A1 (FORTUM OYJ [FI]; HILTUNEN JYRKI [FI]; SUPPOLA KAUKO [FI]) 12 September 2002 (2002-09-12) page 5, line 33 - page 6, line 6; figure 3	1,2

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "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

Date of mailing of the international search report

7 June 2010

10/09/2010

Name and mailing address of the ISA/
 European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040,
 Fax: (+31-70) 340-3016

Authorized officer

 Masset, Markus

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2010/050423

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: 25, 37
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1, 2

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 25, 37

Present claims 25 and 37 relate to a cleaning appliance and a surface treating head by reference to the figures of the application. Therefore, claims 25 and 37 lack clarity (Art. 6 and Rule 6.2(a) PCT). This lack of clarity in the present case is such as to render a meaningful search over the whole of the claimed scope impossible.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.2), should the problems which led to the Article 17(2)PCT declaration be overcome.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1, 2

Air flow in opposite directions

2. claims: 1, 3-9

Annular fluid inlet

3. claims: 1, 10, 11

Inlet and outlet location

4. claims: 1, 12, 14

Plurality of inlet ducts

5. claims: 1, 13, 15

Plurality of outlet ducts

6. claims: 1, 16, 17

Plurality of cyclones

7. claims: 1, 18

Removable filter unit

8. claims: 1, 19

Washable filter unit

9. claims: 1, 20, 21

Filter unit attached to duct assembly

10. claims: 1, 22-24

Filter unit with a plurality of filter members

11. claims: 26-36

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

A removable filter assembly

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2010/050423

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005125939	A1	16-06-2005	NONE
WO 02069778	A1	12-09-2002	FI 20010270 A
			14-08-2002