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Description

[0001] This invention relates to fans, in particular ventilation fans such as extractor fans of the type suitable for affixing to a wall or a ceiling or in a window.

[0002] Fans of this type may be used to ventilate a room via a wall or ceiling duct. They typically employ a motor driven impeller to draw air through the duct. A grill or cover plate is normally disposed in front of the impeller. The grill or cover plate serves to prevent objects such as body parts or items of clothing coming into contact with or potentially being caught in the fast-spinning impeller. Cover plates are often used to improve the visual appeal of the fan by obscuring the view of the internal components of the fan.

[0003] A grill, disposed in front of the impeller, provides low impedance to air flowing towards the impeller. However grills can be unsightly as the front facing gaps still allow the spinning impeller and other internals of the fan to be seen from the front, i.e. from within the room. Grills are also susceptible to dust build up and can be difficult to clean.

[0004] As an alternative to a grill, a cover plate may be provided in front of the fan. Such solid cover plates hide the impeller and the rest of the internal fan structure completely and allow no frontal access at all to the impeller. To allow for air flow into the fan, these types of cover plates must be positioned slightly away from the wall via an opening created around the sides of the cover plate and consequently, while these cover plates are more visually appealing from the front, they protrude from the wall or ceiling more than other designs.

[0005] In addition, compared with a grill, a cover plate means that the air must travel a more circuitous route to reach the impeller, involving at least one change of direction as it travels behind the cover plate and then through the fan. Thus, the cover plate may slightly impede the air flow. Additionally, as air is drawn in around the cover plate from all directions, the air from different directions may collide and interfere, causing turbulence. Turbulence can result in inefficiency, requiring more power for a given throughput of air and may also result in increased noise.

[0006] JP 2008 190781 A discloses a ventilating device having a decoration panel for closing a front face of a suction opening of an axial flow-type air blower. An approximately conical guide member is disposed on a back side of the decoration panel. JP 2003 120596 A discloses a portable blower comprising a frame having a horizontal part mounted with a blower and a vertical part on one side of which the back of a worker abuts and to the other side of which the air inlet port of the blower is opposed. The other side of the vertical part of the frame is provided with a laminar flow means for suppressing the turbulence of sucked air. JP H04 1349 U discloses a ventilation system which is mounted on a ceiling or the like and which exhausts indoor air into an outdoor space through a ventilation duct. WO 2013/181904 A1 discloses an oblique

flow fan for an air conditioning indoor unit, the oblique flow fan comprising a wheel hub with a conical or spherical air guide surface.

[0007] From a first aspect, the invention provides a domestic ventilation fan according to claim 1.

[0008] The fan comprises a cover plate that comprises:

an outer surface; and
an inner surface;

wherein the inner surface comprises a tapering projection that projects and narrows away from the outer surface.

[0009] Thus a cover plate for a fan is provided that improves air flow into the fan, reducing cross-currents, eddies and turbulence and making the flow more laminar. Air flowing from the edge of the cover plate towards the centre is guided substantially perpendicularly away from the cover plate by the projection such that air flowing from opposing edges of the cover plate is largely prevented from colliding and causing turbulence. A reduction in turbulent flow improves efficiency and enables a greater air flow rate for a given opening and a given fan speed. This improvement in efficiency may be used to allow the cover plate to be positioned closer to a wall, ceiling or mounting plate, i.e. providing a smaller opening around and behind the cover plate.

[0010] Alternatively, the improved efficiency may be used to draw more air through the fan for a given power and/or fan speed.

[0011] Minimising noise is also generally an important consideration in fan design as fans are often used in domestic settings, e.g., a bathroom or a kitchen, where noisy fans can be a nuisance. Turbulence is often a significant contributor to noise and therefore the reduction in turbulent flow provided by the cover plate projection reduces the amount of noise produced by a fan. In addition, the fact that a fan equipped with such a cover plate may be operated at a lower speed while providing the same level of airflow can also help to minimise the production of noise.

[0012] The tapering projection may take any suitable form so as to provide the best guidance of airflows towards the impeller of the fan. In some cases, air flow could be expected to arrive at the fan in an asymmetric manner and the projection may be asymmetrically designed accordingly for best flow management. However in the majority of circumstances where the flow into the fan is expected to be substantially symmetrical, the tapering portion is preferably rotationally symmetric about a central axis. This further reduces turbulence by ensuring that air flowing towards the projection from any one direction is guided smoothly away from the cover plate, with minimal interference from air flowing towards the projection from any other direction.

[0013] The profile of the tapering projection may influence the flow of air and consequently the degree of turbulence experienced. The profile of the tapering projection may be designed for a particular application and for

the expected airflows in that application. However, in general, a tapering projection with only a shallow gradient (i.e. one in which the diameter of the projection decreases quickly as it projects away from the outer surface) may result in air flowing from opposing sides of the cover plate towards the projection not being redirected effectively such that it still collides at least to some extent, causing turbulence. Alternatively, a tapering projection with only a steep gradient (i.e. one in which the diameter of the projection decreases slowly as it projects away from the outer surface) may cause air flowing from the sides of the cover plate towards the projection to be reflected back on itself, again causing turbulence.

[0014] These problems can be mitigated by providing a tapering projection that comprises portions of both shallow gradient and steep gradient. Preferably the tapering projection has a curved profile that varies in gradient. As the airflow typically enters behind the cover plate substantially parallel to the wall or ceiling and enters the fan substantially perpendicular to that direction, in some embodiments the tapering projection has a shallower gradient in regions where it has its greatest diameter. Preferably the tapering projection has a steeper gradient in regions where it has its narrowest diameter. In other words, the tapering projection preferably has a profile with shallow gradient nearer to the outer surface and a steeper gradient further away from the outer surface. In preferred embodiments the projection has a curved profile that smoothly varies from a shallow gradient to a steep gradient as it projects from the outer surface. Preferably a shallow gradient is no more than 30 degrees, preferably no more than 20 degrees, more preferably no more than 10 degrees, and a steep gradient is preferably at least 60 degrees, more preferably at least 70 degrees, yet more preferably at least 80 degrees. These angles may be defined relative to a mounting plane being a plane of the surface to which the fan is mounted such as a wall or ceiling. It may be noted that the tapering projection typically extends perpendicular to that plane.

[0015] It is often desirable for reasons of aesthetics for the front facing most visible surface of a cover plate to comprise at least one substantially planar region, typically arranged to be parallel to the mounting surface such as a wall or ceiling. The projection preferably projects along a projection axis which is perpendicular to this planar region.

[0016] The profile of the tapering projection may comprise a section that makes an angle of no more than 60 degrees with the projection axis, preferably no more than 45 degrees, more preferably no more than 30 degrees.

[0017] The projection has a substantially conical shape in that it tapers from a wide base towards a point (although preferably in a curved profile as discussed above). The projection preferably tapers to a narrowest point. Preferably the narrowest point is located at the most distant point of the projection from the outer surface. The narrowest point may form a sharp point or a rounded point or it may be the narrowest point of a frustum, i.e. still

having a non-insignificant width parallel to the mounting plane (perpendicular to the conic projection's axis). However, the narrowest point may also be a waist such that the projection widens again as it projects further from the outer surface of the cover plate, thus directing air radially outwardly at its distal end.

[0018] The size of the projection will have an impact on the effectiveness of the cover plate in redirecting air appropriately. A large projection, with a large width (perpendicular to the extension direction of the projection) and height (in the extension direction of the projection), enables the air to be redirected more gently (i.e. the effective radius of curvature may be greater) thus reducing turbulence. However a larger projection may require more material to manufacture, rendering the cover plate heavier, more expensive and more complicated to produce. If the projection were too large, it could also increase the size of the cover plate, which in space limited applications can be important or it could adversely affect the aesthetics if it required a wider cover plate or caused the cover plate to extend further away from the wall/ceiling. Contrastingly, a small projection, while cheaper to produce, lighter and more compact, may, if too small, be ineffective at guiding the airflow while preventing turbulent flow. Accordingly, in some arrangements such as in cover plates for fans suitable for mounting in 100 mm or 150 mm ducts, the projection may have an axial extent (in the direction perpendicular to the wall/ceiling) of at least 1 cm, preferably at least 2 cm, more preferably at least 3 cm. The projection preferably has an axial extent of no more than 8 cm, preferably no more than 6 cm, more preferably no more than 5 cm. The projection may have a width (in the direction parallel to the wall/ceiling) of at least 3 cm, preferably at least 4 cm, more preferably at least 5 cm. The projection preferably has a width of no more than 20 cm, preferably no more than 15 cm, more preferably no more than 10 cm.

[0019] Producing a cover plate that comprises a tapering projection can be challenging using conventional techniques. For example, it is undesirable to form the projection as a solid structure as this would require a significant material cost and added weight. Equally, it is difficult to produce components with large enclosed voids. Therefore, in some preferred embodiments the cover plate comprises at least a main portion and a detachable portion. This allows the cover plate to be produced as two components, which are then assembled to produce the final cover plate, allowing production to use conventional machines and techniques. Preferably the projection is formed on the main portion. Preferably the detachable portion forms part of the outer surface, allowing the detachable portion to be attached to the main portion even when the inner surface is not accessible, e.g. when the cover plate is mounted on a fan or against a wall. The projection on the inner surface may then be formed as a thin walled structure such that a cavity is formed behind the projection (i.e. on the outer surface side of the main portion of the cover plate). This cavity

can then be closed off by the detachable portion which essentially forms a cap that forms a substantially continuous surface over the cavity to make the cover plate as a whole aesthetically pleasing without excessive weight or cost.

[0020] In some embodiments the inner surface of the cover plate may comprise a section which is substantially parallel to the outer surface of the cover plate. Preferably the tapering projection curves smoothly to meet this parallel section which is in turn preferably parallel to the mounting plane (wall or ceiling). In some embodiments the cover plate may have a radially outer portion that extends in the same direction as the tapering projection, i.e. it extends back towards the wall or ceiling (or other structure) to which the fan is mounted, thus producing an overall dome shape for the cover plate.

[0021] In some sets of embodiments, the cover plate does not contain any substantial through holes from the outer surface to the inner surface, such that air is largely prevented from flowing through the cover plate. It is preferable that the ingress of air through the cover plate is reduced so as to minimise turbulence at the rear of the cover plate. A cover plate with no substantial holes may also be easier to clean.

[0022] Fans are often installed vertically within ceilings with the cover plate facing down into the room. In wet or humid environments such as bathrooms and kitchens, the fan can be susceptible to water (e.g. from splashing or from condensation) dripping or collecting on the inner surface of the cover plate. Accordingly, in some embodiments the cover plate comprises one or more drip holes (or paths) from the inner surface to the outer surface. These holes provide a pathway for water to travel from the inner surface out to the outer surface of the cover plate to avoid pooling and potential damage. Advantageously, such drip holes may be formed as part of the attachment mechanism for the detachable part discussed above. The detachable part may be clipped onto the main part through holes in the main part which can also serve as the drip holes for water.

[0023] The fan comprises:

a cover plate according to the disclosure herein; and
an impeller comprising an axis of rotation;

wherein the cover plate is positioned such that the tapering projection is aligned with the axis of rotation of the impeller.

[0024] The improved appearance, energy consumption and reduced noise production of a fan according to the present invention make it particularly suitable for domestic settings, for example in a bathroom or a kitchen. The fan is a domestic ventilation fan such as those used in household kitchens and bathrooms. Preferably the fan is mountable on a wall or a ceiling or in a window.

[0025] It has been further realised that air flow can be further improved by adjusting the shape of the impeller.

[0026] The impeller may comprise a hub with a plurality

of blades extending therefrom. The impeller comprises an inlet side and an outlet side, and the hub comprises a tapering projection on the inlet side that narrows as it projects away from the hub.

[0027] Having a tapering projection extending away from the hub provides an additional air guiding surface that operates in conjunction with the tapering projection on the cover plate to receive the air directed towards the impeller by the cover plate and continue to guide the air efficiently towards the blades of the impeller. By guiding the air directly and smoothly to the impeller blades there is a reduction in turbulence and a corresponding reduction in noise as well as an improvement in power efficiency. The tapering projection on the impeller is preferably centrally located and preferably symmetrical around the rotational axis of the impeller so that the impeller is mass balanced around its rotational axis to avoid unwanted oscillations / vibrations. As with the tapering projection on the cover plate, the tapering projection on the impeller preferably has a surface that tapers from a shallow gradient to a steeper gradient as it narrows away from the hub. The tapering projection of the impeller and the tapering projection of the cover plate taper away from one another such that in some preferred embodiments their narrowest portions (e.g. tips) face each other.

[0028] The impeller may be designed according to particular requirements of the fan. The impeller may be an axial impeller or a centrifugal impeller. However, in preferred embodiments the impeller is a mixed flow impeller. A mixed flow impeller combines the characteristics of an axial flow impeller such as resistance to back flow with the improved rates of air movement of a centrifugal impeller. The blades of the mixed flow impeller project axially forwards from the hub (towards the air inlet side) so as to push the air outwards (centrifugally) as well as extending radially outwardly from the hub so as to push the air backwards (axially). The tapering projection helps to redirect the air towards the mixed flow blades in a more efficient manner. It has been found that without the tapering projection, mixed flow impellers typically interact with the incoming air predominantly at the lower part of the blades (nearest the hub) with the upper parts of the blades (furthest from the blades) not contributing as much to the movement of air. The tapering projection guides the air towards the blades more uniformly such that the air interacts with the mixed flow blades across the whole length of the blades making better use of the whole blade surface, thus increasing the efficiency of the impeller as a whole and increasing the amount of air that it can move for a given size of impeller and rotational speed.

[0029] The tapering projection of the impeller may have a similar profile to the tapering projection of the cover plate, but this is not necessary and it can be designed to redirect air optimally for any particular design of impeller blades. However, preferably the projection has a significant axial extent so as to provide a long guiding path to the air with a relatively large radius of curvature. The

tapering projection extends the axial length of the impeller such that in preferred embodiments the axial extent of the impeller is greater than the radius of the hub. In some preferred embodiments (e.g. for impellers for 100 mm or 150 mm ventilation fans) the impeller has an axial extent (including the tapering projection) of at least 1.5 cm, preferably at least 1.75 cm, more preferably at least 2 cm.

[0030] Additionally, the tapering projection preferably has a curved profile that varies in gradient. The tapering projection may have a profile with a shallower gradient at the radially outward part of the hub and a steeper gradient towards the impeller rotational axis.

[0031] An impeller for a fan is disclosed that comprises:

a hub; and
one or more blades; wherein
the one or more blades project from the hub; and
wherein the impeller comprises an inlet side and an outlet side, and the hub comprises a tapering projection on the inlet side that narrows as it projects away from the hub.

[0032] Thus it will be seen by those skilled in the art that an impeller for a fan is disclosed that improves air flow and reduces turbulence. In addition, the shape of the impeller's hub pushes air to the edges of the blades, ensuring that an increased surface area of each blade may be utilised to impel air, leading to more efficient operation of the impeller.

[0033] The tapering projection causes air flowing towards the inlet side of the impeller to be guided away from the centre of the impeller. This promotes more laminar airflow and minimises the prevalence of turbulence that might otherwise form near the centre of the impeller. Reduced turbulence leads to improved air flow for a given noise and power usage.

[0034] Preferably the tapering projection is rotationally symmetric about the impeller's axis of rotation. A rotationally symmetric hub may guide air flow more evenly, and may reduce vibration, which can be produced when an asymmetric hub is rotated. Such vibrations are undesirable, as they produce noise. An asymmetric hub may also draw a variable load when driven to rotate at a constant rate, which is undesirable in some drive systems.

[0035] The invention applies to centrifugal, mixed flow and axial type impellers, however preferably the impeller is a mixed flow type. Centrifugal impellers have blades with a leading edge extending substantially parallel to the axis of rotation of the impeller whereas axial impellers have blades with the leading edge extending substantially perpendicular to the axis of rotation of the impeller. Mixed flow type impellers are a hybrid type with blades angled in between the axial and centrifugal arrangements, i.e. the blades are angled so as to impart some radial and some axial momentum to the air.

[0036] The tapering projection preferably has a surface that tapers from a shallow gradient to a steeper gradient

as it narrows away from the hub. The axial extent of the impeller is preferably greater than the radius of the hub. The impeller may in some embodiments have an axial extent of at least 1.5 cm, preferably at least 1.75 cm, more preferably at least 2 cm.

[0037] In some examples an impeller as disclosed herein comprises part of a fan, preferably one that also comprises a cover plate according to the present disclosure. In these examples the tapering projections of the both the cover plate and the impeller are aligned, and positioned to minimise the distance between the two. This configuration results in a minimal amount of turbulence. While it is desirable to have the two tapering portions as proximal as possible, manufacturing limitations (tolerances) may result in a practical separation being required, but in some examples it is preferred that this separation be no more than 2mm. Keeping the two projections as close as possible minimises cross-flow and turbulence arising at the gap between the two projections.

[0038] Features of any aspect or embodiment described herein may, wherever appropriate, be applied to any other aspect or embodiment described herein. Where reference is made to different embodiments or sets of embodiments, it should be understood that these are not necessarily distinct but may overlap.

[0039] Certain preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a cross sectional schematic view of a cover plate according to an embodiment of the invention;

Figure 2 is a cross sectional schematic view of a fan not forming part of the invention;

Figure 3 is a cross sectional schematic view of an impeller according to an embodiment of the invention; and

Figure 4 is a cross sectional schematic view of a fan comprising a cover plate and an impeller according to an embodiment of the invention.

[0040] Figure 1 shows a cross section of a circular cover plate for a fan according to one embodiment of the present invention. The cover plate 2 comprises a main body 4 and a detachable face plate 6. The face plate 6 comprises a cylinder which is detachably connected to the main body 4 by means of clips 16. The face plate 6, main body 4 and cover plate 2 as a whole are substantially rotationally symmetric around a central axis C.

[0041] The main body 4 comprises a radially outer portion 8 with a hollow frustoconical shape and a radially inner portion 10. The radially inner portion 10 comprises a projection 12 that projects and narrows along the central axis C on a rear side of the cover plate 2 to a central point 14. The projection 12 is substantially conical in shape. The profile of the projection 12 comprises a gradient that varies smoothly from a shallower gradient at

its base to a steeper gradient as it nears the central point 14.

[0042] The inner portion 10 also comprises the clips 16, which detachably connect the face plate 6 to the main body 4 on a front side of the cover plate 2, opposite to the rear side. When the face plate 6 is connected to the main portion 4, a contiguous front surface 18 is formed, comprised of front facing surfaces of the outer portion 8 and the face plate 6.

[0043] The cover plate also comprises a contiguous inner surface 19, comprised of rearward facing surfaces of the main body 4 and the inner portion 10, that curves smoothly from a radially outermost edge to the central point 14.

[0044] The operation of the cover plate 2 described above will now be described with reference to Figure 2 which shows a cross sectional schematic view of a fan comprising the cover plate 2.

[0045] A fan 20 comprises the cover plate 2 of Figure 1, a mounting plate 22 and an impeller 24, all of which are substantially rotationally symmetric and lie with their axis of rotational symmetry on a central axis C. The mounting plate 22 comprises a central cavity in which the impeller 24 is disposed, and the cover plate 2 is disposed in front of both of the mounting plate 22 and the impeller 24, such that the inner surface 19 of the cover plate 2 faces both the mounting plate and the impeller 24. The tapering projection 12 of the cover plate 2 projects away from the inner surface 19 towards the impeller 24. Although not illustrated in Fig. 2, the cover plate 2 is rigidly connected to the mounting plate 22.

[0046] The cover plate 2 is spaced away from the mounting plate 22 such that an inlet gap 26 is formed at the edge of the fan 20, between a radially outermost edge of the cover plate 2 and the outer edge of the mounting plate 22.

[0047] The mounting plate 22 (and hence the rest of the fan 20) is attached to a fixed surface 28 (e.g. a wall) which comprises a cylindrical duct 30 (e.g. a ventilation duct). The cylindrical duct 30 lies with its axis of rotational symmetry on the central axis C, such that it is aligned with the central cavity of the mounting plate 22. The front surface 18 of the cover plate 2 faces away from the fixed surface 28 and defines the front of the fan 20. The cover plate 2 has a larger diameter than the mounting plate 22 and impeller 24 such that, when the fan 20 is mounted as described, the mounting plate 22 and impeller 24 are not visible from the front.

[0048] The impeller 24 comprises a plurality of blades 32, and in use, the impeller 24 is driven to rotate about the central axis by a driving means (e.g. a motor, not shown). As the impeller 24 rotates, the resultant motion of the blades 32 causes air surrounding the fan 20 to be drawn through the inlet gap 26, through the impeller 24 and into the duct 30, illustrated here by air flow paths 34.

[0049] The profile of the projection 12 smoothly guides the air flowing in from the inlet gap 26 perpendicularly away from the cover plate 2 towards the impeller 24, re-

ducing turbulence caused by air flowing from opposite edges of the fan 20 meeting at the centre. The reduction in turbulence due to the shape of the cover plate 2 means that the same volume of air flow can be provided while producing less noise, using less energy and with a smaller inlet gap 26 than would be required with a conventional cover plate.

[0050] Turbulence may be further reduced, and efficiency further increased by providing a specially shaped impeller with a tapering projection similar to that of the cover plate, as illustrated in Figure 3.

[0051] Figure 3 shows an impeller 100 that comprises a hub 102 and a plurality of blades 104. The impeller 100 is a mixed flow type impeller wherein the blades 104 extend radially and forwards from the hub 102. The impeller 100 is substantially rotationally symmetric about a central axis C and comprises a central drive connector 105, disposed on the central axis C, to which a drive means (not shown) may be connected to rotate the impeller 100 about the central axis C.

[0052] The impeller 100 comprises an inlet side and an outlet side, and the hub 102 comprises a tapering projection 106, rotationally symmetric about the central axis C, on the inlet side that narrows as it projects forwards away from the hub 102 to a central point 108 that lies on the central axis C. The tapering projection 106 has a curved profile that varies smoothly from a shallower gradient nearest to the outlet side to a steeper gradient as it nears the central point 108.

[0053] Figure 4 shows a fan 120 that comprises the cover plate 2 of Figure 1, a mounting plate 22 and the impeller 100 of Figure 3, all of which are substantially rotationally symmetric and lie with their axis of rotational symmetry on a central axis C. As with the fan illustrated in Figure 2, the mounting plate 22 comprises a central cavity in which the impeller 100 is disposed, and the cover plate 2 is disposed in front of both of the mounting plate 22 and the impeller 100, such that the inner surface 19 of the cover plate 2 faces both the mounting plate 22 and the impeller 100.

[0054] As before, the cover plate 2 is spaced away from the mounting plate 22 such that an inlet gap 26 is formed at the edge of the fan 120, between a radially outermost edge of the cover plate 2 and the outer edge of the mounting plate 22. The fan is mounted to a fixed surface 28 (e.g. a wall) such that the mounting plate 22 and impeller 100 are not visible from the front.

[0055] In use, the impeller 100 is driven to rotate about the central axis C by a driving means (e.g. a motor, not shown) connected to the driving connector 105. As the impeller 100 rotates, the resultant motion of the blades 104 impels air surrounding the fan 120 through the inlet gap 26, through the impeller 100 from the inlet side to the outlet side and into the duct 30, illustrated here by air flow paths 134 (illustrated here on only one side of the fan, for clarity).

[0056] The profile of the projection 12 of the cover plate 2 smoothly guides air flowing in from the inlet gap 26

perpendicularly away from the cover plate 2 towards the impeller 24, and the tapering projection 106 of the impeller 100 then smoothly guides air towards the outside of the impeller 100. This reduces turbulence caused by air from opposite sides of the fan 120 meeting at the centre, and also improves the utilisation of the entire length of the blades 104 by pushing air out to the radial extremities of the impeller 100. This has the effect of increasing the amount of air that the impeller 100 can move for a given size and rotational speed.

[0057] The central point 14 of the cover plate 2 and the central point 108 of the impeller 100 are proximal, such that they are separated by only a small gap. This reduces the chances of cross-flow and turbulence arising at the gap.

[0058] It will be appreciated by those skilled in the art that the invention has been illustrated by describing one or more specific embodiments thereof, but is not limited to these embodiments; many variations and modifications are possible, within the scope of the accompanying claims.

Claims

1. A domestic ventilation fan (120) comprising:

a cover plate (2) comprising an outer surface (18) and an inner surface (19), wherein the inner surface (19) comprises a tapering projection (12) that projects and narrows away from the outer surface (18), having a shape that tapers from a wide base towards a point; and an impeller (100) comprising an axis of rotation (C) and a hub (102); wherein the impeller (100) comprises an inlet side and an outlet side;

characterised in that the hub (102) comprises a tapering projection (106) on the inlet side that narrows as it projects away from the hub (102), having a shape that tapers from a wide base towards a point; wherein the cover plate (2) is positioned such that the tapering projection (12) of the cover plate (2) is aligned with the axis of rotation (C) of the impeller (100).

2. A domestic ventilation fan (120) as claimed in claim 1, wherein the tapering projection (12) of the cover plate (2) is rotationally symmetric about a central axis (C).

3. A cover plate as claimed in claims 1 or 2, wherein the tapering projection has a curved profile that varies in gradient.

4. A domestic ventilation fan (120) as claimed in any preceding claim, wherein the tapering projection (12) of the cover plate (2) has a profile with a shallower

gradient nearer to the outer surface (18) and a steeper gradient further away from the outer surface (18).

5. A domestic ventilation fan (120) as claimed in any preceding claim, wherein the cover plate (2) comprises a substantially planar region, and wherein the tapering projection (12) of the cover plate (2) projects along a projection axis which is perpendicular to the planar region.

6. A domestic ventilation fan (120) as claimed in any preceding claim, wherein the tapering projection (12) of the cover plate (2) has an axial extent of no more than 8 cm, preferably no more than 6 cm, more preferably no more than 5 cm.

7. A domestic ventilation fan (120) as claimed in any preceding claim, wherein the tapering projection (12) of the cover plate (2) has a width of no more than 20 cm, preferably no more than 15 cm, more preferably no more than 10 cm.

8. A domestic ventilation fan (120) as claimed in any preceding claim, the cover plate (2) comprising a main portion (4) and a detachable portion (6), wherein the detachable portion (6) forms part of the outer surface (18).

9. A domestic ventilation fan (120) as claimed in any preceding claim, wherein the inner surface (19) comprises a section which is substantially parallel to the outer surface (18).

10. A domestic ventilation fan (120) as claimed in any preceding claim, the cover plate (2) comprising one or more drip holes.

11. A domestic ventilation fan (120) as claimed in any preceding claim, wherein the tapering projection (106) of the impeller (100) is symmetrical around the rotational axis (C) of the impeller (100).

12. A domestic ventilation fan (120) as claimed in any preceding claim, wherein the axial extent of the impeller (100) is greater than the radius of the hub (102).

13. A domestic ventilation fan (120) as claimed in any preceding claim, wherein the impeller (100) is a mixed flow impeller.

14. A domestic ventilation fan (120) as claimed in any preceding claim, wherein the tapering projection (106) of the impeller (100) and the tapering projection (12) of the cover plate (2) taper away from one another.

15. A domestic ventilation fan (120) as claimed in any

preceding claim, wherein the tapering portion (106) of the impeller (100) and the tapering projection (12) of the cover plate (2) are separated by no more than 2mm.

Patentansprüche

1. Wohnraumlüftungs-Lüfter (120), umfassend:

eine Abdeckplatte (2), die eine Außenfläche (18) und eine Innenfläche (19) umfasst, wobei die Innenfläche (19) einen sich verjüngenden Vorsprung (12) umfasst, der von der Außenfläche (18) entfernt vorspringt und schmaler wird, mit einer Form, die sich von einer breiten Basis zu einem Punkt verjüngt; und einen Impeller (100), der eine Drehachse (C) und eine Nabe (102) umfasst; wobei der Impeller (100) eine Einlassseite und eine Auslassseite umfasst;

dadurch gekennzeichnet, dass die Nabe (102) auf der Einlassseite einen sich verjüngenden Vorsprung (106) umfasst, während er von der Nabe (102) entfernt vorspringt, schmaler wird, mit einer Form, die sich von einer breiten Basis zu einem Punkt verjüngt; wobei die Abdeckplatte (2) so positioniert ist, dass der sich verjüngende Vorsprung (12) der Abdeckplatte (2) mit der Drehachse (C) des Impellers (100) fluchtet.

2. Wohnraumlüftungs-Lüfter (120) nach Anspruch 1, wobei der sich verjüngende Vorsprung (12) der Abdeckplatte (2) um eine Mittelachse (C) herum rotationssymmetrisch ist.

3. Abdeckplatte nach den Ansprüchen 1 oder 2, wobei der sich verjüngende Vorsprung ein gebogenes Profil aufweist, das im Gradienten variiert.

4. Wohnraumlüftungs-Lüfter (120) nach einem vorstehenden Anspruch, wobei der sich verjüngende Vorsprung (12) der Abdeckplatte (2) ein Profil mit einem flacheren Gradienten näher an der Außenfläche (18) und einem steileren Gradienten weiter von der Außenfläche (18) entfernt aufweist.

5. Wohnraumlüftungs-Lüfter (120) nach einem vorstehenden Anspruch, wobei die Abdeckplatte (2) einen im Wesentlichen ebenen Bereich umfasst, und wobei der sich verjüngende Vorsprung (12) der Abdeckplatte (2) entlang einer Vorsprungsachse vorspringt, die zu dem ebenen Bereich senkrecht steht.

6. Wohnraumlüftungs-Lüfter (120) nach einem vorstehenden Anspruch, wobei der sich verjüngende Vorsprung (12) der Abdeckplatte (2) eine axiale Erstreckung

von nicht mehr als 8 cm, vorzugsweise nicht mehr als 6 cm, bevorzugter nicht mehr als 5 cm aufweist.

7. Wohnraumlüftungs-Lüfter (120) nach einem vorstehenden Anspruch, wobei der sich verjüngende Vorsprung (12) der Abdeckplatte (2) eine Breite von nicht mehr als 20 cm, vorzugsweise nicht mehr als 15 cm, bevorzugter nicht mehr als 10 cm aufweist.

8. Wohnraumlüftungs-Lüfter (120) nach einem vorstehenden Anspruch, wobei die Abdeckplatte (2) einen Hauptabschnitt (4) und einen abnehmbaren Abschnitt (6) umfasst, wobei der abnehmbare Abschnitt (6) einen Teil der Außenfläche (18) bildet.

9. Wohnraumlüftungs-Lüfter (120) nach einem vorstehenden Anspruch, wobei die Innenfläche (19) ein Teilstück umfasst, das im Wesentlichen zur Außenfläche (18) parallel ist.

10. Wohnraumlüftungs-Lüfter (120) nach einem vorstehenden Anspruch, wobei die Abdeckplatte (2) ein oder mehrere Abtropflöcher umfasst.

11. Wohnraumlüftungs-Lüfter (120) nach einem vorstehenden Anspruch, wobei der sich verjüngende Vorsprung (106) des Impellers (100) um die Drehachse (C) des Impellers (100) herum symmetrisch ist.

12. Wohnraumlüftungs-Lüfter (120) nach einem vorstehenden Anspruch, wobei die axiale Erstreckung des Impellers (100) größer ist als der Radius der Nabe (102).

13. Wohnraumlüftungs-Lüfter (120) nach einem vorstehenden Anspruch, wobei es sich bei dem Impeller (100) um einen Mischströmungs-Impeller handelt.

14. Wohnraumlüftungs-Lüfter (120) nach einem vorstehenden Anspruch, wobei der sich verjüngende Vorsprung (106) des Impellers (100) und der sich verjüngende Vorsprung (12) der Abdeckplatte (2) sich voneinander entfernt verjüngen.

15. Wohnraumlüftungs-Lüfter (120) nach einem vorstehenden Anspruch, wobei der sich verjüngende Abschnitt (106) des Impellers (100) und der sich verjüngende Vorsprung (12) der Abdeckplatte (2) um nicht mehr als 2 mm getrennt sind.

Revendications

1. Ventilateur domestique (120) comprenant :

une plaque de recouvrement (2) comprenant une surface externe (18) et une surface interne

- (19), dans lequel la surface interne (19) comprend une projection conique (12) qui se projette et rétrécit loin de la surface externe (18), présentant une forme qui s'effile depuis une base large vers un point ; et
une hélice (100) comprenant un axe de rotation (C) et un moyeu (102) ; dans lequel l'hélice (100) comprend un côté entrée et un côté sortie ;
caractérisé en ce que le moyeu (102) comprend une projection conique (106) sur le côté entrée qui rétrécit lorsqu'elle se projette loin du moyeu (102), présentant une forme qui s'effile depuis une base large vers un point ;
dans lequel la plaque de recouvrement (2) est positionnée de telle sorte que la projection conique (12) de la plaque de recouvrement (2) est alignée avec l'axe de rotation (C) de l'hélice (100).
2. Ventilateur domestique (120) selon la revendication 1, dans lequel la projection conique (12) de la plaque de recouvrement (2) est symétrique en rotation autour d'un axe central (C).
 3. Plaque de recouvrement selon les revendications 1 ou 2, dans laquelle la projection conique présente un profil incurvé qui varie en gradient.
 4. Ventilateur domestique (120) selon une quelconque revendication précédente, dans lequel la projection conique (12) de la plaque de recouvrement (2) présente un profil avec un gradient plus faible plus près de la surface externe (18) et un gradient plus prononcé plus loin de la surface externe (18).
 5. Ventilateur domestique (120) selon une quelconque revendication précédente, dans lequel la plaque de recouvrement (2) comprend une région sensiblement plane, et dans lequel la projection conique (12) de la plaque de recouvrement (2) se projette le long d'un axe de projection qui est perpendiculaire à la région plane.
 6. Ventilateur domestique (120) selon une quelconque revendication précédente, dans lequel la projection conique (12) de la plaque de recouvrement (2) présente une étendue axiale de pas plus de 8 cm, de préférence de pas plus de 6 cm, plus préférentiellement de pas plus de 5 cm.
 7. Ventilateur domestique (120) selon une quelconque revendication précédente, dans lequel la projection conique (12) de la plaque de recouvrement (2) présente une largeur de pas plus de 20 cm, de préférence de pas plus de 15 cm, plus préférentiellement de pas plus de 10 cm.
 8. Ventilateur domestique (120) selon une quelconque revendication précédente, la plaque de recouvrement (2) comprenant une portion principale (4) et une portion détachable (6), dans lequel la portion détachable (6) fait partie de la surface externe (18).
 9. Ventilateur domestique (120) selon une quelconque revendication précédente, dans lequel la surface interne (19) comprend une section qui est sensiblement parallèle à la surface externe (18).
 10. Ventilateur domestique (120) selon une quelconque revendication précédente, la plaque de recouvrement (2) comprenant un ou plusieurs trous d'égouttement.
 11. Ventilateur domestique (120) selon une quelconque revendication précédente, dans lequel la projection conique (106) de l'hélice (100) est symétrique autour de l'axe de rotation (C) de l'hélice (100).
 12. Ventilateur domestique (120) selon une quelconque revendication précédente, dans lequel l'étendue axiale de l'hélice (100) est plus grande que le rayon du moyeu (102).
 13. Ventilateur domestique (120) selon une quelconque revendication précédente, dans lequel l'hélice (100) est une hélice à flux mixte.
 14. Ventilateur domestique (120) selon une quelconque revendication précédente, dans lequel la projection conique (106) de l'hélice (100) et la projection conique (12) de la plaque de recouvrement (2) s'effilent à l'opposé l'une de l'autre.
 15. Ventilateur domestique (120) selon une quelconque revendication précédente, dans lequel la projection conique (106) de l'hélice (100) et la projection conique (12) de la plaque de recouvrement (2) sont séparées de pas plus de 2 mm.

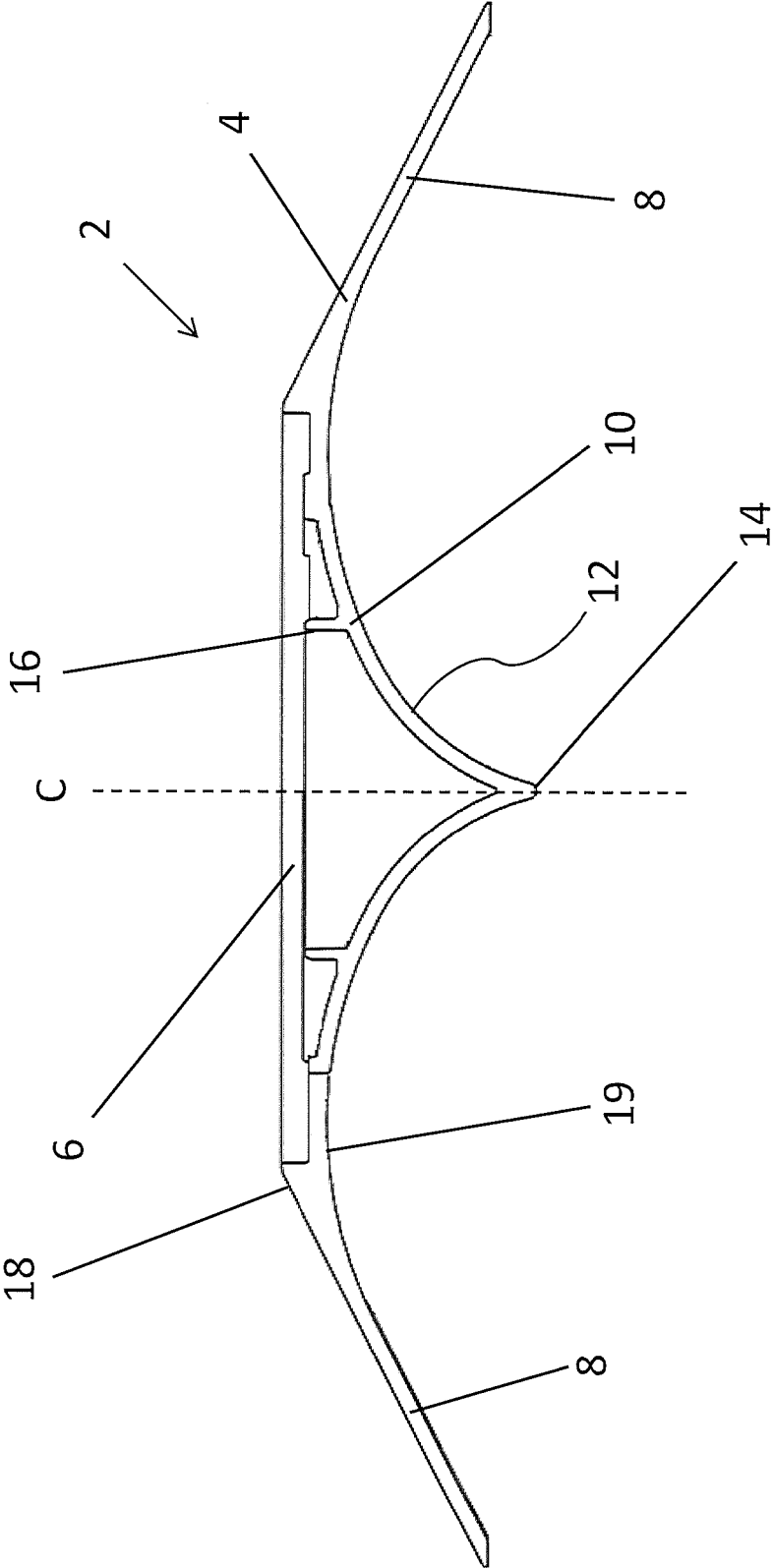


Figure 1

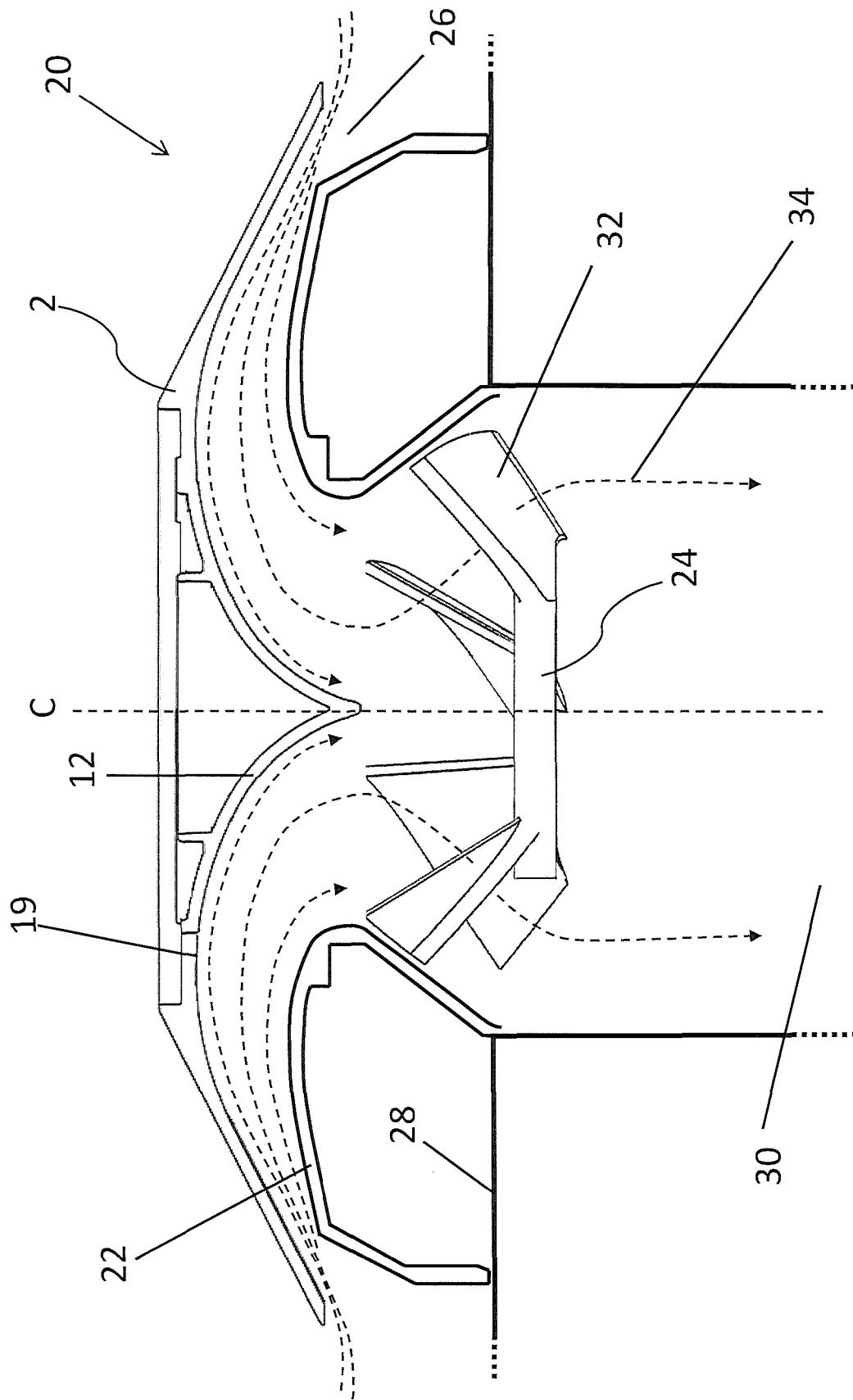


Figure 2

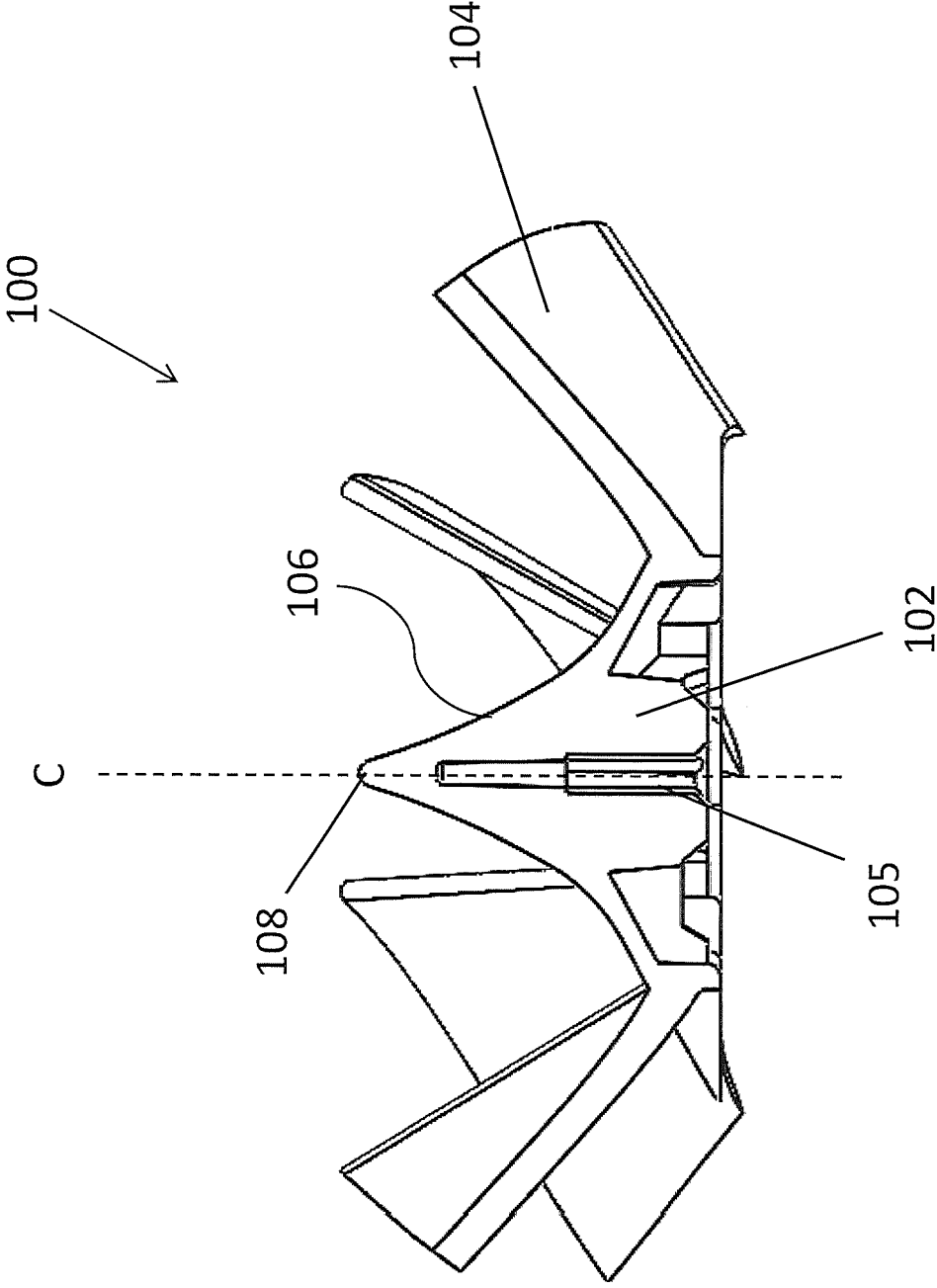


Figure 3

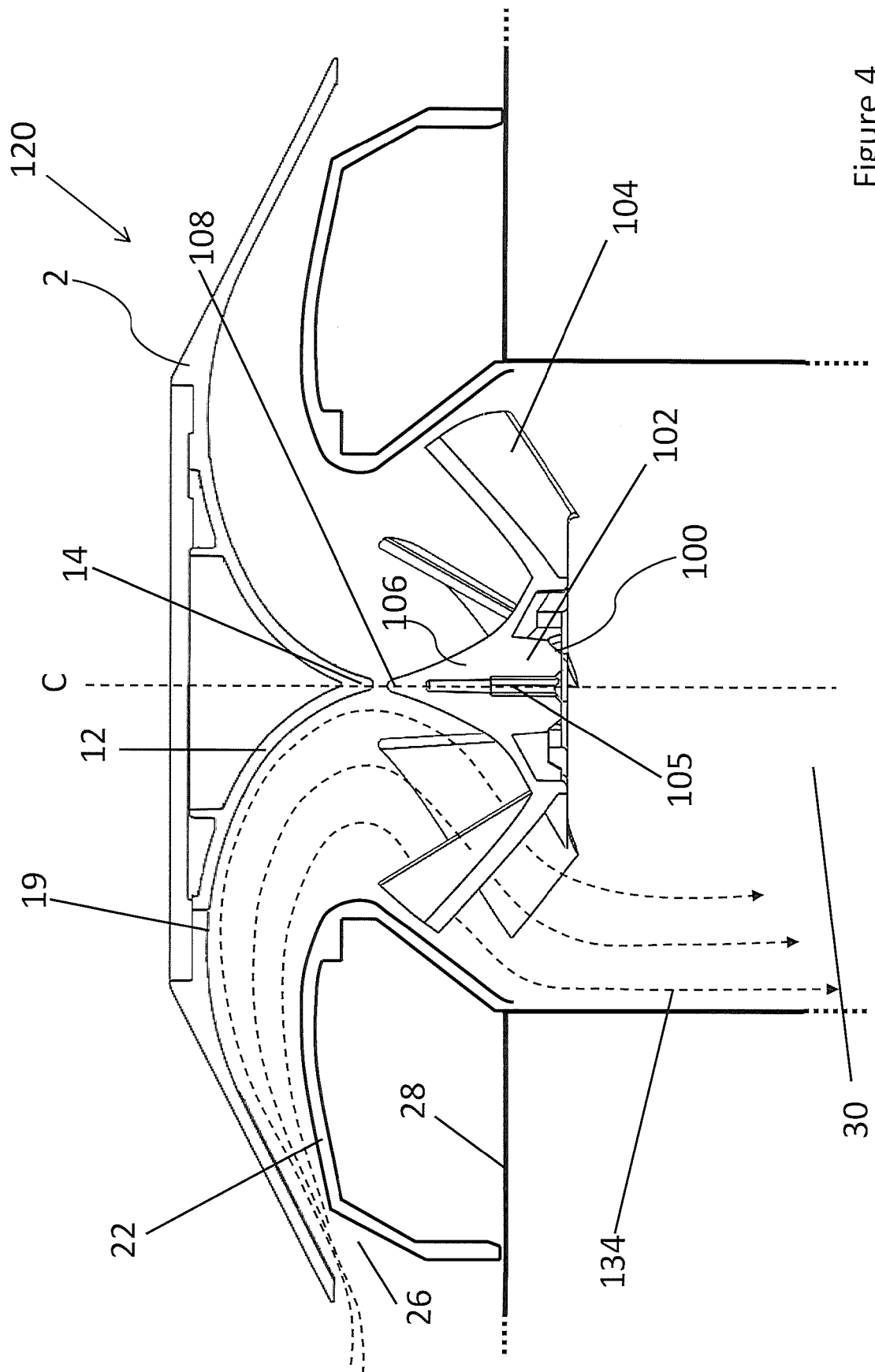


Figure 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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