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(72) Inventors:

- **Burnham, Gavin**
Birmingham B26 1QL (GB)
- **Ivarsson, Bengt Ivar Anders**
Smethwick,
West Midlands B67 6HP (GB)

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(71) Applicant: **Vax Limited**

Droitwich, Worcestershire WR9 0QH (GB)

(74) Representative: **Howe, Steven**

Lloyd Wise
Commonwealth House,
1-19 New Oxford Street
London WC1A 1LW (GB)

(54) **Electric motor housing for a vacuum cleaner fan assembly**

(57) A housing for an electric motor for driving a fan for a vacuum cleaner, comprising respective parts fitting together so that at least part of the housing comprises spaced inner and outer walls between which exhaust flow

of air from the fan takes place, wherein there is provided at least one formation extending into the space between the inner and outer walls to cause the air to flow in an elongated flow path therebetween.

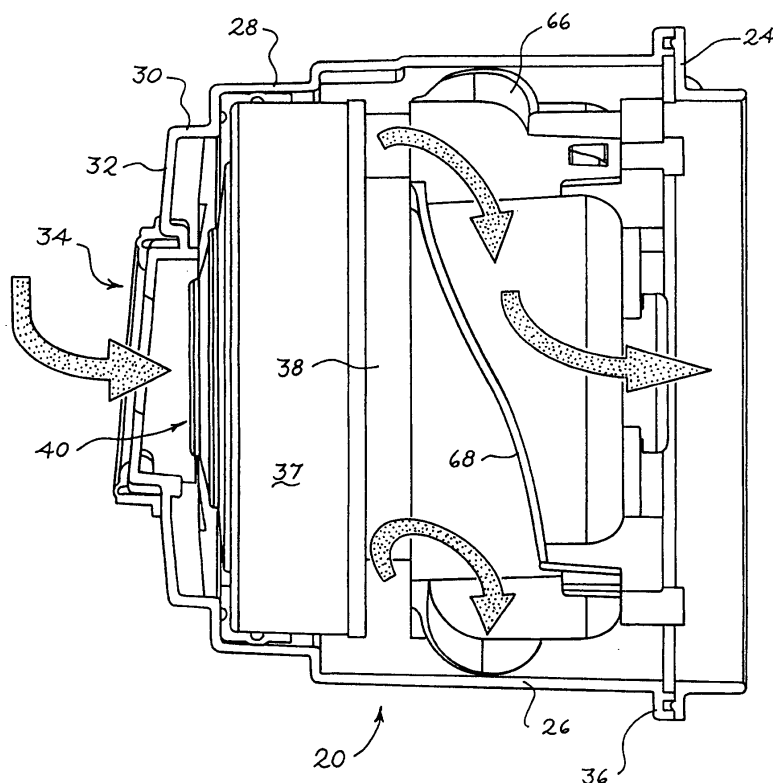


Fig. 5

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Description

[0001] This invention relates to a housing for an electric motor, intended for use for driving a fan in a vacuum cleaner, although it may have applications in other appliances or devices.

[0002] In order to create the volume of air flow necessary for effective cleaning, vacuum cleaners use fans or impellers driven by relatively powerful electric motors. Typically, vacuum cleaners for domestic use may include motors whose power is in the range 1kw to 2kw. For reliable operation of such a motor, which usually will be accommodated in a relatively small space in a cleaner's body, effective cooling is necessary for and this is generally achieved, at least in vacuum cleaners for "dry" use, by providing for the flow of air to pass at least around, and in most cases through the interior of, the motor. Thus in typical vacuum cleaners the flow of cleaning air, having entered the vacuum cleaner directly from a cleaning head (in the case of an "upright" type of cleaner) or by way of a suction hose (in the case of a "cylinder" type of cleaner or an upright cleaner having a hose) passes firstly to a dust separating/collecting device of the cleaner, which by use of one or more cyclonic separating devices and/or filters separates entrained dust and dirt from the air flow and retains it for later disposal. From the separating device, the air is drawn to the fan (usually through a pre-motor filter, which ensures that air passing through the motor is as clean as possible), and thence through the motor and is expelled to the external atmosphere from the cleaner. There may be a final, post-motor, filter to ensure that little or no dust, for example dust from the motor or dust which somehow has escaped the separating device and pre-motor filter, is released to the external atmosphere.

[0003] There are also electric motors of the so-called "by-pass" type, typically used in "wet" vacuum cleaners which are able to draw up liquids, and in appliances such as extractor carpet cleaners which apply cleaning liquid and then extract it by suction from the cleaned carpet, in which the suction air flow created by the motor does not pass through the motor for cooling purposes but instead the motor is cooled by a separately-induced flow of air drawn from a position where liquid cannot be expected to be encountered. The present invention has been devised in relation to installations of electric motors of the first-mentioned kind, i.e. in which the flow of air caused by the suction-producing fan passes through the motor.

[0004] The use of powerful motors and fans, causing high air flow speeds, inevitably generates substantial noise. One important aspect of vacuum cleaner design is minimising the level of noise created in the vicinity of a cleaner while it is in operation. Since in the path of flow of air in a vacuum cleaner the motor is usually immediately before the air is exhausted from a cleaner (albeit possibly with a final exhaust filter to ensure as few particles as possible are entrained in the exhaust air flow), flow of air through and around the motor is very significant

in terms of the overall noise level. Therefore attention has been directed to minimising the generation of noise in this area; one solution which has been adopted is for the motor to be disposed in a housing of which at least part has a double-wall construction with a space between inner and outer walls, through which exhaust air flows from the motor, containing a wadding material. This substantially reduces noise emission. However, such a construction is expensive, and presents some unwanted resistance to flow of air.

[0005] It is broadly the object of the present invention to address the above-described problem of noise emission, in an improved manner.

[0006] According to one aspect of the invention, we provide a housing for an electric motor for driving a fan for a vacuum cleaner, the housing comprising respective parts fitting together so that at least part of the housing comprises spaced inner and outer walls between which exhaust flow of air from the fan takes place, wherein there is provided at least one formation extending into the space between the inner and outer walls to cause the air to flow in an elongated flow path therebetween.

[0007] The spaced inner and outer walls may each be generally cylindrical so that an annular space is defined therebetween for flow of air. The "straight-line" flow of air therebetween would be in the axial direction through the annular space, and in accordance with the invention some flow of air may be caused in the direction circumferentially of such an annular space.

[0008] The causing of air to flow in an elongated flow path in the space between the inner and outer walls of the housing causes a significant reduction in the sound level created by such flow. At the same time, an unacceptable resistance to the flow of air need not be created, as long as a highly-labyrinthine flow path is not established.

[0009] The formation or formations which cause the air to flow in the elongated flow path may comprise at least one rib or vane extending from one or more of the housing parts into the space between the inner and outer walls thereof.

[0010] The at least one rib or vane may be part-helical in configuration, so that the flow path for air is at least partially helical, through the annular space.

[0011] Four of the rib or vane formations may be provided, each having a circumferential extent of approximately a quarter of the annular space between the inner and outer walls.

[0012] The invention will now be described by way of example with reference to the accompanying drawings, of which:

Figure 1 is a diagrammatic side elevation of a vacuum cleaner in which the invention can be incorporated.

Figure 2 is a planned view of the vacuum cleaner of figure 1, illustrating the position at which an electric motor may be disposed therein.

Figure 3 is an exploded perspective view of the principal components of an electric motor housing in accordance with the invention.

Figure 4 is a partially cut away perspective view of the motor housing, in the assembled condition.

Figures 5 and 6 are partial sections through the motor housing, illustrating the air flow therethrough.

[0013] Referring firstly to figures 1 and 2 of the drawings, these depict a vacuum cleaner of the "cylinder" type, wherein the invention can be utilised. It comprises a body 10 having a pair of wheels 11, 12 on opposite sides of the body at a rear portion thereof, to enable the body to be moved over a floor surface as required. Although not shown in the drawings, there would also be provided a front wheel or wheels beneath the body towards the opposite, front end thereof. Also towards the front end thereof, the body accommodates a removable separator/collector assembly indicated generally at 14, for separating entrained dust and dirt from the suction air flow being drawn from whatever is being cleaned, and retaining such dust and dirt for later disposal. One or more cyclonic separator devices and/or filters may be utilised in the separator/collector. Shown in figure 2 is an inlet aperture 16 in the separator/collector assembly 14 for connection of a flexible suction hose whose other end has an inlet fitting for direct use as a suction nozzle, or connection to a wand or cleaning head, in known manner.

[0014] The suction air flow for cleaning as aforesaid is created by an electric motor and fan assembly which may be disposed where indicated at 18, generally in the rear part of the body 10 of the cleaner, between the wheels 11, 12 thereof. A passage extends from the fan in the assembly 18 to a port which communicates with an outlet port of the separator/collector assembly 14, for outflow of the suction airflow after the separation of entrained dust and dirt therefrom in the assembly 14.

[0015] A pre-motor filter would be provided either in the body 10 of the cleaner or in the separator/collector assembly 14 for cleaning of the suction air flow before it passes to the motor and fan assembly 18. From the assembly 18, air is expelled to the external atmosphere, possibly by way of an exit filter so that little or no remaining dust is expelled to the external atmosphere.

[0016] Referring now to figures 3, 4, 5 and 6 of the drawings, these illustrate in exploded, cut away, and sectional views the arrangement of the electric motor and fan of the vacuum cleaner in relation to a housing therefor.

[0017] Figure 3 shows the housing for the motor comprising first and second housing parts 20, 22 and a cover ring 24. The first housing part 20 is generally cup-shaped in configuration, with a generally cylindrical peripheral wall 26 stepped down in diameter as shown at 28, 30 leading to an annular end wall 32 which, as seen in figure 5, has an opening 34 therein. At the opposite end of the peripheral wall 26 there is a flange formation 36. The opening 34 provides for inflow of suction air to an assem-

bly of an electric motor and fan, the casing of whose fan is indicated at 37 in figures 4 and 5 and the casing of whose motor is indicated at 38. The fan casing 37 has an opening 40 for inflow of air to the fan within the casing, such opening 40 facing the opening 34 in the wall 32.

[0018] Also visible in figure 3 of the drawings is an opening 42 in a portion 44 extending from the wall 28, for receiving a relief valve to admit air from the external atmosphere to the fan inlet opening 40 in case the normal path for suction air flow becomes blocked, e.g. by the ingestion of a blocking object into the cleaning head, suction hose, or separator/collector, so that under such circumstances the motor is not deprived of cooling air flow.

[0019] The second housing part 22 is a generally cup-shaped component but of smaller axial extent than the housing part 20. The part 22 comprises a peripheral wall 46 of generally cylindrical configuration, and an end wall 48 closing the housing part 22 at its end remote from the end wall 32 of the housing part 20. The motor and fan assembly 37, 38 is held between the housing parts 20, 22, the fan casing 37 being rubber-mounted within the wall portion 28 of the housing part 20 and the opposite end of the casing 38 of the motor being rubber mounted within a boss 50 on the wall 48 of the housing part 22.

The housing part 22 is secured to the housing part 20 by four circumferentially spaced outwardly extending lugs as indicated at 52, 53, 54, 55 provided on the housing part 22 where the peripheral wall 46 joins the end wall 48 thereof. The lugs 52 to 55 are received in recesses in the flange 36 of the housing part 20, such recesses being indicated at 56 to 59, and support the two housing parts relative to one another so that the peripheral wall 46 is spaced inwardly of the peripheral wall part 26, with an annular space defined therebetween.

[0020] With the housing parts 20, 22 fitted together as aforesaid, the cover ring 24 is fitted as shown in figures 4 and 5, engaging the flange part 36 of the housing part 20 and holding the lugs 52 to 55 in the recesses 56 to 59. The cover ring 24 is secured by circumferentially spaced axially extending screws, each passing through a hole in the ring 24, an aligned hole in the respective lug e.g. as indicated at 62 in relation to the lug 52, and having engagement with a bore at the base of the recess in the housing part 20 as indicated at 64 in relation to the recess 56. The cover ring has a cylindrical wall portion 25 which may accommodate or co-operate with a post-motor filter.

[0021] The peripheral wall 46 of the housing part 22 is provided with four circumferentially spaced ribs or vanes which extend radially outwardly from the wall 46 to touch or very nearly touch the internal surface of the peripheral wall part 26 of the housing part 20. Three of such ribs are visible at 66, 68, 70 with the shape of the rib 68 being particularly clearly visible in figure 5. It will be noted that it extends generally helically but of variable curvature, from the free end of the peripheral wall 46 of the housing part 22, to a base part of the lug 54 approximately two thirds of the distance to the end wall 48 of the housing

part 22. The arrangement of the ribs and lugs is such that air cannot flow axially in a straight line from one end to the other of the annular space defined between the peripheral walls 26, 46 of the two housing parts 22 but instead is forced to extend its flow path in a generally helical configuration.

[0022] Thus, the flow of air through the motor and fan assembly is as shown by the heavy arrows on figures 5 and 6. After entering the fan casing at opening 40, the air flows through the fan and the motor to leave the motor at the end thereof remote from the fan, and then flows in the opposite direction, towards the fan casing, in an annular space defined between the motor casing 38 and the wall 46 of the housing part 22.. Having flowed past the motor casing, it flows in a generally helical path through the annular space between the walls 26, 46 guided by the ribs in such space. It then exits the motor housing assembly through the centre of the ring 24.

[0023] The above described path of air flow subsequent to having passed through the fan has a silencing effect, without providing an undue restriction to such flow of air. The construction of the housing is straight forward, and the provision of wadding material or the like for quietening purposes is unnecessary.

[0024] When used in this specification and claims, the terms "comprises" and "comprising" and variations thereof mean that the specified features, steps or integers are included. The terms are not to be interpreted to exclude the presence of other features, steps or components.

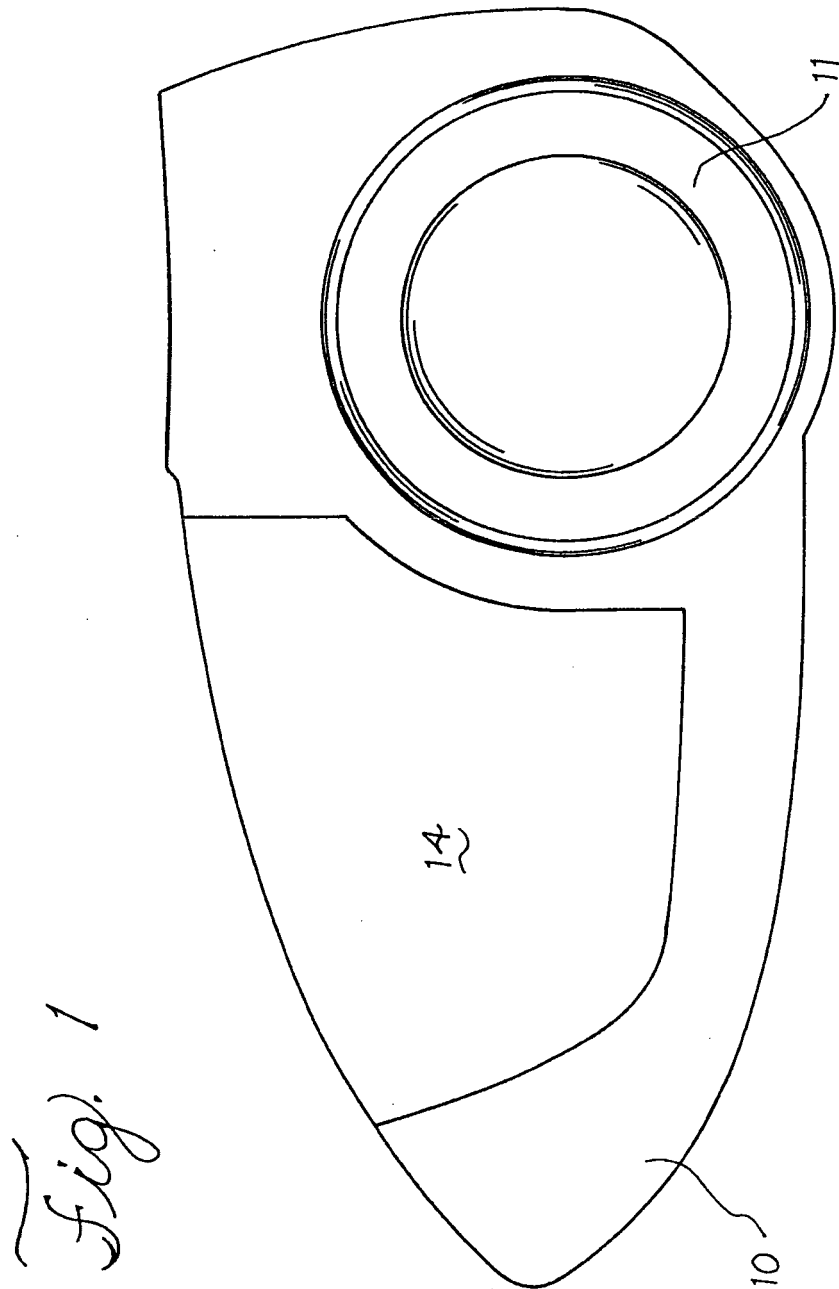
[0025] The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. A housing for an electric motor for driving a fan for a vacuum cleaner, comprising respective parts fitting together so that at least part of the housing comprises spaced inner and outer walls between which exhaust flow of air from the fan takes place, wherein there is provided at least one formation extending into the space between the inner and outer walls to cause the air to flow in an elongated flow path therebetween.
2. A housing according to claim 1 wherein the spaced inner and outer walls are generally cylindrical so that an annular space is defined therebetween for flow of air.
3. A housing according to claim 2 wherein some flow of air is caused in the direction circumferentially of

the annular space.

4. A housing according to claim 3 wherein some flow of air is caused in the direction helically of the annular space.
5. A housing according to claim 4 wherein the formation (s) comprises at least one rib or vane extending from one or more housing parts into the space between the inner and outer walls thereof.
6. A housing according to claim 4 and claim 5 wherein the at least one rib or vane is part-helical in configuration.
7. A housing according to claim 6 wherein four of the rib or vanes are provided, each having a circumferential extent of approximately a quarter of the annular space between the inner and outer walls.
8. An electric motor and fan assembly for a vacuum cleaner, comprising an electric motor and a fan accommodated within a housing according to any one of the preceding claims.
9. A vacuum cleaner having an electric motor and fan assembly according to claim 8, for creating the suction air flow of the cleaner.



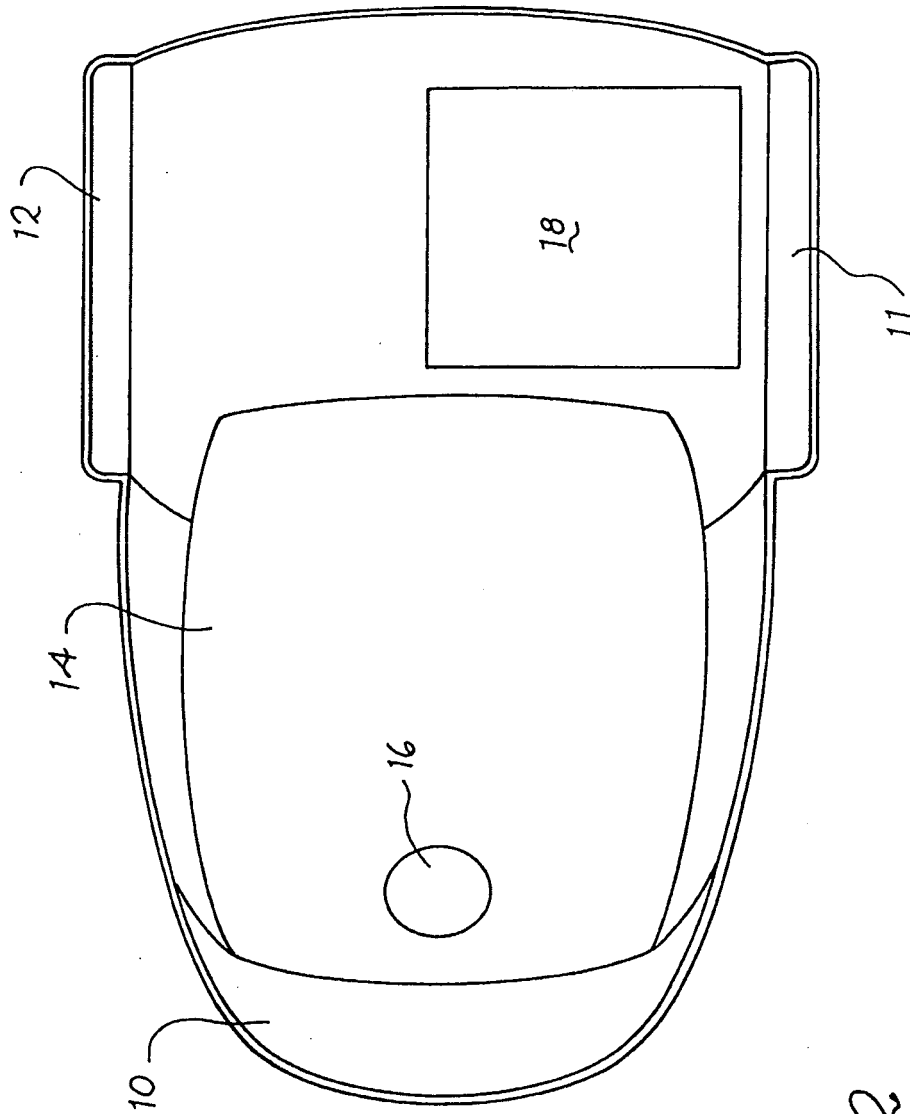


Fig. 2

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Fig.

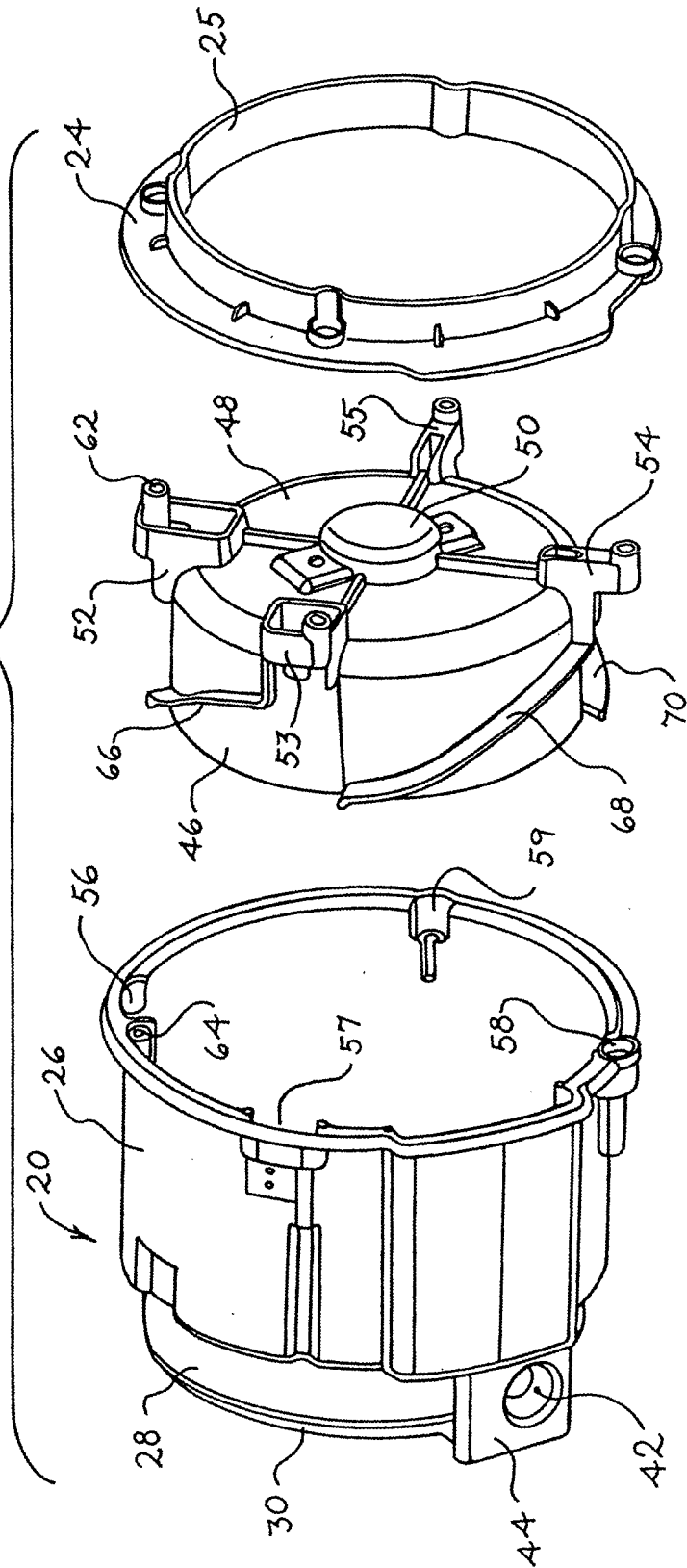


Fig. A

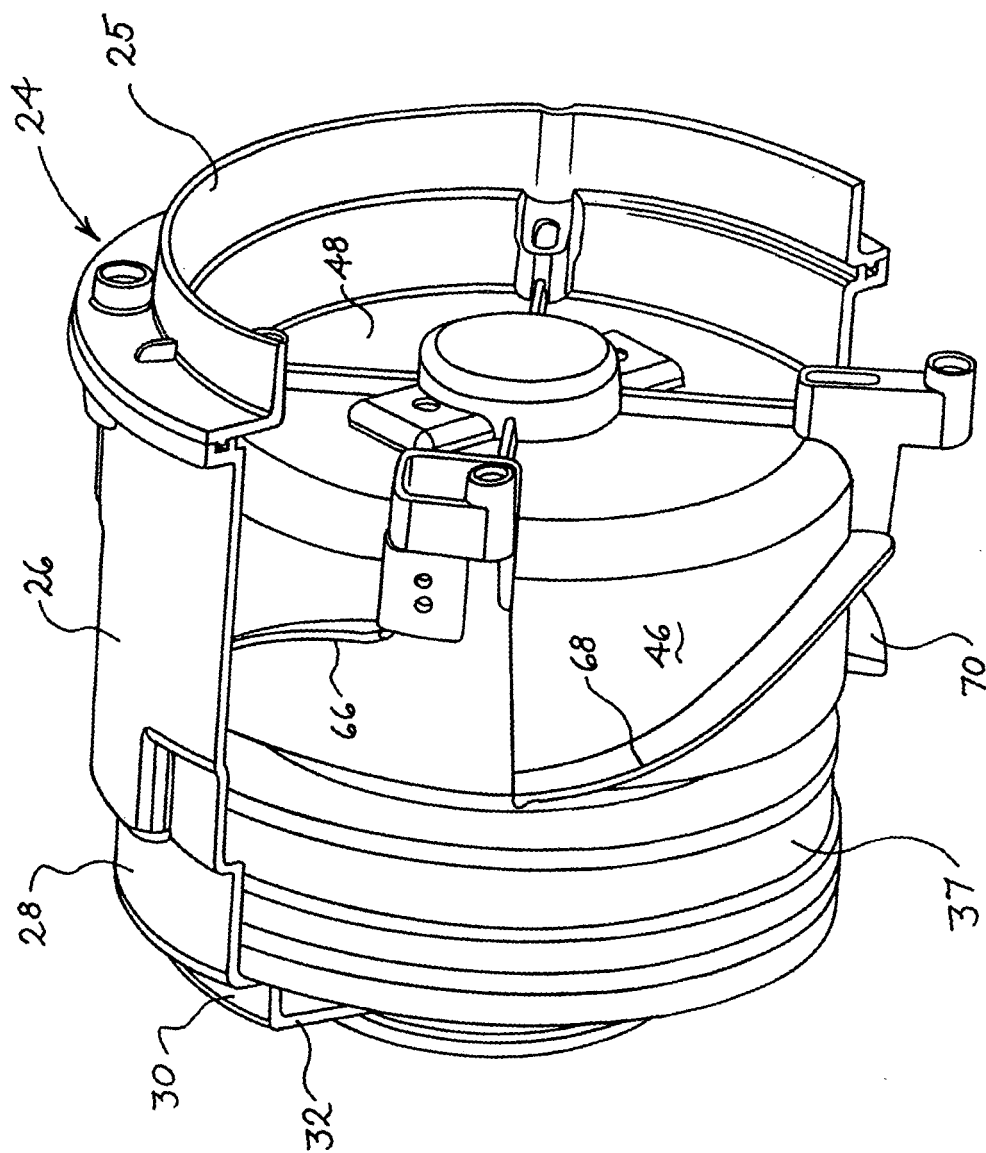


Fig. 5

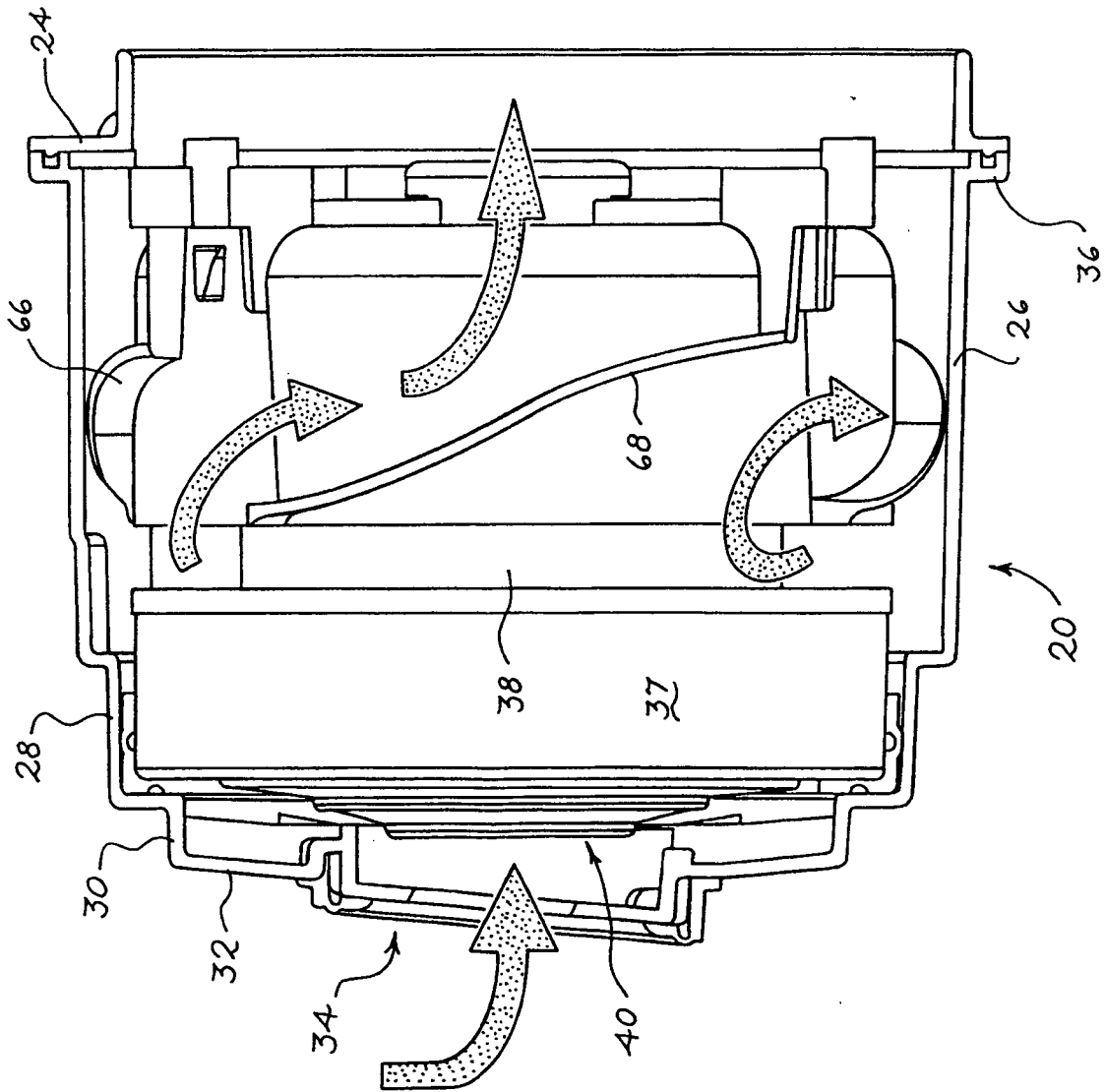


Fig. 6

