US 20070243087A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2007/0243087 A1**

Burnham et al. (43) **Pub. Date: Oct. 18, 2007**

(54) **ELECTRIC MOTOR HOUSING**

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(21) Appl. No.: **11/732,444**

(22) Filed: **Apr. 3, 2007**

(30) **Foreign Application Priority Data**

Apr. 5, 2006 (GB) 0606838.1

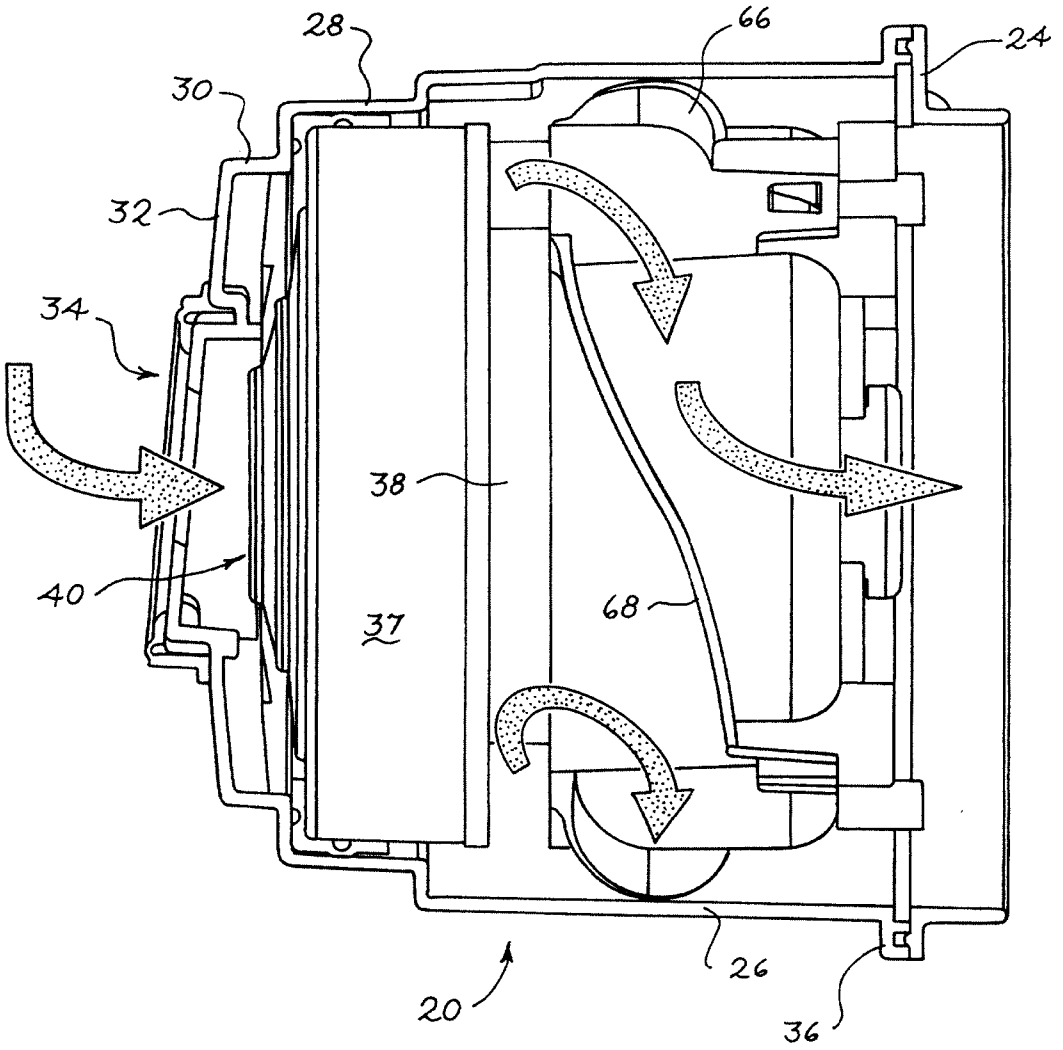
Publication Classification

(51) **Int. Cl.**
F04B 17/00 (2006.01)

(52) **U.S. Cl.** **417/423.2**

(57) **ABSTRACT**

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.



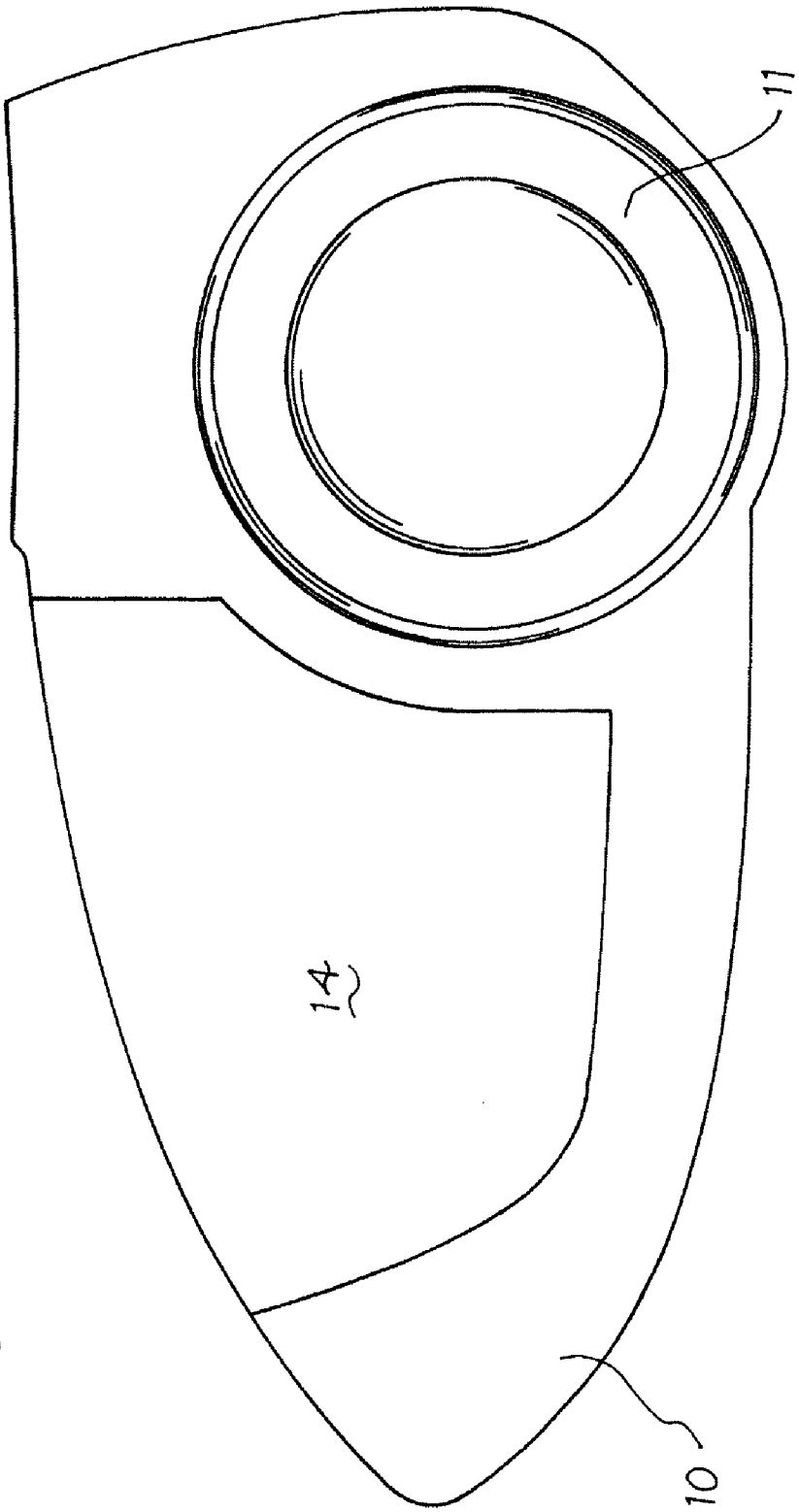


Fig. 1

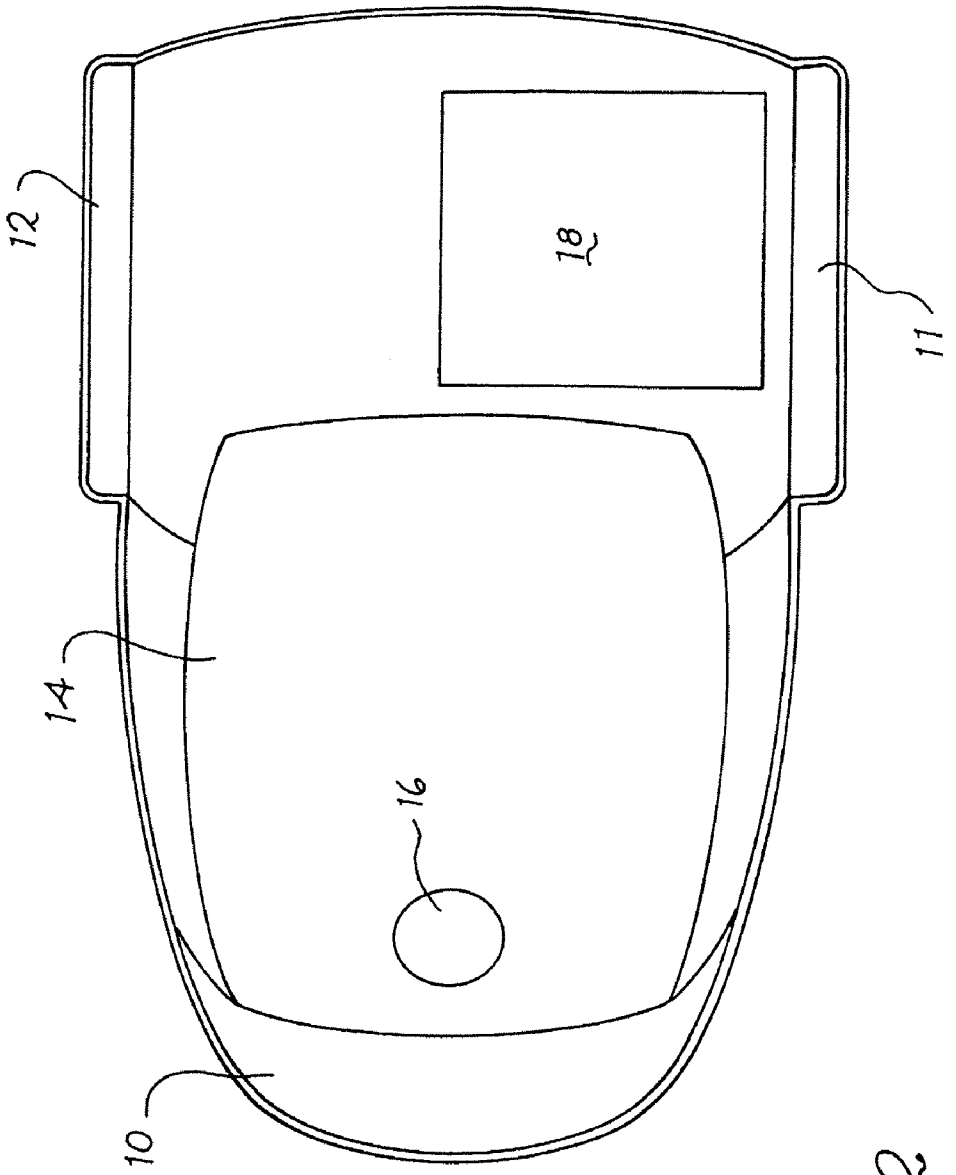


Fig. 2

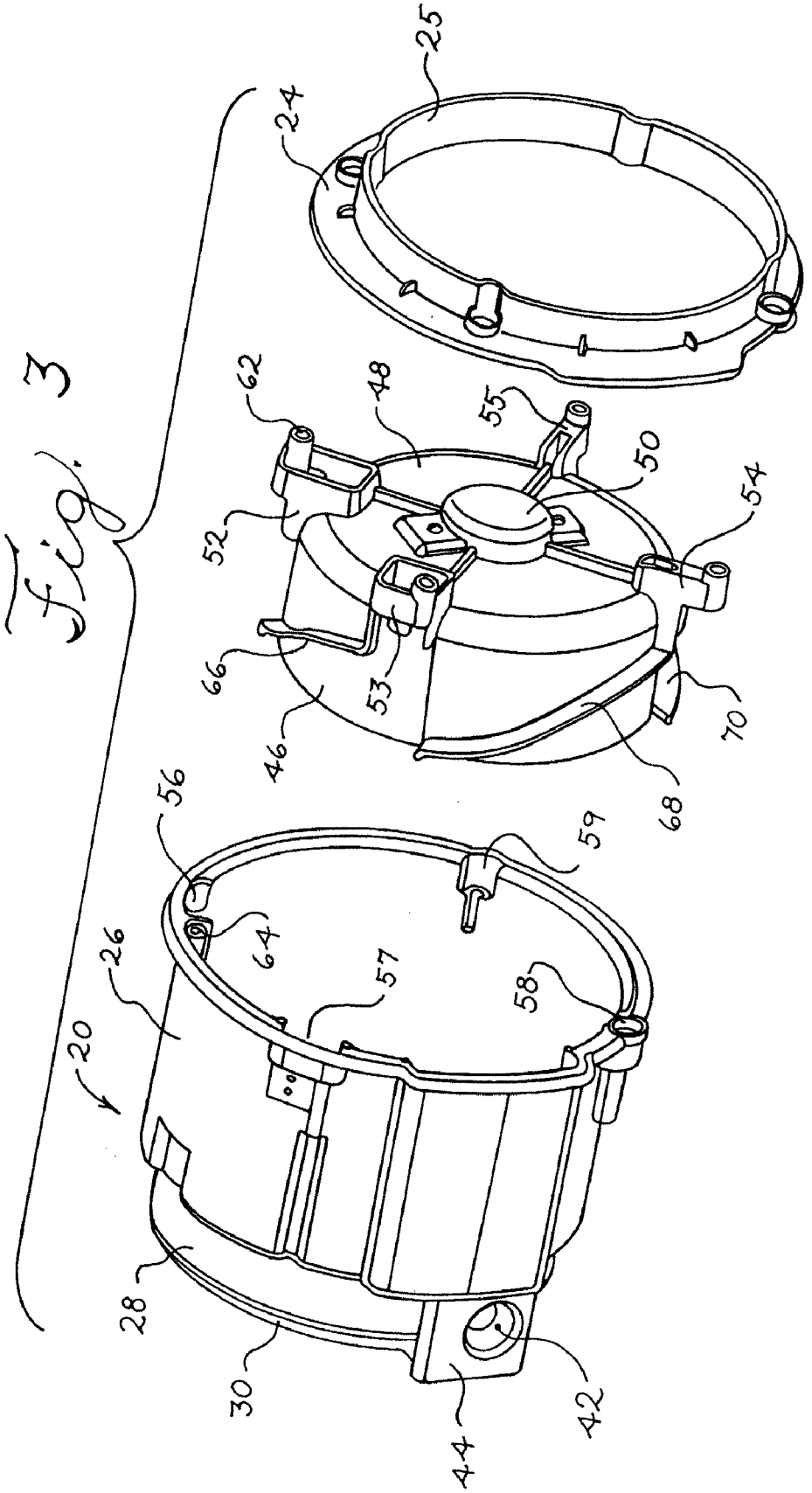


Fig. 3

Fig. 4

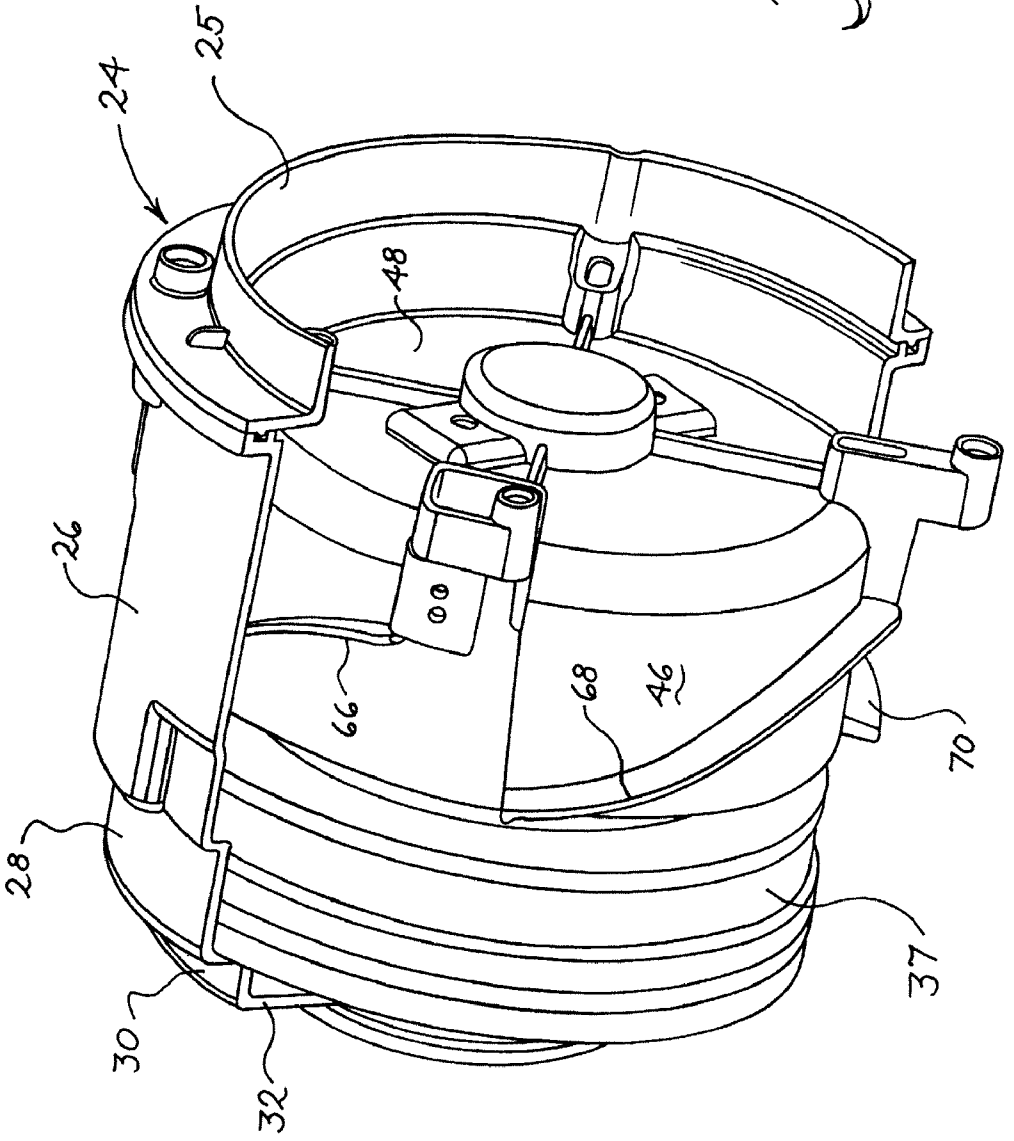


Fig. 5

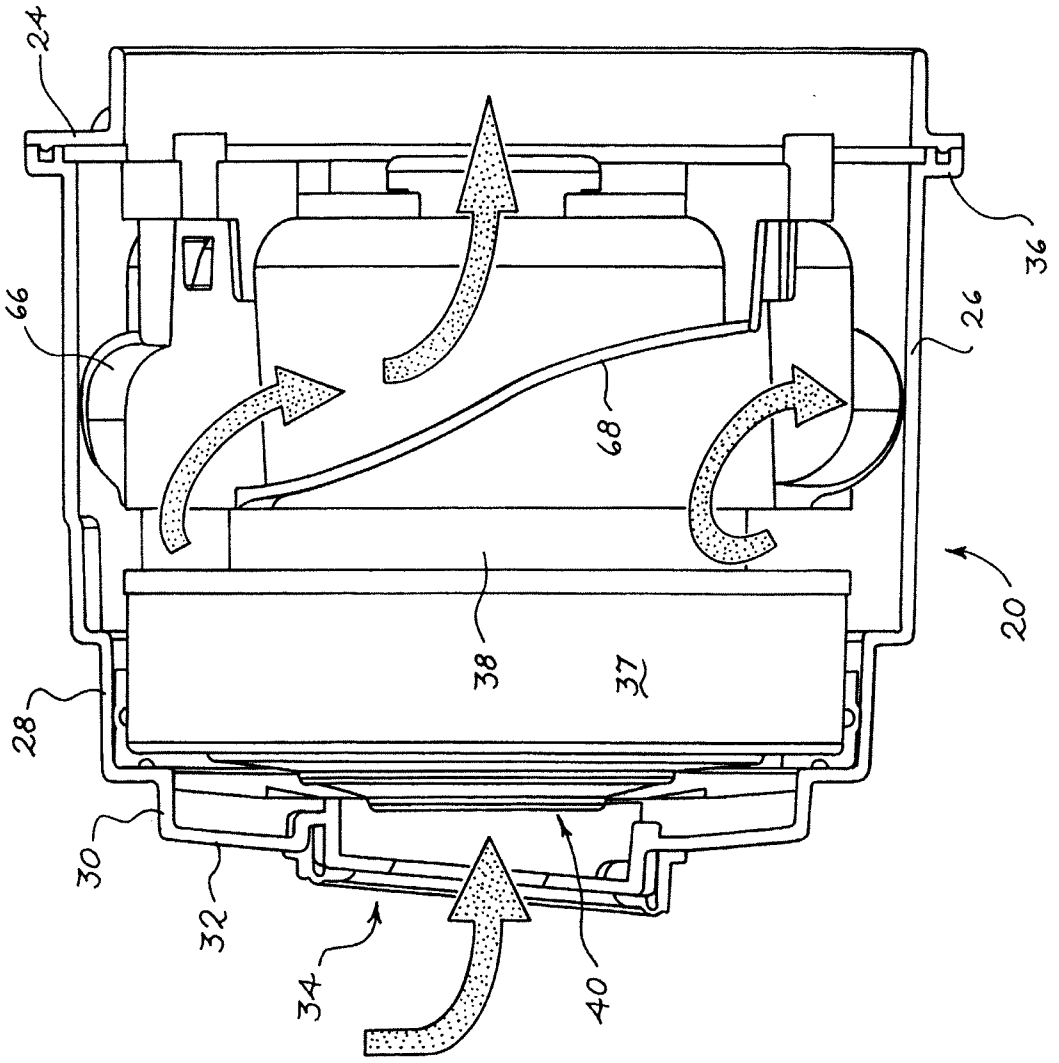
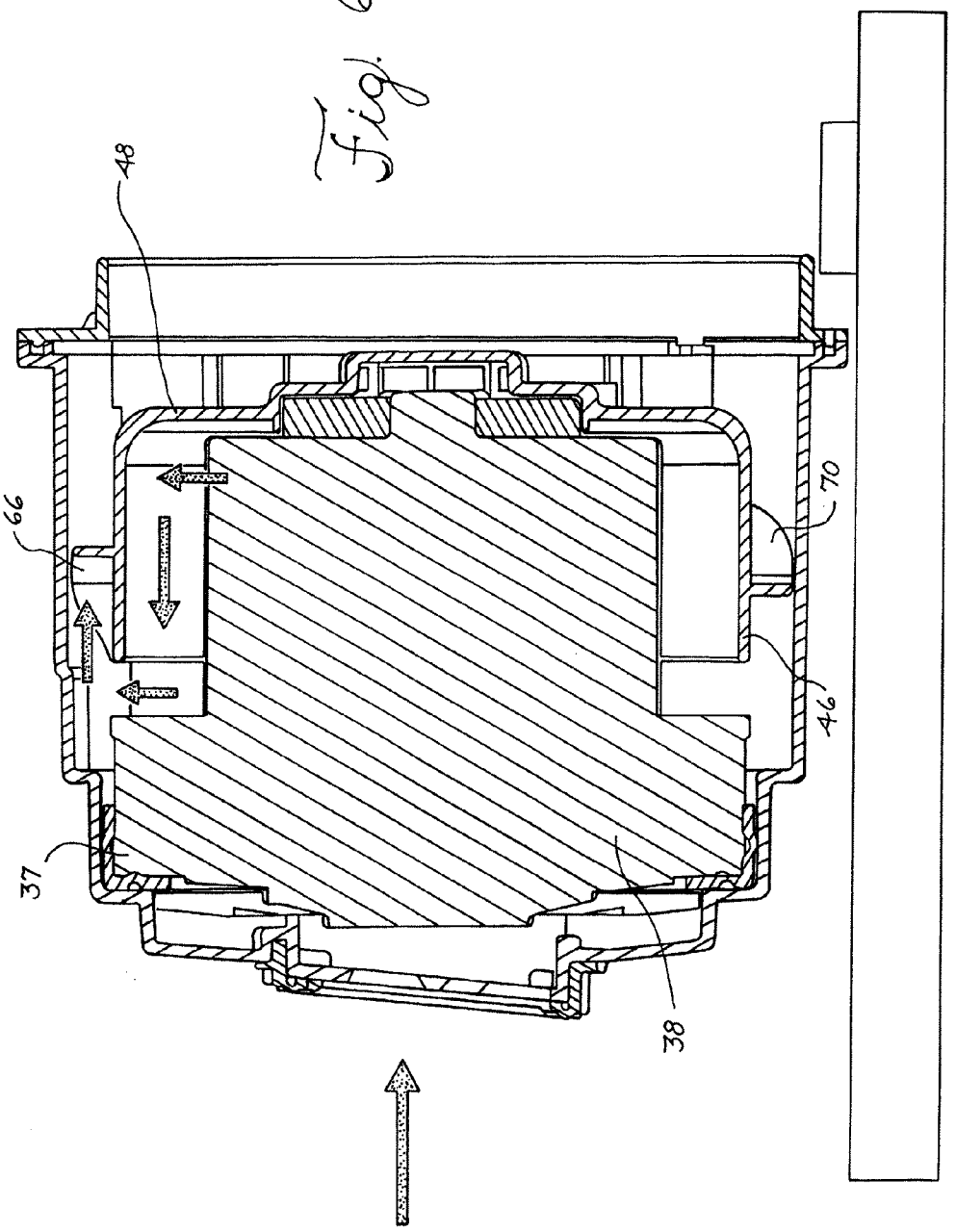


Fig. 6



ELECTRIC MOTOR HOUSING

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from United Kingdom application number 0606838.1 filed on Apr. 5, 2006, the entirety of which is fully incorporated by reference herein.

BACKGROUND

[0002] 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.

[0003] 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 1 kw to 2 kw. 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.

[0004] 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 or 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.

[0005] 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.

SUMMARY

[0006] It is broadly the object of the present invention to address the above-described problem of noise emission, in an improved manner.

[0007] 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.

[0008] 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.

[0009] 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.

[0010] 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.

[0011] 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.

[0012] 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.

DESCRIPTION OF THE DRAWINGS

[0013] The invention will now be described by way of example with reference to the accompanying drawings, of which:

[0014] FIG. **1** is a side view of a vacuum cleaner.

[0015] FIG. **2** is a plan view of the vacuum cleaner of FIG. **1**.

[0016] FIG. **3** is a partial exploded view of an electric motor housing for use with the vacuum cleaner of FIG. **1**.

[0017] FIG. **4** is a perspective of the motor housing of FIG. **3**.

[0018] FIG. **5** is a partial section view of the motor housing of FIG. **3**.

[0019] FIG. **6** is another partial section view of the motor housing of FIG. **3**

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] Referring firstly to FIGS. **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 FIG. **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.

[0021] 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**.

[0022] 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.

[0023] Referring now to FIGS. **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.

[0024] FIG. **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 FIG. **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 assembly of an electric motor and fan, the casing of whose fan is indicated at **37** in FIGS. **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**.

[0025] Also visible in FIG. **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.

[0026] 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.

[0027] With the housing parts **20**, **22** fitted together as aforesaid, the cover ring **24** is fitted as shown in FIGS. **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.

[0028] 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 FIG. **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.

[0029] Thus, the flow of air through the motor and fan assembly is as shown by the heavy arrows on FIGS. **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**.

[**0030**] 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.

[**0031**] 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.

[**0032**] 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.

1-11. (canceled)

12. A housing for an electric motor driving a vacuum cleaner fan, comprising spaced inner and outer walls receiving exhaust air flow from a fan, and at least one formation extending into a space between the inner and outer walls to define an elongated flow path therebetween.

13. A housing of claim 12, wherein the spaced inner and outer walls are generally cylindrical defining an annular space therebetween.

14. The housing of claim 13, wherein at least a portion of the air flow is in a circumferential direction within the annular space.

15. The housing of claim 14, wherein at least a portion of the air flow is in a helical direction within the annular space.

16. The housing of claim 12, wherein the at least one formation comprises at least one rib or vane extending from one of the inner and outer walls into the space between the inner and outer walls thereof.

17. The housing of claim 16, wherein the at least one rib or vane is at least partially helical.

18. The housing according to claim 16, wherein the at least one rib or vane comprises four ribs or vanes that are substantially evenly spaced apart along the circumference of the inner wall.

19. The housing of claim 12, further comprising an electric motor provided within the housing for rotating the fan.

20. The housing of claim 12, wherein the formation extends radially from the inner wall toward the outer wall.

21. The housing of claim 20, wherein the formation contacts or is in substantially close proximity to the outer wall.

22. The housing of claim 16, wherein the at least one rib or vane extends radially and helically from the inner wall toward the outer wall.

23. The housing of claim 22, wherein the at least one rib or vane extends at a varying curvature along the length inner wall.

24. The housing of claim 12, wherein the formation extends along approximately two thirds of a length of the inner wall.

25. The housing of claim 12, wherein the formation engages a lug that extends radially outward from the inner wall, the lug connecting the inner wall to the outer wall.

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