Fan cover locating mechanism

The invention relates to fans, particularly to domestic ventilation and/or extractor fans and a mechanism for quickly locating a front plate or grill onto a mounting structure.

It is important for safety and aesthetic reasons to provide some form of barrier in front of the main air inlet for a fan, for example to prevent larger objects from being sucked into or inserted into the fan or simply to provide a better appearance to the fan within a kitchen or bathroom. However, these barriers (such as front plates or grills) need to be removed for installation or maintenance or for access to certain controls. For example the installer needs to make electrical connections to connect the fan to mains power and certain controls like overrun timers or humidity sensors may need calibrating or adjusting depending on the user's choice or the environment in which the fan is installed.

When the fan is installed in a ceiling or high up in a wall, as is often the case both to minimize the impact of the fan on the room and to withdraw the more hot and humid air which rises to the top of the room, the fitting of the grill or front plate can become difficult. in particular it may not be possible to see the attachment mechanism once the plate or grill is in place. Additionally the user may need to stand on a ladder to reach the fan and may therefore only have one hand free to engage the plate or grill with the fan. Installers may also be carrying tools for making the necessary electrical connections. Either way, it is desirable to be able to fit the front plate to the fan with one hand.

In existing fans with detachable front plates or grills, these cover members are generally attached via snap fits, typically requiring a 50 Newton force for separation. Separation can therefore be awkward and jerky and re-attachment can be difficult due to the difficulty of aligning the clips. An

aggressive snap engagement is required in order to meet safety regulations with regard to inaccessibility of the moving fan parts behind. In other models the grill or plate may be hinged and is removably held in place in the closed position by fastening with a screw or the like.

According to the invention there is provided a fan comprising a base unit and a removable cover member, the cover member comprising at least one groove on the surface facing the base unit and at least one first connector part on the surface facing the base unit and the base unit comprising at least one projection extending towards the cover member for engagement with the or each groove and at least one second connector part for engagement with the first connector part, wherein the or each projection is provided on a post which extends from the base unit towards the cover member, and wherein the or each groove and the or each projection are arranged such that the first and second connector parts can be engaged and disengaged by sliding the or each projection within the or each groove.

The projection and groove arrangement makes it possible to align the first and second connector parts quickly and easily and by feel rather than by sight. This makes it straightforward to fit the cover member to the base unit with one hand without significant trial and error. The correct alignment can be established quickly and easily. The cover member is simply pressed against the base unit and moved until the projections are engaged in the grooves, then while maintaining this engagement, the cover member is slid so as to engage the first and second connector parts and thereby to secure the cover member to the base unit.

The posts provide support for the cover member and define the distance of separation between the cover member and the base unit. The posts may be formed in aerodynamic shapes so as to minimize turbulence in the incoming air flow.

The projection could take the form of a complete or nearly complete circle, with the groove likewise taking the form of a complete or nearly complete circle. There would have to be sufficient air vents under the projection to allow air to flow into the fan. However it is preferred that the projections are smaller. The projections may still be in the form of circular arcs with corresponding grooves in the form of circular arcs. If the projections are small enough they need not be arcuate at all in order to mate with arcuate grooves.

The base unit may have only one projection. This arrangement can work if the projection is elongate and engages in the groove in a directional fashion. However preferably the base unit comprises a plurality of projections. The plurality of projections provide several contact points for the cover member and once all the projections are engaged they will the cover member can be held in a stable position while it is slid into secure engagement with the base unit.

In the most preferred embodiments the base unit has exactly three projections. Three projections is sufficient to create a stable platform against which to hold the cover member during the engagement operation while still keeping the resistance low to the incoming air stream. A greater number of projections would mean a greater number of obstacles in the incoming airflow which would increase turbulence and thereby increase noise and reduce efficiency.

The projections may all be located at different distances from the centre of the fan (typically the axis of rotation of the motor and impeller). In such situations a different groove is required for each projection even the sliding movement is rotational. However, in preferred embodiments the projections are all located at the same radial distance from the centre and the groove is formed as a circle or as an arc which is a substantial portion of a circle (e.g. a near-complete circle). The projections can then all engage in the same groove. This increases the symmetry of the arrangement and makes it

easier to locate the projections into the correct grooves (because there is only one groove). Preferably therefore the cover member comprises a single circular groove for engagement with the or each projection.

Alternatively the cover member may comprise one groove for each projection. If the engagement of the cover member and the base unit is rotational then these grooves will each be circular arcs. If the engagement is in a straight line, then the grooves will be straight. Preferably the grooves are significantly longer than the projections so as to allow significant sliding movement of the two pieces.

The groove(s) are preferably formed at a radially intermediate location, i.e. not too close to the centre and not too close to the edge. Close to the centre would mean that the structures got in the way of the main air inlet of the fan and too close to the edge would mean that the cover member might be difficult to manoeuver without the edge slipping off the projections. Preferably the groove(s) are located at a radius of around 40 to 60 percent of the distance from the centre to the edge of the cover member, more preferably between around 45 and 55 percent and most preferably at about percent. In preferred embodiments, the cover member is formed from a central circular section which may be domed and which is surrounded by a conical annulus, i.e. the whole shape forming a domed frustum and preferably the groove is located in the region of the interface between the central circular section and the conical annulus.

~~Preferably the or each projection is provided on a post which extends from the base unit towards the cover member. The posts provide support for the cover member and define the distance of separation between the cover member and the base unit. The posts may be formed in aerodynamic shapes so as to minimize turbulence in the incoming air flow.~~

Preferably the posts are elongate in the radial direction. The base unit and the cover member are preferably circular although this is not essential.

Regardless of shape, radial here means perpendicular to the axis of rotation of the motor and impeller.

The projections may be formed at any location on top of the posts. For example they may be formed on the radially outer end or in the middle. Preferably the or each projection is formed on the radially inward end of the post.

The posts may take any form, but in preferred embodiments the surface of the post which faces the cover member is shaped to match the facing surface of the cover member. This ensures a good mating between the cover unit and the posts and reduces potential areas of turbulence. As mentioned elsewhere, the cover member may be convex or substantially dome shaped, e.g. with a central domed section and a surrounding conical annulus.

The second connector part may be formed on the post(s). ~~The first and second connector parts may comprise a male connector part and a female connector part. The male and female parts can be either way round, but preferably the male connector part is located on the cover member and the female part on the base unit.~~

~~The male connector part may be a simple projection with a friction fit into a corresponding hole. However preferably it comprises a plurality of fingers which extend into the female connector part. The fingers have some flexibility and can therefore be biased inwardly upon insertion. The resilience of the fingers provides friction between the two parts to hold them together. In the engaged state, a projection on at least one finger of the male connector part may be located behind a lip on the female part so as to resist separation of the two parts. Preferably this resistance is only mild, e.g. enough to prevent accidental disengagement, but weak enough that it can easily be overcome by hand.~~

~~In preferred embodiments the male part and the female part are arranged to engage circumferentially.~~

According to a second aspect, the invention provides a method of engaging a cover member with a fan base unit, wherein the cover member comprises at least one groove on the surface facing the base unit and at least one first connector part on the surface facing the base unit and wherein the base unit comprises at least one projection extending towards the cover member for engagement with the or each groove and at least one second connector part for engagement with the first connector part, the method comprising: holding the or each projection in contact with the surface facing the base unit, and moving the cover member laterally so that ~~locating~~ the or each projection locates in the or each groove, and sliding the or each projection within the or each groove so as to bring the first connector part into engagement with the second connector part.

According to a third aspect, the invention provides a fan comprising a base unit and a removable cover member, the cover member comprising at least one groove on the surface facing the base unit and at least one first connector part on the surface facing the base unit and the base unit comprising at least one projection extending towards the cover member for engagement with the or each groove and at least one second connector part for engagement with the first connector part, wherein the or each groove and the or each projection are arranged such that the first and second connector parts can be engaged and disengaged by sliding the or each projection within the or each groove, wherein the first and second connector parts comprise a male connector part and a female connector part, and the male connector part comprises a plurality of fingers which extend into the female connector part.

The male and female parts can be either way round, but preferably the male connector part is located on the cover member and the female part on the base unit.

The fingers have some flexibility and can therefore be biased inwardly upon insertion. The resilience of the fingers provides friction between the two parts to hold them together. In the engaged state, a projection on at least one finger of the male connector part may be located behind a lip on the female part so as to resist separation of the two parts. Preferably this resistance is only mild, e.g. enough to prevent accidental disengagement, but weak enough that it can easily be overcome by hand.

According to a fourth aspect, the invention provides a fan comprising a base unit and a removable cover member, the cover member comprising at least one groove on the surface facing the base unit and at least one first connector part on the surface facing the base unit and the base unit comprising at least one projection extending towards the cover member for engagement with the or each groove and at least one second connector part for engagement with the first connector part, wherein the or each projection is provided on a post which extends from the base unit towards the cover member, wherein the or each groove and the or each projection are arranged such that the first and second connector parts can be engaged and disengaged by sliding the or each projection within the or each groove, and wherein the first and second connector parts comprise a male connector part and a female connector part, and wherein the male connector part comprises a plurality of fingers which project in a circumferential direction parallel with, and spaced apart from, the inside surface of the cover and which extend into the female connector part.

According to a fifth aspect, the invention provides a fan comprising a base unit and a removable cover member, the cover member comprising at least one groove on the surface facing the base unit and at least one first connector part on the surface facing the base unit and the base unit comprising at least one projection extending towards the cover member for engagement with the or each groove and at least one second connector part for engagement with the first connector part, wherein the or each groove and the or each projection are arranged such that the first and second connector parts can be engaged and disengaged by sliding the or each

projection within the or each groove, and wherein the fan is configured so that the or each projection is holdable in contact with the surface facing the base unit whilst the cover member is moved laterally so that the or each projection locates in the or each groove.

All of the preferred features described above in relation to the fan apparatus apply equally well to the method.

Preferred embodiments of the invention will now be described, by way of example only, and with reference to the accompanying drawings in which:

Fig. 1A is a section view of a fan base unit according to the invention;
Fig. 1 B shows a more detailed view of a post of Fig. 1A;
Fig. 2 is an exploded view of a fan base unit and a cover plate according to the invention;
Fig. 3 is a detailed section view of the cover plate engaged with the base unit;
Fig. 4 is a plan view of the outer surface of a cover plate; and
Fig. 5 is a plan view of the inner surface of a cover plate.

Figs. 1A and 1 B show a domestic ventilation fan 10 of the kind typically installed in a kitchen or bathroom. The fan 10 has a motor 12 with an axis 14 onto which an impeller 16 is mounted. The fan 10 comprises a base unit formed of a cylindrical part 22 for mounting into a wall or ceiling (or into an appropriate duct) and a front section 24 which in use is mounted flush to the wall or ceiling. In this embodiment the motor is housed in the rear cylindrical part 22 and the front section 24 is hollow and houses electrical connectors and control circuitry respectively for connecting the fan to mains electricity and for controlling operation of the fan. To be more specific, the rear wall 28 of the front section 24 is mounted flush to the wall or ceiling. The remainder of the hollow front section 24 projects out from the wall or ceiling.

The front section 24 has a central aperture 26 through which air is drawn by the impeller 16 in order to move air from inside the room to outside the room. For safety as well as for aesthetic purposes, a front plate 30 is mounted in front of the front section 24 so as to hide the aperture and the fan controls from view within the room (the fan controls in this embodiment being located on the front of the front section 24) and to hinder large foreign objects from entering or being inserted into the aperture 26. In order to allow air to flow into the aperture 26 and to permit ventilation, the front plate 30 must be separated from the front section 24 of the main fan body 20 so that a gap is formed between the two, thereby forming a path for air to flow from the room, round the plate 30 and into the fan 10 via the aperture 26.

Fig. 2 shows an exploded view of the fan 10 with the front plate 30 separated from the rest of the fan unit 20. Fig. 3 shows a close up section view of a portion of the fan 10 with the front plate 30 engaged with the base unit 20.

The plate 30 is separated from the front section 24 by three posts 40 which project forward from the front section 24 and to which the plate 30 is mounted in use. The distance by which the posts 40 project from the front section 24 determines the separation of the plate 30 from the front section 24 and thereby determines the size of the air flow path between the two.

The front plate 30 needs to be removable so that the installer can access the front section 24 to connect the fan to the electricity supply and set up the fan for initial use and so that the end users of the fan can access the fan controls on the front of the front section 24. In this embodiment the front plate 30 is removably mounted to the posts 40 by rotation. The inside surface 32 of the front plate 30 has three connectors 34, one for engagement with each post 40. The connectors 34 each have fingers 36 which project in a circumferential direction parallel with the inside surface 32 of the front plate 30. The posts 40 each have a circumferentially facing opening 42 sized to receive the fingers 36 of a connector 34. To engage the

connectors 34 with the openings 42, the front plate 30 needs to be positioned so that the connectors 34 align with the openings 42. Then the plate 30 is rotated so that the connectors 34 move circumferentially round into the openings 42. Once engaged, the connectors 34 are supported within the openings 42 and thus prevent axial separation of the front plate 30 and the front section 24 (i.e. separation along the main axis of rotation of the fan, i.e. generally away from the fan body). The fingers 36 also have radial projections 38 which are forced inwards upon contact with the openings 42 during engagement and which spring back out again when they have passed through the opening 42 and out the other side (the fingers 36 being slightly longer than the width of the opening 42). This sprung engagement provides some resistance to rotation and prevents accidental disengagement of the front plate 30 from the posts 40. The sprung engagement is however only enough to hold the plate 30 in place against slippage or small knocks and can easily be disengaged by hand for access to the main fan unit 20.

When fitting the front plate 30 to the main fan unit 20, the posts 40 are not visible which prevents visible alignment of the connectors 34 with the openings 42. Fans are often installed high up in walls, or in ceilings and therefore the installer or the user may find themselves attaching the plate 30 to the base unit 20 with one hand, perhaps while standing on a ladder or while holding tools in the other hand. To facilitate the alignment, the inside surface 32 of the front plate 30 contains a circular groove 50. The tops 44 of the posts 40 each have a locating projection (or lug) 46 which fits into the groove 50. The locating projections 46 are thus located at points on a circle corresponding to the groove 50.

To engage the front plate 30 with the posts 40, the front plate 30 is held against the posts 40 such that the projections 46 are in contact with the inner surface 32 of the plate 30. The plate 30 can then be moved laterally until one or more of the locating projections 46 engage with the groove 50. This engagement can easily be felt by the user. Once one locating

projection 46 is in, further movement of the plate 30 will rapidly result in engagement of the remaining locating projections 46 in the groove 50. Once all locating projections are located in the groove 50 it is a simple matter of rotating the plate 30 such that the projections 46 slide circumferentially in the groove 50 until the connectors 34 mate with the openings 42 in the posts 40. The engagement of the front plate 30 with the base unit 20 is thus easy and quick and can be performed entirely by touch and feel.

Disengagement of the front plate 30 from the posts 40 is a simple matter of rotating the plate 30 in the opposite direction until the connectors 34 disengage from the openings 42 in the posts 40. The plate 30 is then free to be removed.

The front plate 30 has a convex shape, i.e. when viewed from the front the perimeter is further away than the centre. In this embodiment the plate 30 has a central circular section 52 with a high radius of curvature surrounded by a conical annular section 54. The angle of the annular section 54 matches the angle of the tops 44 of the posts 40 so that when the two parts 20, 30 are engaged, the inner surface 32 of the plate 30 mates closely with the tops 44 of the posts 40. The groove 50 is formed at the junction between the central circular section 52 and the conical annual section 54.

The posts 40 are elongate in the radial direction and the locating projections 46 are located at the radially inner ends of the tops 44 of the posts 40.

The inner and outer faces of the front plate 30 are shown in plan view in Figs. 4 and 5 to more clearly show the groove 50 and the connectors 34.

It will be appreciated that the description here refers to certain features as being at the front or top. Both terms are used to mean the side which is viewed during use or which faces into the room. These terms are not intended to be limiting on the orientation of the individual pieces. It will be

appreciated that the fan may be mounted in a variety of positions and orientations.

Claims

1. A fan comprising a base unit and a removable cover member, the cover member comprising at least one groove on the surface facing the base unit and at least one first connector part on the surface facing the base unit and the base unit comprising at least one projection extending towards the cover member for engagement with the or each groove and at least one second connector part for engagement with the first connector part, wherein the or each projection is provided on a post which extends from the base unit towards the cover member, and wherein the or each groove and the or each projection are arranged such that the first and second connector parts can be engaged and disengaged by sliding the or each projection within the or each groove.

2. A fan as claimed in claim 1, wherein the base unit comprises a plurality of projections.

3. A fan as claimed in claim 2, wherein the base unit has exactly three projections.

4. A fan as claimed in any preceding claim, wherein the cover member comprises a single circular groove for engagement with the or each projection.

5. A fan as claimed in any of claims 1 to 3, wherein the cover member comprises one groove for the or each projection.

6. A fan as claimed in claim 5, wherein the or each groove is formed as a circular arc.

7. ~~A fan as claimed in any preceding claim, wherein the or each projection is provided on a post which extends from the base unit towards the cover member.~~

~~8.~~7. A fan as claimed in ~~claim 7~~any preceding claim, wherein the or each post is elongate in the radial direction.

~~9.~~8. A fan as claimed in claim ~~8~~7, wherein the or each projection is formed on the radially inward end of a post.

~~10.~~9. A fan as claimed in any preceding claim, ~~claim 7, 8 or 9~~ wherein the surface of the post which faces the cover member is shaped to match the facing surface of the cover member.

~~11.~~10. A fan as claimed in any preceding claim, wherein the first and second connector parts comprise a male connector part and a female connector part.

~~12.~~11. A fan as claimed in claim ~~11~~10, wherein the male connector part comprises a plurality of fingers which extend into the female connector part.

~~13.~~12. A fan as claimed in claim ~~12~~11, wherein in the engaged state, a projection on at least one finger of the male connector part locates behind a lip on the female part so as to resist separation of the two parts.

~~14.~~13. A fan as claimed in claim ~~11~~10, ~~12~~ 11 or ~~13~~12, wherein the male part and the female part are arranged to engage circumferentially.

~~15.~~14. A method of engaging a cover member with a fan base unit, wherein the cover member comprises at least one groove on the surface facing the base unit and at least one first connector part on the surface facing the base unit and wherein the base unit comprises at least one projection extending towards the cover member for engagement with the or each groove and at least one second connector part for engagement with the first connector part, the method comprising:

holding the or each projection in contact with the surface facing the base unit, and moving the cover member laterally so that ~~locating~~ the or each projection locates in the or each groove, and

sliding the or each projection within the or each groove so as to bring the first connector part into engagement with the second connector part.

~~16.~~15. A fan substantially as hereinbefore described, with reference to the drawings.

~~17.~~16. A fan comprising a base unit and a removable cover member,

the cover member comprising at least one groove on the surface facing the base unit and at least one first connector part on the surface facing the base unit and the base unit comprising at least one projection extending towards the cover member for engagement with the or each groove and at least one second connector part for engagement with the first connector part,

wherein the or each groove and the or each projection are arranged such that the first and second connector parts can be engaged and disengaged by sliding the or each projection within the or each groove,

wherein the first and second connector parts comprise a male connector part and a female connector part, and the male connector part comprises a plurality of fingers which extend into the female connector part.

17. A fan comprising a base unit and a removable cover member,

the cover member comprising at least one groove on the surface facing the base unit and at least one first connector part on the surface facing the base unit and the base unit comprising at least one projection extending towards the cover member for engagement with the or each groove and at least one second connector part for engagement with the first connector part,

wherein the or each projection is provided on a post which extends from the base unit towards the cover member,

wherein the or each groove and the or each projection are arranged such that the first and second connector parts can be engaged and disengaged by sliding the or each projection within the or each groove, and

wherein the first and second connector parts comprise a male connector part and a female connector part, and wherein the male connector part comprises a plurality of fingers which project in a circumferential direction parallel with, and spaced apart from, the inside surface of the cover and which extend into the female connector part.

18. A fan comprising a base unit and a removable cover member,

the cover member comprising at least one groove on the surface facing the base unit and at least one first connector part on the surface facing the base unit and the base unit comprising at least one projection extending towards the cover member for engagement with the or each groove and at least one second connector part for engagement with the first connector part,

wherein the or each groove and the or each projection are arranged such that the first and second connector parts can be engaged and disengaged by sliding the or each projection within the or each groove, and

wherein the fan is configured so that the or each projection is holdable in contact with the surface facing the base unit whilst the cover member is moved laterally so that the or each projection locates in the or each groove.