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(54) **Ventilation hub with a plurality of radially arranged inlets and an outlet and a method for manufacturing the same**

(57) A ventilation hub unit (10) comprising a casing (12) having a plurality of inlets (14) and one outlet (16), wherein said plurality of inlets (14) are arranged radially at the perimeter of said hub unit (10). The Ventilation hub may have a plurality of spigot inserts (18), one such spigot

insert (18) associated with each inlet (14) wherein each spigot insert (18) comprises a first end for insertion into an inlet (14), and a second end for receiving, in use, a duct. The spigot inserts (18) may each comprises a flow regulator (38).

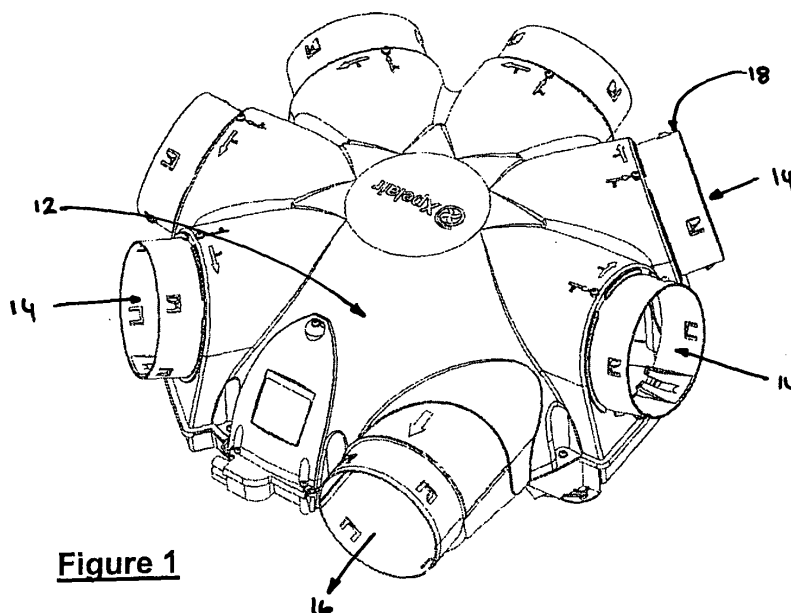


Figure 1

Description

[0001] This invention relates to extraction of air from buildings, in particular hubs for central ventilation systems for buildings.

[0002] It is a known alternative to having ventilation devices, for example extractor fans, in individual rooms, e.g. bathroom, kitchen etc, to use a building ventilation system which comprises a central extraction unit to which a plurality of ventilation inlets are connected via conduits. In this manner, not only can the extraction unit be centralised for easy maintenance access, but the sound of the extraction is removed from the point of use.

[0003] To minimise the amount of ducting needed, it is common to have ventilation hubs where a number of conduits from different locations can come together, and which have a single conduit leading therefrom towards a vent. Such hubs may be located for example in a suspended ceiling. There are a number of problems associated with current hubs. One of the problems is that their geometry can cause unnecessary pressure drops within the system, thereby necessitating a more powerful impeller to provide the same extraction rate. This is largely because the air flow path within the hub is required to undergo a series of 90 degree turns which created these pressure drops. A further problem is that the inlets are oriented parallel to one another, and parallel the output, all on one side of the hub unit. This results in conduits requiring an additional 90 degree turn to lead into or out of the unit, compounding the above mentioned problem, and increasing the overall vertical dimension of the hub. Another problem with ventilation hubs is that they can be problematic to retrofit to existing ventilation systems as different systems and different legislative regimes require different sized ventilation ducts which may not match the ventilation hub.

[0004] It is the purpose of the present invention to produce an improved extraction hub unit.

[0005] According to a first aspect of the invention there is provided a ventilation hub unit comprising a casing having a plurality of inlets and one outlet, wherein said plurality of inlets are arranged radially at the perimeter of said hub unit.

[0006] By arranging the inlets radially around the perimeter of the unit the overall depth of space needed for instalment can be reduced. This is especially beneficial for example where the unit is to be located above suspended ceilings. In addition by placing the inlets radially, when conduits are attached thereto, they naturally diverge radially outwardly from the hub, allowing them to lead to various locations in a minimum of depth. As the conduits naturally radiate in this manner, the conduit can be attached to the conduit without the need for any ninety degree bends associated with prior art units. This increases the efficiency of the hub by eliminating pressure reduction points.

[0007] Preferably the unit has a substantially round profile and preferably the outlet is a tangential outlet.

[0008] Preferably the unit comprises a first chamber, into which said inlets open, and a second chamber out of which said outlet exits. The first chamber may comprise an axial outlet leading to the second chamber, and the axial outlet may have a radiused surface leading thereinto. By radiusing the lead into the first chamber outlet, turbulence is reduced as the multiple airflows from the plurality of inlets meet at the outlet and pass there-through. Preferably the upper interior surface of the first chamber comprises a central radial curved surface to direct airflow passing therethrough towards the axial outlet of the first chamber. In this manner the upper surface substantially mirrors the curved surface leading into the first chamber outlet, further reducing turbulence and minimising pressure drops within the hub unit.

[0009] Preferably an impeller is located in the second chamber. The impeller moves air through the ventilation hub and expels it out of the outlet.

[0010] In a preferred arrangement the unit comprises a plurality of spigot inserts, one such spigot insert associated with each inlet wherein each spigot insert comprises a first end for insertion into an inlet, and a second end for receiving, in use, a duct. The plurality of spigot inserts may have second ends of differing diameter for receiving different sized duct. Alternatively, or in addition the first end of each of the spigot inserts may be of a different cross sectional shape to the second end of each spigot inserts. This allows for great flexibility of the hub, as it can easily be adapted for use with different shaped or sized ducts. As the types of ducting, including both size and shape, vary geographically this flexibility allows the same hub unit to be easily and quickly adapted for any customer specific configuration.

[0011] In another preferred arrangement the spigot insert further comprises a flow regulator, which may be self-governing. Preferably the flow regulator comprises a flexible membrane that partially restricts the flow through the spigot insert and, in use, an increased flow flexes the membrane to further restrict flow through the membrane, thereby automatically regulating the flow. Alternatively the flow regulator may be manually adjustable to restrict the flow through the spigot insert. Preferably the spigot insert has retaining feature for retaining a removable flow restrictor therein. The use of flow restrictors in the hub provides a central point for balancing the flow through the various ducts leading into the unit, which, in the absence of flow restrictors, is determined by a number of features including the length of duct and any bends in the duct. By placing these flow restrictors in the spigot inserts, at the point of installation flow restrictors can be added or removed and adjusted, if manual, at a single location greatly facilitating the installation. This is a particularly beneficial feature when the unit is being retrofitted to replace a unit that is already part of an installed system.

[0012] Preferably the unit further comprising retaining means for retaining the spigot inserts within said inlets, which may be a screw.

[0013] In a preferred arrangement the unit outlet has a larger cross sectional area than the unit inlets. Preferably the cross sectional area of the hub outlet is equal or greater than the total of the cross sectional areas of the inlets.

[0014] The unit may comprise six radial inlets, which may have an angular spacing of less than 50 degrees.

[0015] Preferably the unit is substantially round in plan profile and has a maximum depth of 190mm. In this manner the unit may be installed in a shallow space for example a domestic suspended ceiling.

[0016] According to a second aspect of the invention there is provided a method of manufacturing a ventilation hub unit comprising:

moulding a base section having an internal surface forming a first half impeller cavity, a first half outlet and an electrics tray;

moulding a mid section comprising a first surface comprising forming a second half impeller cavity and a second half outlet, and a second surface comprising an opening therein having a curved section leading into the opening;

moulding a cover section comprising an internal surface forming a first surface of an inlet cavity and a plurality of radially disposed inlet openings therein; and

assembling said base, mid and cover section so as to form a ventilation hub unit having: an impeller cavity having an outlet formed between the base section and the mid section and an inlet section, formed between the mid section and the cover section, having a plurality of radial inlets and an outlet leading to said impeller cavity;

[0017] Preferably the base, middle and cover sections are formed by moulding process having a single axis of tool separation. By designing all three parts having a single axis of tool separation the manufacture of the parts can be greatly simplified and the moulding process speeded up, thereby increasing efficiency.

[0018] Preferably the method further comprising the steps of moulding a plurality of spigot inserts having a first end and a second end; and inserting the first end of a spigot inserts into said inlet openings.

[0019] Prior to inserting the first end of the spigot insert into the inlet openings, a flow regulator may be inserted into said spigot insert.

[0020] Preferably method further comprising the step of fixing the spigot inserts in the inlets with screws.

[0021] Embodiments of the invention will now be described, by way of example only, with reference to the drawings in which:

Figure 1 is a perspective view of a ventilation hub unit in accordance with the invention.

Figure 2 is a perspective view of an alternative ven-

tilation hub in accordance with the invention;

Figure 3 is an exploded perspective view of the ventilation unit of Figure 2;

Figure 4 is a detail view of reducing spigot insert in accordance with the invention;

Figure 5 is a straight spigot insert of the invention having flow regulation means; and

Figure 6 is the insert of Figure 5 with the flow regulation means removed.

[0022] Referring to Figure 1 to 3 a ventilation hub unit 10 is shown having a casing 12 having a plurality of openings therein forming inlets 14 therein and an outlet 16. Six inlets 14 are radially spaced around the exterior of the unit at approximately a forty-five degree angle of separation. In use the inlets 14 are connected to ducts that lead to ventilation points. The hub unit 10 has an impeller 28 therein to draw air into the inlets 14, from the ducting, and expel the air from the outlet 16 that exits substantially tangentially to the hub unit. The inlets 14 comprise spigot inserts 18, inserted into the casing 12. In Figure 1 the inserts 18 are shown having equal sized inlet diameters and in Figure 2 the inserts 18 are shown having different sized inlet diameters. By changing the inserts 18, or replacing one or more of the inserts 18 with blanking plugs (not shown) the hub unit 10 can be easily configured for use with a ventilation system having anything up to six ducts of differing sizes, thus facilitating installation. The inserts 18 are secured in place by using screws 20. The casing 12 comprises three main sections, a base section 25, a middle section 24, and a top section 26. When assembled, an interior surface 22 of the base section 25 and the middle section 24 come together to form an impeller chamber in which the impeller 28 sits and rotates to draw air through the unit. The middle section 24 has a central hole 30 therein which is centrally located and forms an outlet from a first chamber, formed between the middle section 24 and the top section 26, leading to the impeller chamber. The surface 32 surrounding the central hole 30 is profiled such that its curve leads into the of the first chamber outlet 30 creating a smooth fluid flow path for the air passing through the hub unit 10 and thereby reduces pressure loss up due to unnecessary eddies within the unit. The impeller 28 is driven by a motor which forms a central part of the impeller and about which the impeller 28 spins. The three main parts of the hub unit 10, the base section 25, the middle section 24 and the top section 26 are all formed of plastics materials in a moulding process. The three sections 24, 25, 26 are all designed in a manner that can be moulded by a simple up-and-down tool, i.e. the tool necessary to mould the parts separates in a single axis of movement. To achieve this the inlets that receive the spigot inserts 18 are angled with respect the central axis of the unit about which they

are radially spaced such that the inlet holes can be formed without the need of side action movement from a tool. This design greatly reduces the complexity of the tool design needed to mould the part.

[0023] Referring to Figure 4 a detail view of a spigot insert 34 is shown. The spigot insert has a reduced section 36 enabling a conduit of lesser diameter than the opening in the casing 12 to be easily attached to the unit. Within the flow path through the spigot insert 34 is located a resilient flap regulator which comprises a flap 38 which is attached to the insert 34 so that it is maintained at an angle to the flow path without blocking the flow path. The flap 38 is made of a resilient material so that as the flow increases through the spigot insert 34 fluid pressure on the surface of the flap 38 facing the direction of flow will cause the flap 38 to resiliently deform towards the unit thereby reducing the cross section of the spigot insert through which fluid can flow. In this manner the flow regulator is self-regulating. A small wall feature 40 within the spigot insert 34 prevents the flap 38 from deforming past perpendicular to the fluid flow. Without any flow regulators the upstream fluid resistance would dictate the fluid flow, drawn through each of the inlets of the hub unit. This can result in ventilation points in rooms further from the hub unit having reduced ventilation due to reduced flow. By flow regulating in the manner above, the same flow is achieved through the various inlets to the hub unit which can be used to help balance the ventilation flow from the various ventilation points.

[0024] Referring to Figures 5 and 6 a spigot insert 42 is shown having an equal diameter to the openings in the casing 12 that it is intended to go. The spigot insert 42 has an internal feature 44 moulded into its interior surface which can receive a removable flow regulator comprising an axis 48 and two flaps 50. In use the flaps are deflected in the direction of flow by the passage of air through the spigot insert 42. A adjuster 52 is located on the axis 48 that adjusts the resistance to the deflection of the flaps 50. This is achieved by means of a rotating support (not shown) behind the flaps 50, which prevents the deflection of the flaps 50 to a greater or lesser extent depending on its rotational position. Minimum resistance is provided when the support is parallel with the axis 48 and maximum resistance is given when the support is perpendicular to the axis 48. by using a manual flow regulator the balance of flow through individual spigot inserts can be manually adjusted to balance the system from a single location point. Often a system will have one high volume extraction, for example from above a cooker, and a number of smaller volume extractions from bathrooms or toilets. A unit may have a manual flow regulator on all the inlets or may just have a manual flow regulator on the high volume inlet and either no regulation, or self regulating flow regulators, on the smaller volume inlets.

Claims

1. A ventilation hub unit (10) comprising a casing (12) having a plurality of inlets (14) and one outlet (16), wherein said plurality of inlets (14) are arranged radially at the perimeter of said hub unit (10).
2. A ventilation hub unit (10) according to claim 1 wherein said unit has a substantially round profile.
3. A ventilation hub unit (10) according to claim 2 wherein the outlet (16) is a tangential outlet.
4. A ventilation hub (10) according to any previous claim comprising a first chamber, into which said inlets (14) open, and a second chamber out of which said outlet (16) exits.
5. A ventilation hub unit (10) according to claim 4 wherein the first chamber comprises an axial outlet (30) leading to the second chamber.
6. A ventilation hub unit (10) according to claim 5 wherein the axial outlet has a radiused surface (32) leading thereinto.
7. A ventilation hub unit (10) according to any one of claim 4 to 6 further comprising an impeller (28) in the second chamber.
8. A ventilation hub unit (10) according to any preceding claim further comprising a plurality of spigot inserts (18), one such spigot insert (18) associated with each inlet (14) wherein each spigot insert (18) comprises a first end for insertion into an inlet (14), and a second end for receiving, in use, a duct.
9. A ventilation hub unit (10) according to claim 8 wherein said plurality of spigot inserts comprise spigot inserts (18) having second ends of differing diameter for receiving different sized duct.
10. A ventilation hub unit (10) according to claim 8 wherein said the first end of each of the spigot inserts (18) is substantially circular in cross section, and the second end of each spigot inserts (18) is substantially rectangular in cross section.
11. A ventilation hub unit (10) according to claim 8 wherein the spigot insert (18) further comprises a flow regulator (38).
12. A ventilation hub unit (10) according to claim 11 wherein the flow regulator (38) is self-governing.
13. A ventilation hub unit (10) according to claim 12 wherein the flow regulator comprises a flexible membrane (38) that partially restricts the flow through the

spigot insert (18) and wherein, in use, an increased flow flexes the membrane to further restrict flow through the membrane.

14. A ventilation hub unit (10) according to claim 11 wherein the flow regulator is manually adjustable to restrict the flow through the spigot insert (18). 5

16. A ventilation hub unit (10) according to claim any one of claims 11 to 14 wherein the spigot insert (18) has retaining feature (44) for retaining a removable flow regulator therein. 10

17. A ventilation hub unit (10) according to any one of claims 8 to 16 further comprising retaining means for retaining the spigot inserts (18) within said inlets (14). 15

18. A ventilation hub unit (10) according to claim 17 wherein said retaining means comprises a screw. 20

19. A ventilation hub unit (10) according to any previous claim wherein the unit outlet (16) has a larger diameter than the unit inlets (14). 25

20. A ventilation hub unit (10) according to claim 19 wherein the cross sectional area of the hub outlet (16) is equal or greater than the total of the cross sectional areas of the inlets (14). 30

21. A ventilation hub unit (10) according to any preceding claim wherein the unit comprises six radial inlets (14).

22. A ventilation hub unit (10) according to claim 21 wherein the inlets have an angular spacing of less than 50 degrees. 35

23. A ventilation hub unit (10) according to any preceding claim wherein the unit is substantially round in plan profile and has a maximum depth 190mm. 40

24. A method of manufacturing a ventilation hub unit (10) comprising: 45

moulding a base section (25) having an internal surface forming a first half impeller cavity, a first half outlet and an electrics tray;
moulding a mid section (24) comprising a first surface comprising forming a second half impeller cavity and a second half outlet, and a second surface comprising an opening therein having a curved section (32) leading into the opening;
moulding a cover section (26) comprising an internal surface forming a first surface of an inlet cavity and a plurality of radially disposed inlet openings therein; and
assembling said base (25), mid (24) and cover 50

(26) section so as to form a ventilation hub unit (10) having: an impeller cavity having an outlet formed between the base section (25) and the mid section (24) and an inlet section, formed between the mid section (24) and the cover section (26), having a plurality of radial inlets and an outlet leading to said impeller cavity;

25. The method according to claim 24 wherein said base (25), middle (24) and cover (26) sections are formed by moulding process having a single axis of tool separation.

26. The method according to claim 24 or claim 25 further comprising the steps of
moulding a plurality of spigot inserts (18) having a first end and a second end;
and
inserting the first end of a spigot inserts (18) into said inlet openings.

27. The method according to claim 26 further comprising the step of:

prior to inserting the first end of the spigot insert (18) into the inlet openings, inserting a flow regulator (38) into said spigot insert.

28. The method according to claim 26 or claim 27 further comprising the step of:

fixing the spigot inserts (18) in the inlets with screws.

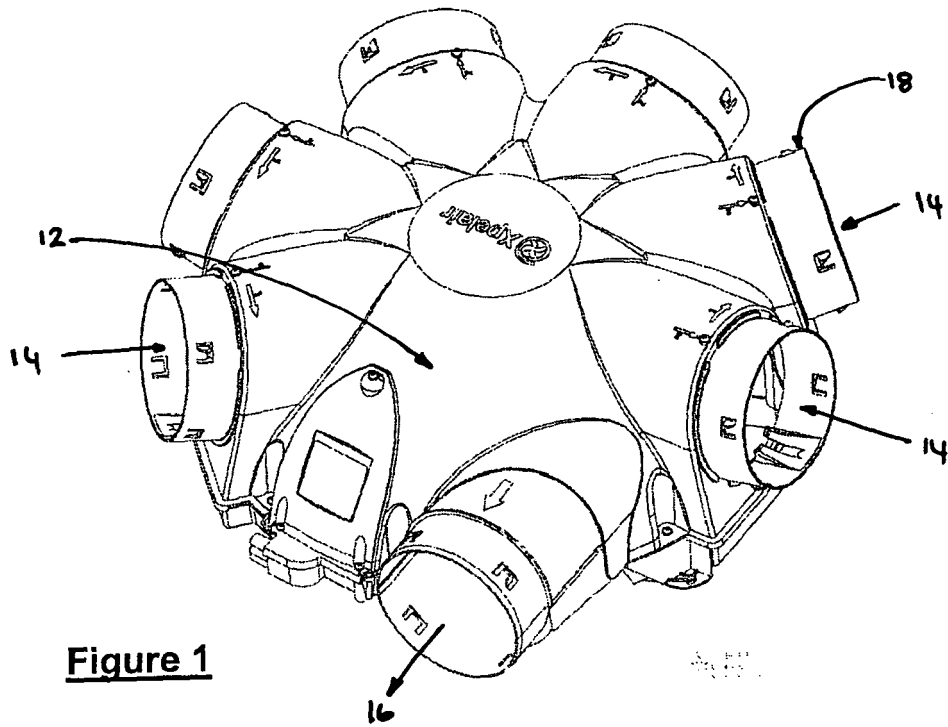


Figure 1

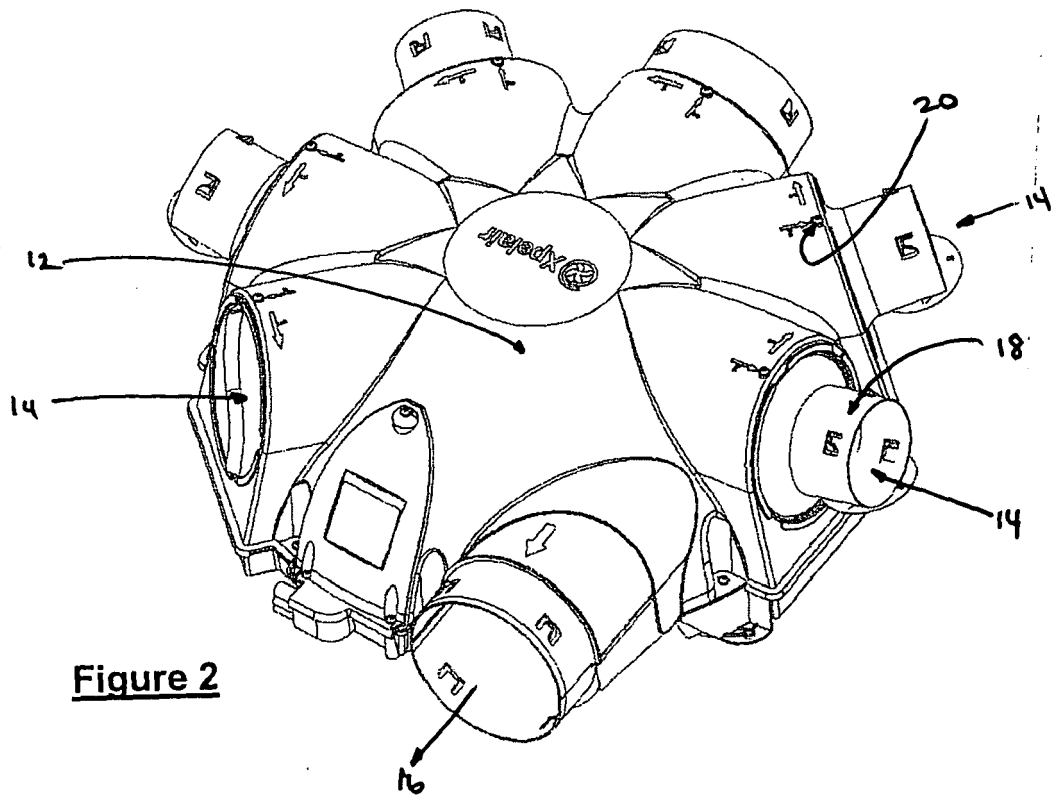


Figure 2

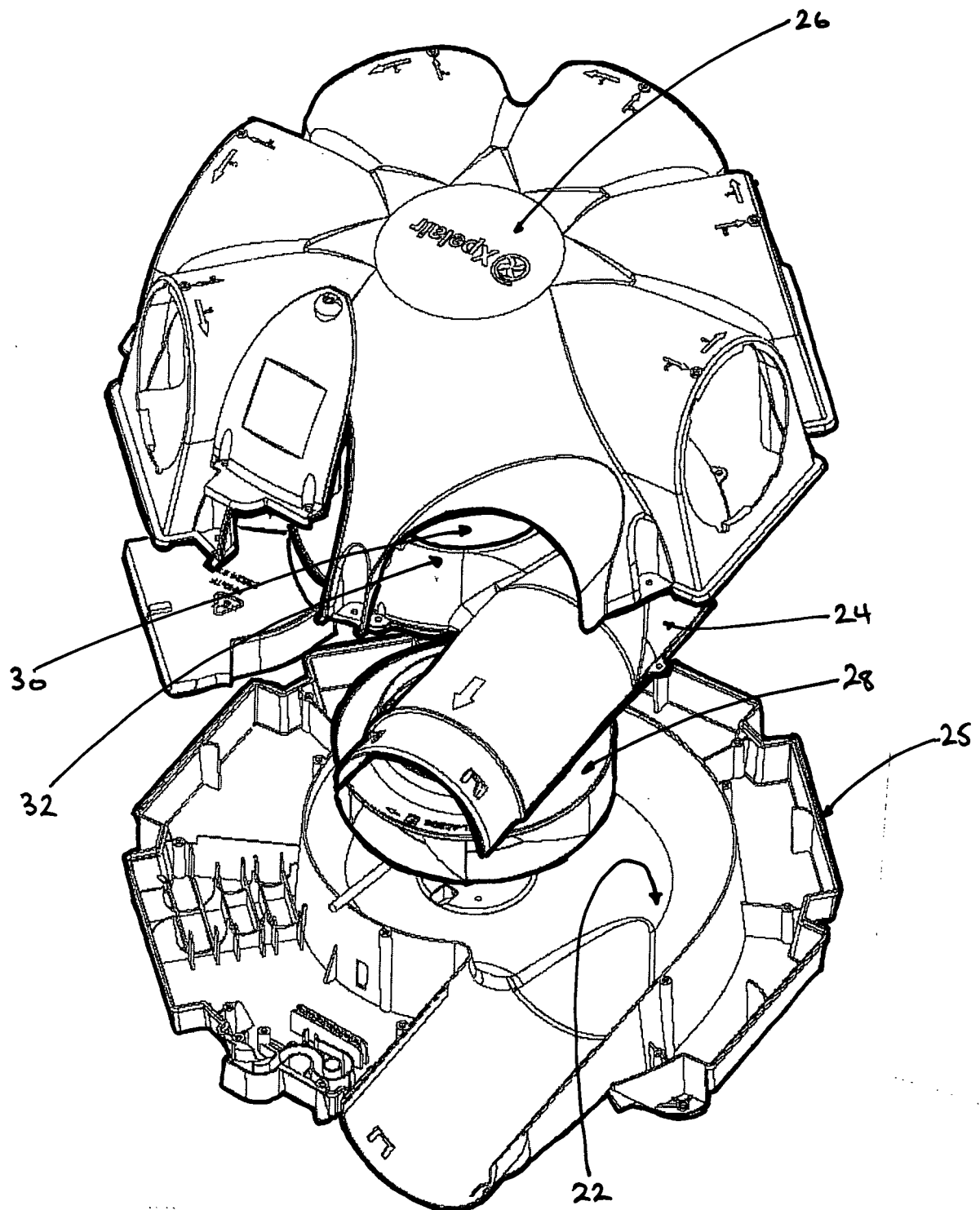


Figure 3

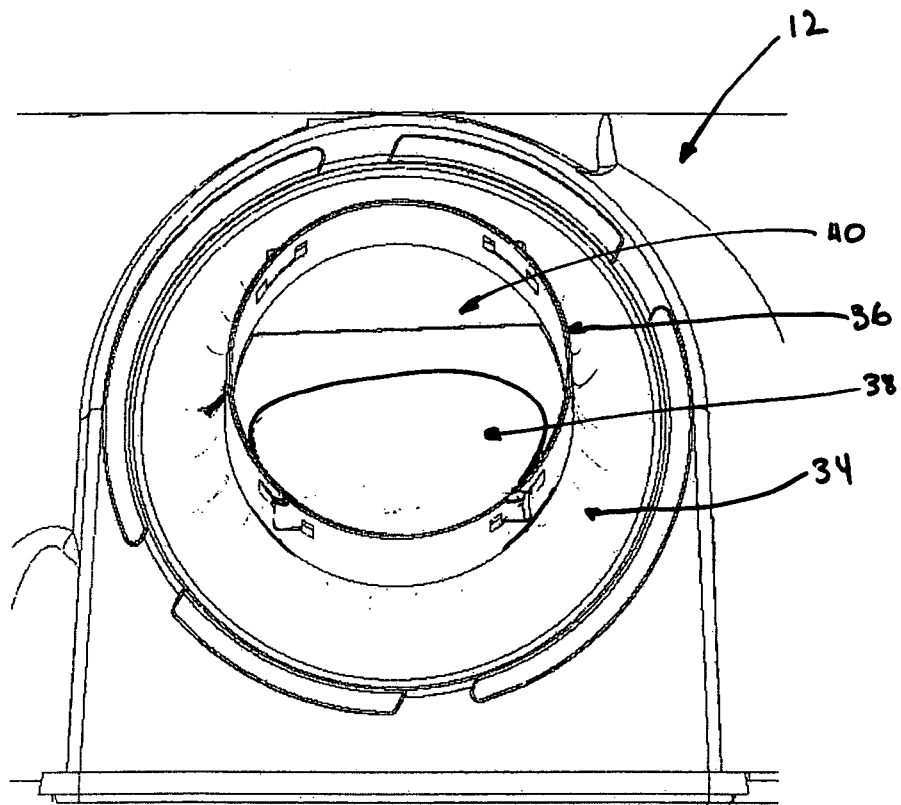


Figure 4

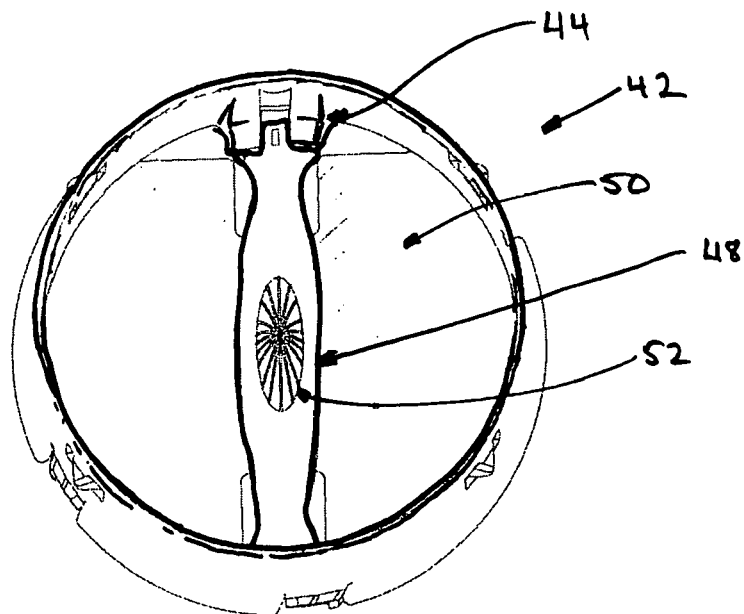


Figure 5

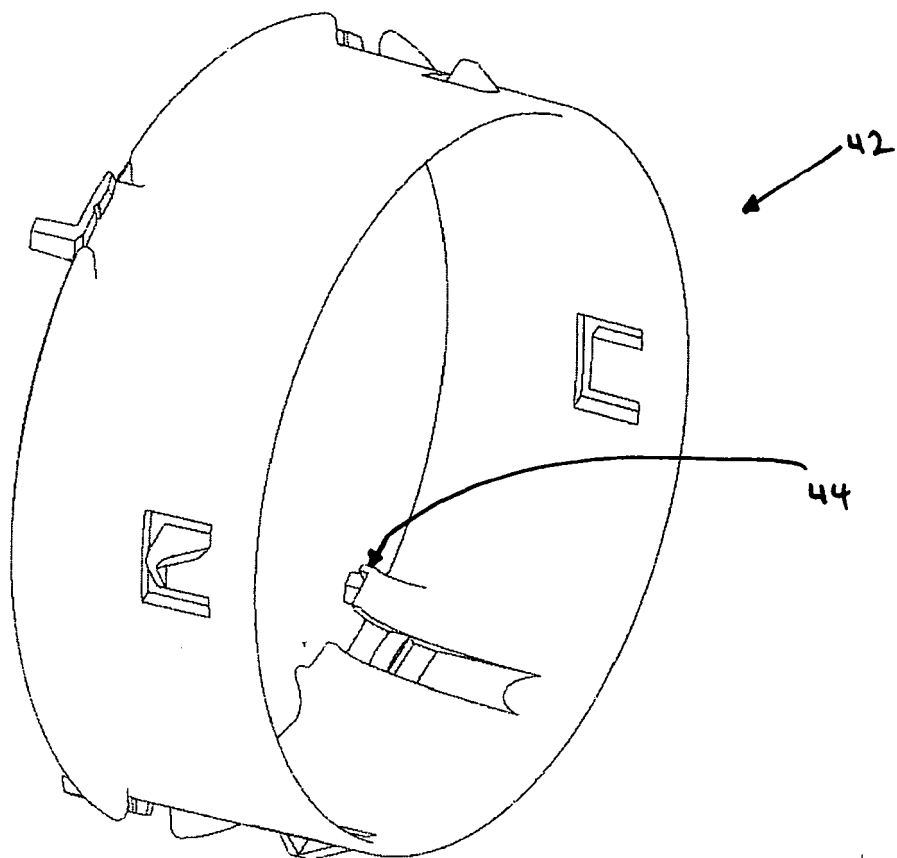


Figure 6



EUROPEAN SEARCH REPORT

Application Number
EP 09 25 2172

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	NL 1 029 313 C2 (INNOSOURCE B V [NL]) 27 December 2006 (2006-12-27)	1-7, 14, 18, 19, 22-27	INV. F24F7/06
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 25 February 2010	Examiner Decking, Oliver
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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