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(54) A backdraught shutter for a ventilating fan.

(57) A backdraught shutter for a ventilating fan defining an air flow path through the fan is designed to close off the air flow path when the fan is not operational. The shutter comprises a plurality of blades (2,3,4) mounted upon a supporting member for pivotal movement between positions corresponding to the closure and opening of the air flow path through the fan. The blades (2,3,4) tend to the closed position under the action of gravity when the shutter is in a first, predetermined position and the shutter is provided with means for retaining the blades in the closed position when the fan is in a second, different orientation and the fan is not operational, the retaining means permitting automatic movement of the blades to the open position when the fan is switched on. The shutter may be formed integrally with the fan or formed as a separate accessory.

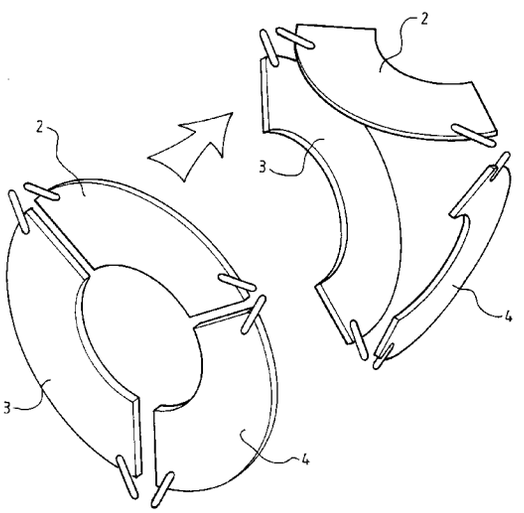

FIG 3

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When a ventilating fan is mounted upon an external wall or window in order to extract stale or humid air from a room or to introduce "fresh" air from outside into the room there is a risk of air passing through the fan housing from outside when the fan is not operating and creating a draught in the room, particularly when it is windy outside. Such a draught is referred to as a "backdraught". Clearly this is undesirable and to counter this problem it is known to provide ventilating fans with a so-called backdraught shutter which serves substantially to close off the air flow path through the fan when the fan is not operating.

Fans are also sometimes mounted on internal walls or partitions and thus, for example, it is known to mount an extractor fan in a horizontal mode in a ceiling in a bathroom with air being extracted from the bathroom and passing to the outside through a conduit or the like provided in a roof space. Backdraught problems can also occur with fans of this type.

A common design of ventilating fan comprises a housing defining a circular section aperture extending therethrough. A motor which drives the fan blades is mounted centrally within the circular aperture on radially extending supporting arms. The motor is usually also of circular cross-section so that an annular air flow path is defined between the motor and the housing, the fan blades extending radially outwardly from the motor within the air flow path. It is this annular air flow path which needs to be closed in order to prevent a backdraught.

An existing backdraught shutter design comprises a plurality of shutter blades each pivotally mounted on the fan housing around the outer edge of the annular air flow path between the housing and the body of the motor so as to extend radially inwardly and cover a sector of the annular air flow path. The existing design is intended for use with fans which are mounted in a vertical surface. The blades of the shutter are designed to move to the closed position under the action of gravity when the fan is not operational. In order to ensure that all of the blades move to the closed position it is necessary to provide the blades in the lower half of the shutter device with counter weights positioned radially outwardly of the axis about which the blades pivot. Alternatively the blades may be provided with means for biassing them to the closed position. When the fan is operational the flow of air induced by the impeller moves the shutter blades to the open position. When the fan is switched off the blades move to the closed position either under the action of gravity or under the action of the biassing means referred to above.

Where biassing means are provided for moving the blades to the closed position these must not exert a very strong biassing force on the blades since the blades must be able to move to the open position when the fan is switched on, even at a slow speed with a relatively low rate of air flow. If the biassing force is too strong then clearly the blades will not move to the open position when desired. On the other hand if the biassing force is too weak then the blades may inadvertently open when the fan is not operational, thereby defeating the purpose of providing the backdraught shutter.

The present invention seeks to provide an improved backdraught shutter for a ventilating fan which is of simple construction and which works effectively and reliably.

According to one aspect of this invention there is provided a backdraught shutter for a ventilating fan defining an air flow path through the fan, the shutter being designed to close off the air flow path through the fan when mounted thereon and when the fan is not operational, the shutter comprising a plurality of blades and a supporting member upon which the blades are pivotally mounted for movement between first and second positions corresponding to the air flow path through the fan being closed and open, the blades tending to the first position under the action of gravity when the shutter is in a first, predetermined orientation, characterised in that the shutter is further provided with means for retaining the blades in the first position when the shutter is in a second, different orientation and the fan is not operational, the retaining means permitting automatic movement of the blades to the second position when the fan is switched on.

Preferably the means for retaining the blades in the first position comprise stops mounted on the supporting member, there being a stop associated with each blade, the stops serving to limit pivotal movement of the blades.

The first predetermined orientation of the shutter may correspond to the fan being mounted in a vertical surface with the air flow path through the fan extending substantially horizontally and the second orientation of the shutter may correspond to the fan being mounted in a substantially horizontal surface with the air flow path through the fan extending substantially vertically.

Preferably the supporting member defines a circular opening within which the blades are mounted, the blades being of arcuate form and together forming an annulus extending around an outer region of the circular opening defined by the supporting member, each blade forming a sector of the annulus.

Conveniently each blade is pivotally mounted within the circular opening of the supporting member by means of a pair of projecting spigots which are receivable within holes formed in the supporting member, the axes of the mounting spigots being aligned and serving to define the pivot axis of the blade.

Advantageously the pivot axis of at least one blade is disposed radially outwardly from the centre of mass of that blade with respect to the circular opening defined by the supporting member and the pivot

axis of at least one additional blade is disposed radially inwardly of the centre of mass of that additional blade with respect to the circular opening defined by the supporting member.

The shutter may comprise three blades.

The supporting member may be constituted by part of the ventilating fan, such as a grille or cover provided over one end of the fan.

This invention also provides a ventilating fan incorporating a backdraught shutter as described above.

In order that the present invention may be more readily understood and so that further features thereof may be appreciated the invention will now be described by way of example, with reference to the accompanying drawings, in which:

FIGURE 1 is an end elevation of a backdraught shutter in accordance with the present invention when mounted on part of a ventilating fan;

FIGURE 2 is a vertical cross-sectional view taken on the line II-II of Figure 1;

FIGURE 3 is a schematical, perspective view showing the blades of the backdraught shutter in the closed and in the open position;

FIGURE 4 is a view corresponding generally to Figure 1, but showing a slightly modified embodiment of the shutter;

FIGURE 5 is an end elevation showing part of another modified version of the shutter in the closed position; and

FIGURE 6 corresponds to Figure 5 and shows one of the blades in the open position.

Referring to the drawings, one embodiment of a backdraught shutter in accordance with this invention comprises a frame or frame-like member 1 which supports a set of three blades 2, 3, 4, each of which is pivotally mounted for movement between open and closed positions.

The frame 1 may be constituted by part of a ventilating fan in which the backdraught shutter is provided or may be separate element which can be mounted on part of a ventilating fan. In the latter case the backdraught shutter would be provided as an accessory for the fan. Thus, the shutter may either be formed integrally with the fan or provided as an accessory therefor.

In the embodiment shown in the drawings the backdraught shutter is illustrated as forming an integral part of an extractor fan which, as can be seen in Figure 2, has a main housing 5 defining a circular opening extending through the fan. The main housing is formed with a spider (not visible in the drawings) to support a centrally located motor 6 which drives an impeller 7 having blades 8 which extend radially outwardly and are disposed in an annular air flow path defined between the motor/impeller assembly and the housing 5.

A grille or cover 9 is mounted upon one end of the housing. The grille or cover 9 is an internal grille or cover, that is to say it is mounted on that end of the housing 5 which is directed inwardly with respect to the room which is being ventilated and thus when the fan is an extractor fan air is drawn through the cover 9 by the fan before being expelled through the opposite end of the housing 5 which would, of course, be provided with an external cover or grille or would be connected to a length of ducting through which extracted air is conveyed before it is expelled into the atmosphere. The grille 9 comprises a peripheral region 10 by way of which it is mounted on the end of the housing 5, the peripheral region defining a circular opening which is aligned with the circular opening defined by the housing 5 when the grille is mounted thereon. Thus, the peripheral region 10 of the grille bounds the endmost portion of the annular air flow path through the fan. A series of spaced apart bars which are illustrated schematically in Figure 2 at reference 11 extend across the opening between opposed parts of the peripheral region 10 of the grille.

In the specific embodiment illustrated it is the peripheral region 10 of the grille 9 which constitutes the frame which supports the blades 2, 3, 4 of the backdraught shutter. Thus, in Figure 1 of the drawings the frame member 1 corresponds to the peripheral region 10 of the grille 9 with the bars 11 which extend across the grille having been omitted from Figure 1 of the drawings for the purposes of illustration only.

Each of the shutter blades 2, 3, 4 is substantially planar and of arcuate form so that together the three blades may serve substantially to close off the annular air flow path defined between the motor 6 and the peripheral region 10 of the grille 9. Each blade subtends an angle of approximately 120° and therefore extends around approximately one third of the annular air flow path.

Each blade is mounted within the circular opening defined by the peripheral region 10 of the grille 9 by means of two spigots 12 formed at opposed positions on its radially outermost edge. The axes of the two spigots 12 formed on each blade are aligned so as to define a pivot axis extending across the blade in the plane thereof. The pivot axis for each blade is identified by the reference numeral 13 in Figure 1. It is envisaged that the blades, the grille and the fan housing will be injection moulded from a plastics material and the blades will be mounted within the circular opening defined by the grille 9 by inserting the spigots 12 on each blade into appropriately dimensioned and positioned holes formed in the inwardly facing surface of the peripheral region 10 of the grille. Initially one spigot 12 will be inserted into a hole in the grille and the blade will then be flexed or bent slightly in order to allow the second spigot 12 to be inserted into an opposed hole whereupon the blade will return to its planar condition and be held in place within the grille.

The two lowermost blades 3, 4 shown in Figure 1 of the drawings are of the same design and the mounting spigots 12 for these blades are located relatively close to the ends of the radially outermost edge of the blades so that the pivot axis 13 for each of the blades 3, 4 passes relatively close to the radially innermost edge of the blade. This results in the centre of mass of the blade being disposed radially outwardly of the pivot axis and below the pivot axis when the fan is mounted vertically i.e. with the grille 9 in a substantially vertical plane and the air flow path through the fan extending substantially horizontally. The spigots 12 formed on the upper blade 2, as viewed in Figure 1 are positioned further away from the ends of the radially outermost edge of the blade (i.e. closer to the centre of the outermost edge) so that the pivot axis 13 for this blade passes relatively close to the radially outermost edge. This results in the centre of mass of the blade 2 being disposed radially inwardly of the pivot axis for this blade and below the pivot axis when the fan is mounted vertically.

The inwardly directed surface of the peripheral region 10 of the grille 9 is formed with three inwardly projecting stops 14, there being one stop 14 positioned adjacent the central point on the radially outermost edge of each blade 2, 3, 4. The stops are provided to limit rotation of the blades about the axes 13 and to retain the blades in the closed position i.e. substantially closing off the annular air flow path when the fan is mounted horizontally i.e. with the grille 9 in a substantially horizontal plane and the air flow path extending substantially vertically. In addition the stops 14 prevent the blades from moving to an open position in the event of a backdraught through the fan.

The stop 14 associated with the blade 2 is positioned internally of the blade i.e. on that side of the blade which is closest to the main housing 5 and to the interior of the fan, whereas the stops 14 associated with the blades 3, 4 are positioned externally of the blades i.e. on that side of the blades closest to the grille bars 11.

The above-described arrangement of the pivot axes 13 relative to the centres of mass of the blades 2, 3, 4 ensures that when the fan is switched off the blades 2, 3, 4 will naturally move to the closed position (as illustrated in Figures 1 and 2) under the action of gravity so as to substantially shut off the annular air flow path through the fan.

When the fan is mounted vertically the blades will, of course, normally stand in a vertical plane when the fan is not operational. When the fan is switched on a flow of air is induced by the impeller 7 with air being drawn into the main body of the fan through the grille 9 and causing each shutter blade to pivot about its respective axis 13 as it moves to the open position. Each blade will pivot through an angle of approximately 90° so that only the edge of each blade is presented to the flow of air, thereby offering minimal flow resistance. It is to be noted that in moving from the closed to the open position the upper blade 2 pivots about its axis 13 in an opposite direction to that in which the blades 3, 4 pivot about their respective axes. This opposed pivoting action of the blades is shown in Figure 3 of the drawings where the left hand view shows the blades in the closed position whilst the right hand view shows the blades in the open position. It will be appreciated that the blade 2 pivots to the open position such that its radially outermost edge is presented towards the flow of air drawn through the grille 9 whilst the blades 3, 4 pivot about their axes so that their radially innermost edges are presented to the flow of air drawn through the grille. The direction in which each blade pivots about its axis 13 is dictated by the position of the centre of mass of the blade relative to the pivot axis. As explained above the centre of mass of the blade 2 is positioned radially inwardly of the pivot axis whilst the centre of mass of each of the blades 3, 4 is positioned radially outwardly of the relevant pivot axis and it is this arrangement which results in the opposed pivoting movement of the blades as explained above.

When the fan is switched off again the blades will naturally fall back to the closed position so that they hang in a vertical plane. In the event of a backdraught through the fan i.e. a flow of air through the main housing 5 in a direction towards the grille 9 the blades will remain in the closed position since they are prevented from moving to the open position in a direction opposite to that in which they move when air is drawn through the fan by the impeller by the presence of the stops 14. Thus the blades serve to prevent any backdraught from passing through the grille 9 and into the room which is ventilated by the fan.

In order to consider the operation of the shutter when the fan is mounted horizontally Figure 1 can be regarded as an underneath view of the shutter. It will be appreciated that in the absence of the stops 14 all of the blades 2, 3, 4 would naturally tend to rotate about their respect axes 13 until the blades hang vertically. However, the stops 14 engage the outermost edges of the blades and serve to limit rotation of the blades so that when the fan is not operational each blade is held in a horizontal plane. When the fan is switched on the blades move from the closed position to the open position in the same manner as explained above in relation to a vertically mounted fan. Similarly when the fan is switched off again the blades will naturally rotate about their axes 13 in an attempt to hang in a vertical plane with their respective centres of mass below their pivot axes. However, as mentioned above, this rotation is limited by the stops 14 so that the blades are held in the closed position in a horizontal plane. Again should a flow of air pass through the fan housing in a direction towards the internal grille 9 the blades 2, 3, 4 will remain in the closed position

and prevent such a flow or backdraught from passing into the room or space in which the fan is mounted.

It will be appreciated from the description given above that the shutter blades automatically remain in the closed position whenever the fan is not operational regardless of whether the fan is mounted vertically or horizontally.

As already mentioned the shutter could be located on the main housing 5 or on a separate ring-like element which is mountable on part of the fan. However, the mounting of the shutter on the grille 9 enables the shutter to be detached from the fan with the grille and this facilitates cleaning of the fan. In addition locating the shutter between the internal grille 9 and the impeller 7 makes use of a normally dead space within the fan and thereby keeps the overall depth of the fan to a minimum. This location of the shutter within the fan serves to reduce the random wind-induced opening and closing of the shutter blades which is commonly encountered with externally mounted shutter blades which operate under the action of gravity.

It is to be appreciated that various modifications may be made to the specific embodiment described above without departing from the scope of the present invention. Thus, whilst it is envisaged that the shutter blades will be formed from a plastics material it would be possible for them to be formed of any relatively thin flexible material such as plate aluminium. Whilst in the embodiment described above mounting spigots 12 are provided on each of the blades and corresponding holes are provided in the grille 9 it would be possible for the grille 9 to be formed with projecting spigots which are received in holes or the like formed in the blades of the shutter.

In a slightly modified arrangement illustrated in Figure 4 of the drawings it is envisaged that the spigots 12 provided on each of the blades may be received within holes which are formed in small plastic blocks 15 which are a press fit within appropriate cut outs formed in the inwardly directed surface of the peripheral region 10 of the grille 9 rather than in holes formed directly in that surface. As can be seen from Figure 4 of the drawings each press-fitted block 15 will define two bores, each designed to accommodate one spigot 12 formed on one of the blades 2, 3, 4. The blades are mounted in position within the circular opening defined by the grille 9 in the same manner as described above in relation to Figure 1 once the blocks 15 have been press-fitted into place.

As will be appreciated from the position of the pivot axes 13 of the two lower blades 34 in Figure 4, these blades are located very close to the central motor boss 6 when in the open position. In order to provide a greater gap between these two blades and the motor boss 6 when the shutter is open, the blades may be dished over a central region 16 adjacent their radially inner edges, as shown in Figures 5 and 6. This dished region would be shaped so as to provide a uniform spacing 17 between the blades 3, 4 and the boss 6 when the blades are in the open position. In this arrangement the top blade 2 would still be substantially planar, but the two lower blades 3, 4 would be modified as described.

Whilst a shutter comprising three blades has been described it will be possible for the shutter to have a different number of blades and indeed it is envisaged that with relatively large fans it may well be desirable to provide a greater number of blades.

The features disclosed in the foregoing description, in the following claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.

Claims

1. A backdraught shutter for a ventilating fan defining an air flow path through the fan, the shutter being designed to close off the air flow path through the fan when mounted thereon and when the fan is not operational, the shutter comprising a plurality of blades (2, 3, 4) and a supporting member (1, 9) upon which the blades (2, 3, 4) are pivotally mounted for movement between first and second positions corresponding to the air flow path through the fan being closed and open, the blades (2, 3, 4) tending to the first position under the action of gravity when the shutter is in a first, predetermined orientation, characterised in that the shutter is further provided with means (14) for retaining the blades in the first position when the shutter is in a second, different orientation and the fan is not operational, the retaining means (14) permitting automatic movement of the blades to the second position when the fan is switched on.

2. A backdraught shutter according to Claim 1 wherein the means for retaining the blades in the first position comprise stops (14) mounted on the supporting member (1, 9), there being a stop (14) associated with each blade (2, 3, 4), the stops (14) serving to limit pivotal movement of the blades.

3. A backdraught shutter according to Claim 1 or Claim 2 wherein the first predetermined orientation of the shutter corresponds to the fan being mounted in a vertical surface with the air flow path through the fan extending substantially horizontally and the second orientation of the shutter corresponds to the fan being mounted in a substantially horizontal surface with the air flow path through the fan extending substantially vertically.

4. A backdraught shutter according to any one of Claims 1 to 3 wherein the supporting member (1, 9) defines a circular opening within which the blades (2, 3, 4) are mounted, the blades (2, 3, 4) being of arcuate form and together forming an annulus extending around an outer region of the circular opening defined by the supporting member (1, 9), each blade (2, 3, 4) forming a sector of the annulus.

5. A backdraught shutter according to Claim 4 wherein each blade (2, 3, 4) is pivotally mounted within the circular opening of the supporting member (1, 9) by means of a pair of projecting spigots (12) which are receivable within holes formed in the supporting member (1, 9) or in inserts (15) in the supporting member (1, 9), the axes of the mounting spigots (12) being aligned and serving to define the pivot axis (13) of the blade.

6. A backdraught shutter according to Claim 5 wherein the pivot axis (13) of at least one blade (2) is disposed radially outwardly from the centre of mass of that blade (2) with respect to the circular opening defined by the supporting member (1, 9) and the pivot axis (13) of at least one additional blade (3, 4) is disposed radially inwardly of the centre of mass of that additional blade (3, 4) with respect to the circular opening defined by the supporting member (1, 9).

7. A backdraught shutter according to any one of the preceding claims wherein the shutter comprises three blades (2, 3, 4).

8. A backdraught shutter according to any one of the preceding claims wherein the supporting member (1, 9) is constituted by part of the ventilating fan.

9. A backdraught shutter according to Claim 8 wherein the supporting member is constituted by a grille or cover (9) provided over one end of the fan.

10. A ventilating fan incorporating a backdraught shutter in accordance with any one of the preceding claims.

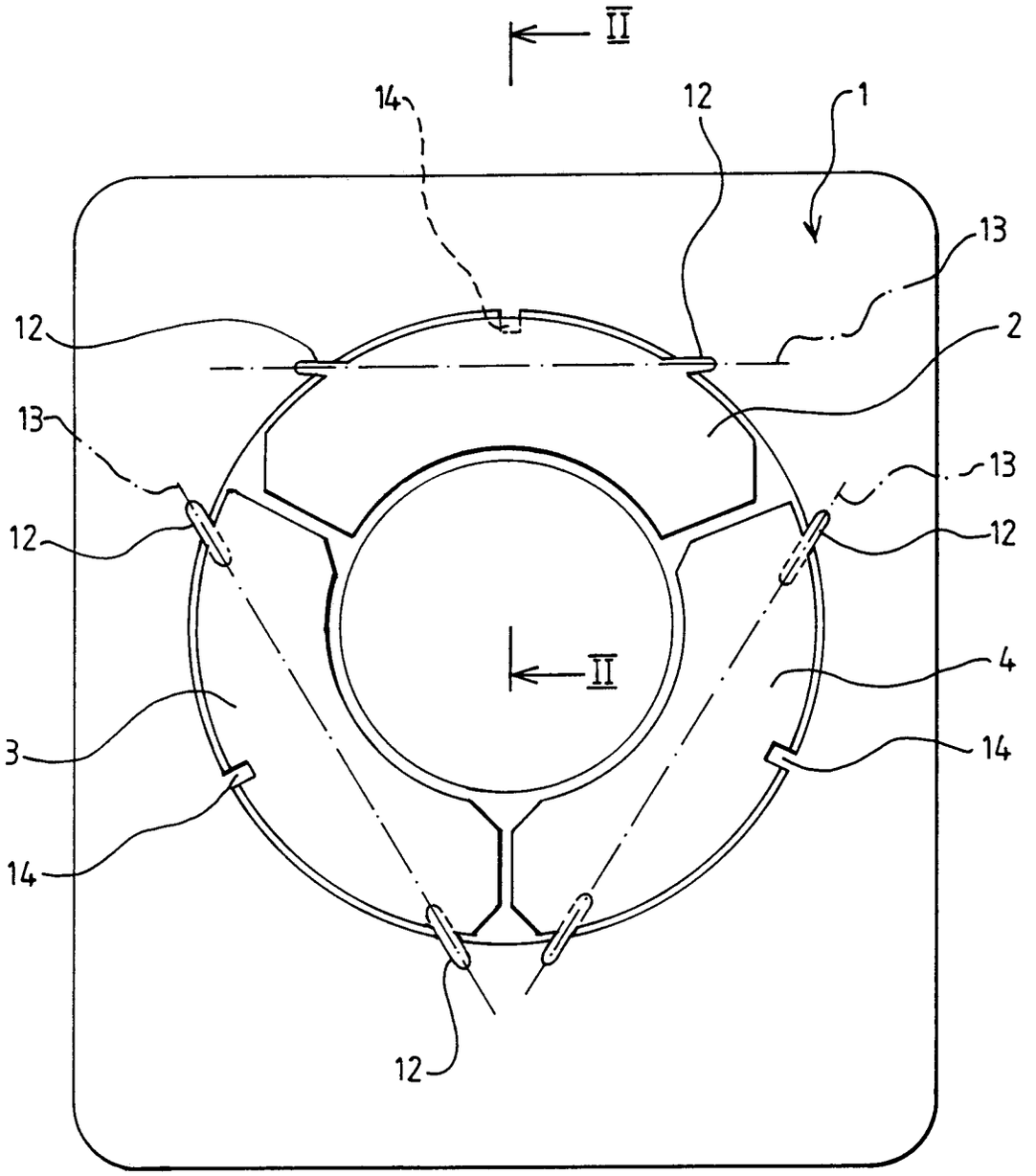

FIG 1

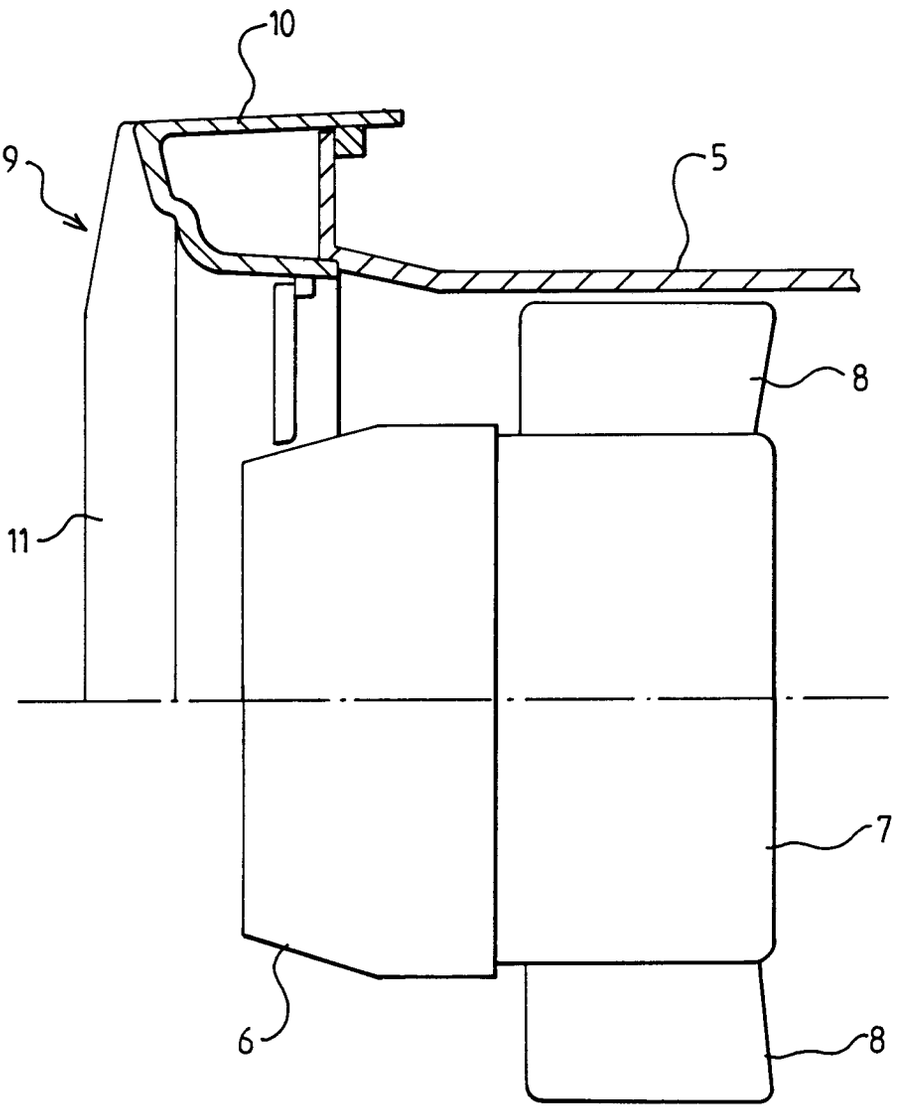

FIG 2

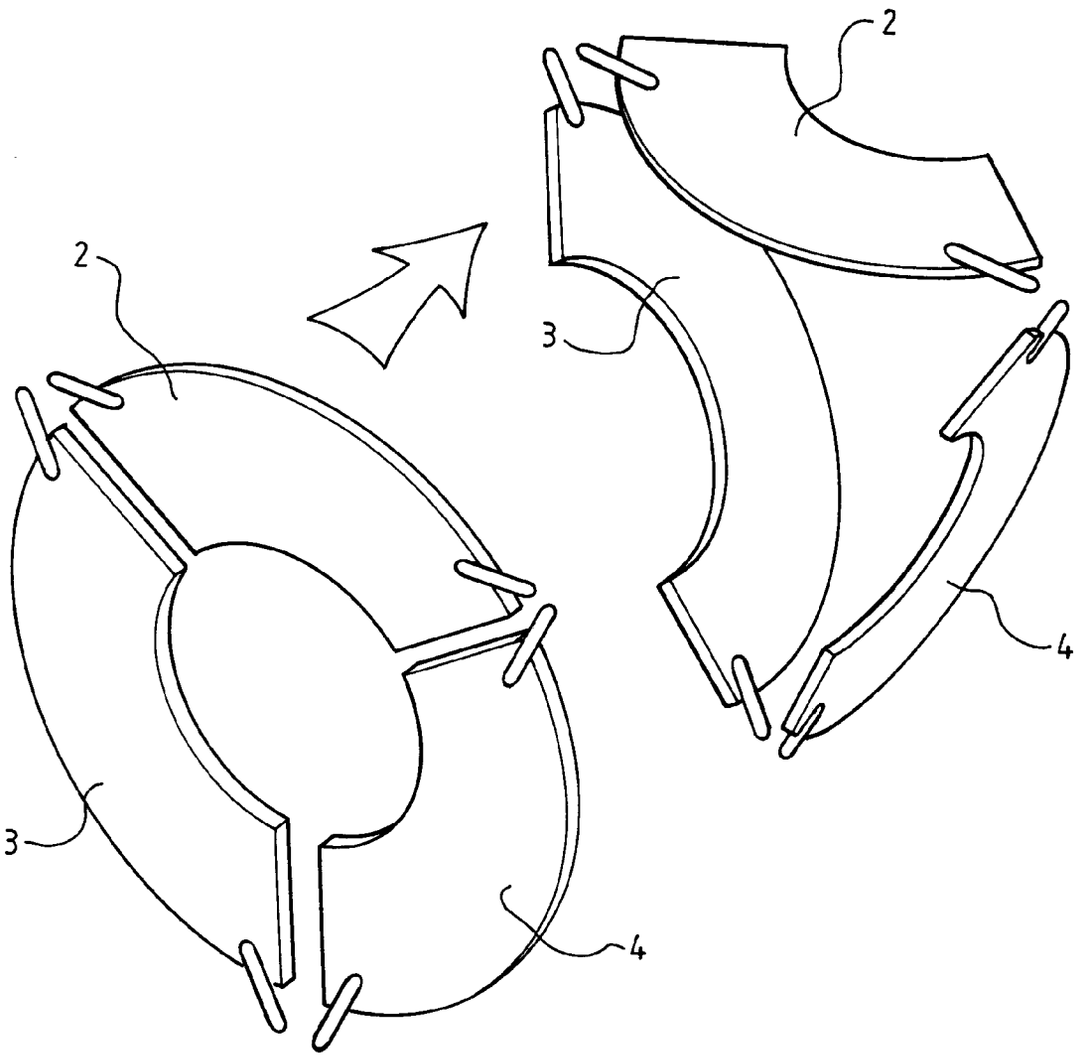

FIG 3

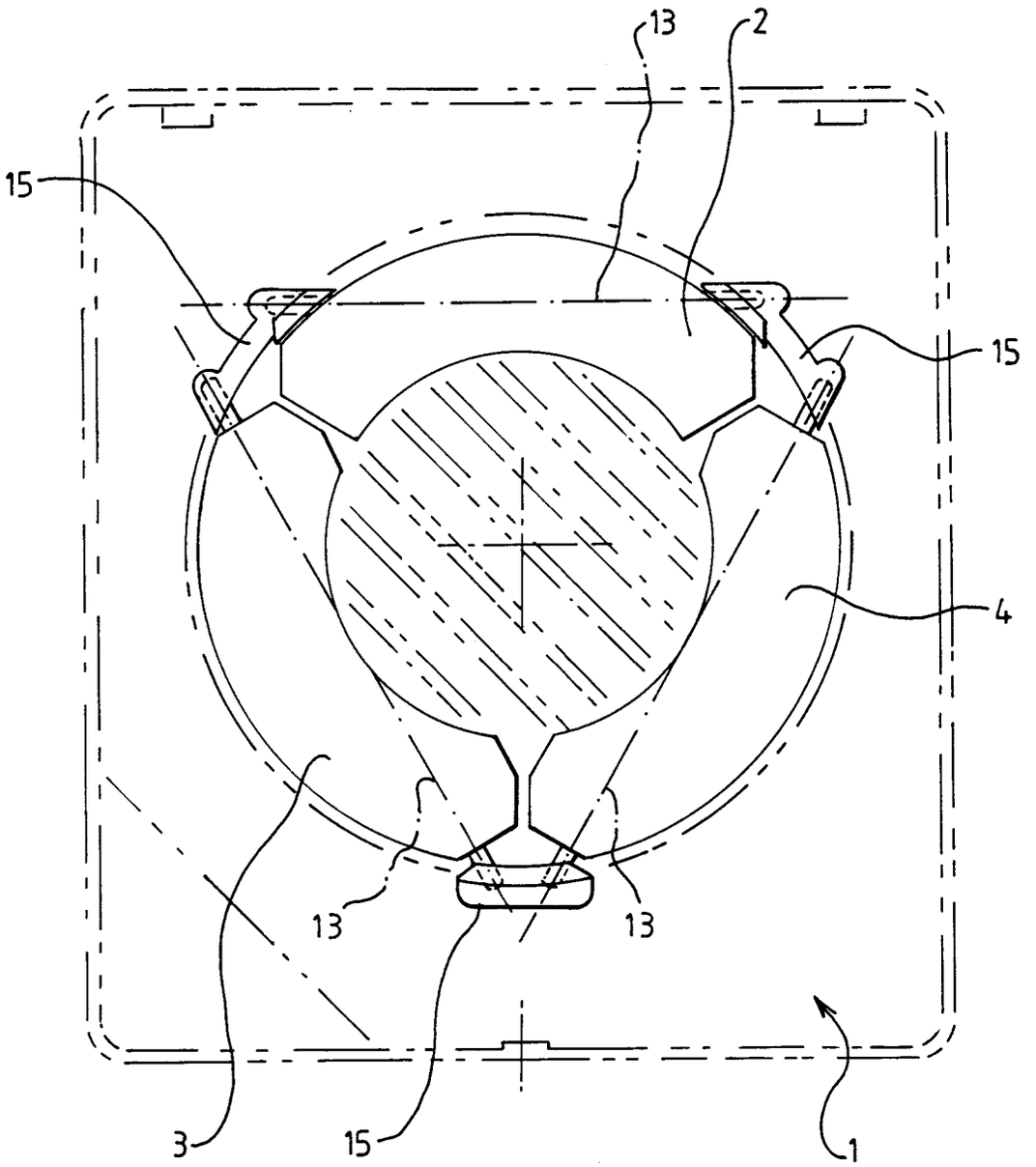

FIG 4

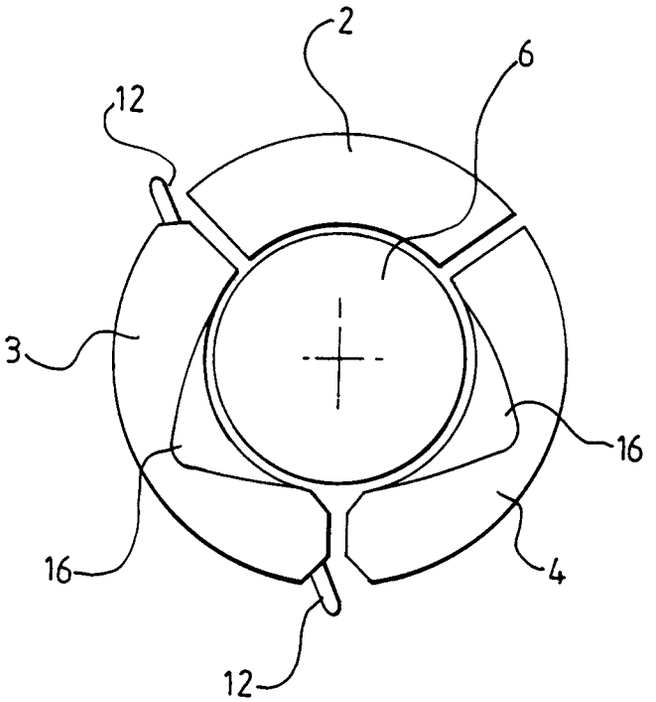

FIG 5

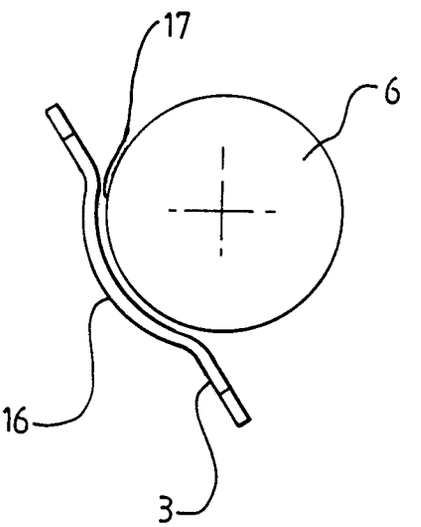

FIG 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 30 1871

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-2 541 665 (PRUDHON) * the whole document * ---	1-4,8,10	F04D25/14 F24F7/013
Y	US-A-2 687 687 (PRUDHON) * the whole document * ---	1-4,8,10	
Y	US-A-2 153 604 (WHELLER) * the whole document * ---	1-4,8,10	
A	FR-A-1 285 936 (VENT-AXIA) * page 2, column 1, line 47 - page 3, column 1, line 8; figures 1,2 * ---	1,4,6,8,10	
A	GB-A-2 074 243 (PAX ELECTRO PRODUCTS) * the whole document * -----	1,2,4,8,10	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F04D
F24F
F16K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	03 JUNE 1993	TEERLING J.H.

CATEGORY OF CITED DOCUMENTS

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