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(54) **SUPPLY AIR DEVICE WITH ROTATABLE NOZZLE AND METHOD FOR DIRECTING SUPPLY AIR JETS FROM SUPPLY AIR DEVICE**

(57) A supply air device (1) comprising a frame structure (2) having a bottom plate (3) facing a room, into which the supply air is arranged to be discharged from the supply air device, wherein
- the bottom plate comprises circular openings (4), and
- rotatable supply air nozzles (5) are arranged within each opening (4),
characterized in that
- the perimeter of each circular opening (4) comprises plurality of opening detents (6), and
- the perimeter of each supply air nozzle (5) comprises at least one nozzle detent (7) engageable with the opening detents, wherein
- the supply air nozzle is rotatable about its central axis between positions where at least one nozzle detent is engaged with opening detents.

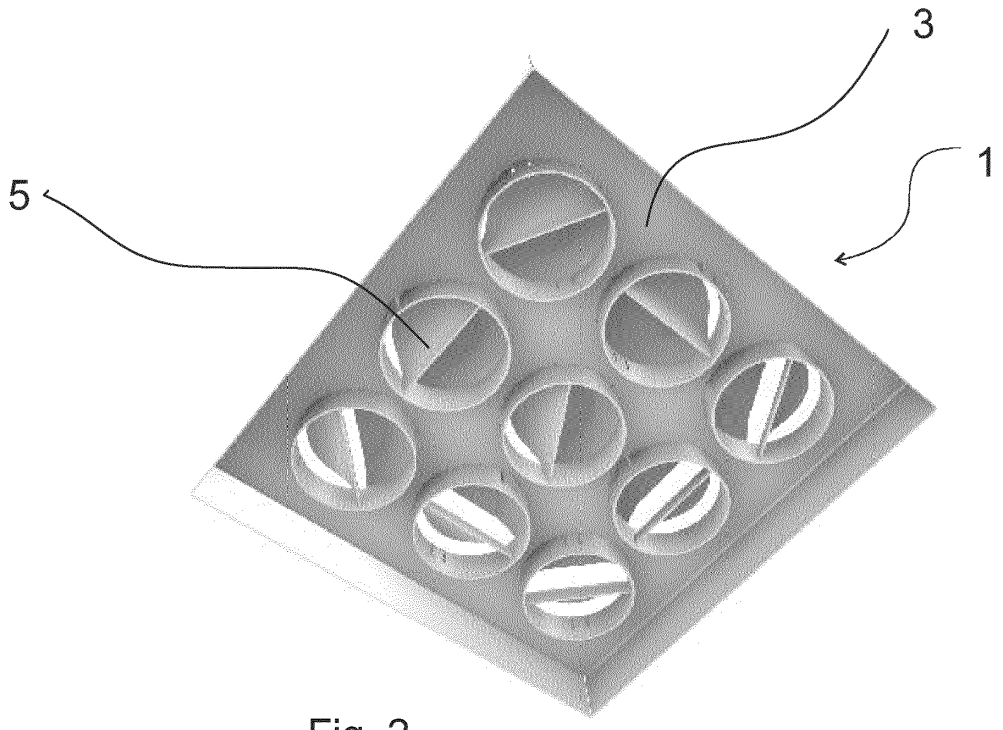


Fig. 2

EP 3 702 688 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a supply air device having supply air nozzles and a method for directing supply air jets from the supply air device into a room.

BACKGROUND OF THE ART

[0002] The method of using multiple nozzles in a supply air device is a common practice. This allows for the user to create multiple alternative air flow patterns with the same supply air device without the need to change it to another.

[0003] The challenge of the current practice is that the nozzles are freely turnable with minimum force to any adjustment direction. This causes a problem that setting a specific total flow pattern is difficult, because there is no predetermined position for the nozzle. Even more importantly the airflow pattern of the diffuser may easily be deteriorated by mistake of the user for example in accordance of the device cleaning. This is especially dangerous, when the supply air device is used in critical applications, where the exact performance of the airflow pattern is essential for safety.

OBJECTIVE OF THE INVENTION

[0004] The objective of the device and method is to alleviate the disadvantages mentioned above.

SUMMARY

[0005] According to a first aspect, the present invention provides a supply air device comprising a frame structure having a bottom plate facing a room, into which the supply air is arranged to be discharged from the supply air device, wherein the bottom plate comprises circular openings and rotatable supply air nozzles are arranged within each opening. The perimeter of each circular opening comprises plurality of opening detents, and the perimeter of each supply air nozzle comprises at least one nozzle detent engageable with the opening detents. The supply air nozzle is rotatable about its central axis between positions where at least one nozzle detent is engaged with opening detents.

[0006] The advantage of the present device is that the turning of the nozzles is made more accurate by predetermined locking positions, and the risk of the unintentional change of the position is minimized by said locking function.

[0007] In an embodiment of the device, the perimeter of each circular opening comprises at least three opening detents.

[0008] In an embodiment of the device, the number of opening detents is 4-36.

[0009] In an embodiment of the device, the number of nozzle detents is equal to the number of opening detents.

[0010] In an embodiment of the device, the shape of the opening detent is triangular.

[0011] In an embodiment of the device, the shape of the opening detents is curved.

[0012] In an embodiment of the device, the shape of the nozzle detent corresponds the shape of the opening detent.

[0013] In an embodiment of the device, the air supply nozzle comprises air directing plate for directing the air jet from the air supply nozzle.

[0014] In an embodiment of the device, each of the supply air nozzles is arranged to be rotated individually whereby the air jet from each supply air nozzle is directed individually.

[0015] In an embodiment of the device, the opening detents are spaced equally.

[0016] In an embodiment of the device, the supply air nozzle comprises a flange and at least one elastic fixing member, which flange and at least one elastic fixing member are adapted to take a hold on the bottom plate while allowing the rotation of the supply air nozzle.

[0017] In an embodiment of the device, the flange is arranged to cover the nozzle detents and the opening detents when the supply air nozzle is arranged within an opening.

[0018] In the second aspect, a method is provided for directing supply air jets from the supply air device according to any of preceding claims, wherein the method comprises steps of:

- inserting a supply air nozzle into each opening of a bottom plate of the supply air device,
- directing the air jets from the supply air device by rotating each of supply air nozzles about their central axis,
- locking the supply air nozzles direction by engaging at least one nozzle detent of each supply air nozzle with one opening detent of the corresponding opening.

[0019] In an embodiment of the method, directing the air jets is done by rotating plurality of the supply air nozzles in series.

[0020] It is to be understood that the aspects and embodiments of the invention described above may be used in any combination with each other. Several of the aspects and embodiments may be combined together to form a further embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The accompanying drawings, which are included to provide a further understanding of the invention and constitute a part of this specification, illustrate embodiments of the invention and together with the description help to explain the principles of the invention. In the drawings:

Fig. 1 shows a bottom view of an air supply device,

Fig. 2 shows an internal view of the air supply device,

Fig. 3 illustrates a supply air nozzle within an opening,

Fig. 4 is a detailed view of a nozzle detent and an opening detent,

Fig. 5 shows the opening of a bottom plate of the air supply device,

Fig. 6 is a detailed view of the opening detent,

Fig. 7 illustrates an embodiment of the supply air nozzle,

Fig. 8 illustrates an embodiment of the supply air nozzle,

Fig. 9 shows a side view of an embodiment of the supply air nozzle, and

Fig. 10 is a detailed view of an embodiment of the nozzle detent.

DETAILED DESCRIPTION

[0022] Figure 1 shows a bottom view of a supply air device 1. The supply air device is an apparatus which provides supply air into a room. The air may be fresh outdoor air or it may be circulated room air. It may be also combination of the fresh outdoor air and the circulated room air. The supply air device may be installed on the ceiling as a surface mounting, or it may be installed inside a false ceiling. The supply air device 1 comprises a frame structure 2, which forms the outer cover of the device. The frame structure 2 comprises a bottom plate 3 facing a room space, into which the supply air is discharged from the supply air device. The frame structure may comprise side walls (as in figure 2) or side wall, and top wall to cover the internal parts of the supply air device. The supply air device 1 may have cubic structure having straight side walls. It may also have cylindrical structure having cylindrical outer wall.

[0023] The bottom plate 3 of the supply air device 1 comprises circular openings 4, through which the supply air is discharged from the device into the room. Number of the openings may vary and they are placed at a distance from each other. Each of the openings has a supply air nozzle, which is used for directing the air jets discharged from supply air device. According to one embodiment, the number of the openings is at least four. By having four openings it is possible to direct the supply air jets by four different supply air nozzles.

[0024] The bottom plate 3 may be impermeable apart from the openings 4. Thus, the air jets may be directed more precisely in specific direction or directions and side flows to unwanted directions are prevented.

[0025] Figure 2 shows an internal view of the air supply device 1 having nine circular openings. Each of the openings has a rotatable supply air nozzle, which is used for directing the supply air jets. The size and the form of the supply air nozzles corresponds the size and form of the openings. The supply air nozzles are arranged to rotate about their central axis to direct the air jets in different directions.

[0026] Figure 3 illustrates the supply air nozzle 5 within an opening. The perimeter of the opening comprises plurality of opening detents 6 and the perimeter of the supply air nozzle 5 comprises at least one nozzle detent 7, which is engageable with the opening detents 6. The supply air nozzle 5 may be rotated about its central axis between positions where the nozzle detent is engaged with different opening detents 6. By having detents 6 and 7, the supply air nozzle may be locked in its position and it does not rotate accidently. The supply air nozzle 5 may have cylindrical design so that the outer side wall of the supply air nozzle is cylindrical. The central axis of the supply air nozzle is the central axis of the cylindrical shape.

[0027] The term "detent" refers to a catch, threshold or such that prevents motion until released. It may be some kind of protrusion or it may be some kind of cut or such. In an embodiment, the opening detent is a cut and the nozzle detent is a protrusion. In another embodiment, the opening detent is a protrusion and the nozzle detent is a cut.

[0028] Figure 4 is a detailed view of detail A of figure 3. It shows three opening detents 6 located at a distance from each other, and a nozzle detent 7, which is engaged with the middle (in the figure) opening detent 6. The shape (cross section) of the opening detent 6 may correspond the shape (cross section) of the nozzle detent. Thus, the supply air nozzle 5 may be turned and locked more easily.

[0029] Figure 5 shows the opening of a bottom plate of the air supply device. The opening 4 is a hole which is for example cut into the bottom plate 3 of the supply air device 1. The opening is in circular form so that the supply air nozzle, arranged within the opening, may rotate freely around its central axis. The perimeter of the opening comprises several opening detents 6 to lock the rotatable supply air nozzle in its place. The number of opening detents may be for example three so that the supply air nozzle may be locked in three different positions. However, the number of the opening detents 6 may be something from 4 to 36 so that the supply air nozzle may be locked in as many different positions as there are opening detents. Increasing the number of the opening detents increases the possibilities to adjust the air jets discharged from the supply air nozzles. The opening detents may be spaced equally at the perimeter of the opening.

[0030] According to one embodiment, the number of the nozzle detent is two and the nozzle detents are lo-

cated at the opposite positions at the perimeter of the supply air nozzle.

[0031] According to one embodiment, the number of the nozzle detent is four and the number of the opening detents is at least four. The nozzle detents are located at the equal distance from each other at the perimeter of the supply air nozzle.

[0032] The number of the nozzle detents may correspond the number of the opening detents. Thus the supply air nozzle may be locked more firmly in its position.

[0033] The nozzle detents are located at the perimeter of the supply air nozzle so that each of them is engaged with one opening detent at the same time.

[0034] Figure 6 is a detailed view of the opening detents. The opening detent 6 may have different shapes (the cross section of the opening detent). In figures, the opening detents 6 have curved shape. The curved shape may be for example half circular shape. The shape of the opening detent 6 may also be triangular.

[0035] Figure 7 illustrates an embodiment of the supply air nozzle 5. The supply air nozzle may comprise an air directing plate 9 which is used for directing the air flow discharged through it into the room. At least part of the supply air nozzle end plate, which is facing towards the room space, may be impermeable. For example, in figure 7, half of the cross section of the cylindrical supply air nozzle is covered by impermeable end plate 10 and the other half of the cross section forms a discharge opening 8. The air directing plate 9 is arranged within the discharge opening 8 so that it directs the air jet discharged into the room space.

[0036] The air directing plates 9 may be in different angle in different supply air nozzles. For example, on supply air nozzle may have an air directing plate that directs the air jet along the ceiling, and another supply air nozzle may have an air directing plate that directs the air jet towards the floor. Thus, different kind of air flow may be provided with one supply air device.

[0037] Figure 8 illustrates an embodiment of the supply air nozzle 5. The supply air nozzle may comprise a flange 11. The flange 11 may be arranged to the perimeter of the supply air nozzle 5 so that it extends from the perimeter of the supply air nozzle. The flange 11 is remained outside of the bottom plate, when the supply air nozzle is installed into the supply air device. Thus, the flange 11 may cover the nozzle detents 7 and the opening detents when the supply air nozzle 5 is arranged within an opening 4. Thus, detents and the gap between the opening and the supply air nozzle do not collect unwanted particles and impurities from the room and the device remain hygienic.

[0038] The supply air nozzle 5 may comprise at least one elastic fixing member 12 at the perimeter of the supply air nozzle 5. The elastic fixing member 5 has two positions: a rest position, in which the elastic fixing member 5 is at least partially extending outside of the perimeter of the supply air nozzle 5, and biased position, in which the elastic fixing member is inside the perimeter of the supply air nozzle 5. The elastic fixing member 5 may move between said rest position and biased position. The supply air nozzle may comprise two or more elastic fixing members.

[0039] The supply air nozzle 5 may be installed into the supply air device by pushing it partly through the opening so that the perimeter of the supply air nozzle is adjacent with the perimeter of the opening. When pushing the supply air nozzle through the opening, the elastic fixing member moves from the rest position to the biased position as the perimeter of the opening pushes it towards the center of the supply air nozzle. When supply air nozzle is pushed so far into the opening that the bottom plate has passed the elastic fixing member, the elastic fixing member returns in the rest position. Thus, the elastic fixing member holds the supply air nozzle in the supply air device so that some external force is needed to remove the supply air nozzle from the supply air device.

[0040] To prevent pushing the supply air nozzle inside the supply air device, the outer perimeter of the flange 11 may extend further than the perimeter of the opening. As seen in figure 9, the supply air nozzle may have a tiny gap between the flange 11 and the elastic fixing member 12. Thus, the bottom plate is arranged between the elastic fixing member 12 and the flange 11 when the supply air nozzle is installed. The flange 11 and the elastic fixing member hold the supply air nozzle still so that the supply air nozzle does not move in and out of the air supply device. However, they allow the supply air nozzle to rotate about its central axis and, thus, directing the air jets discharged through the supply air nozzles.

[0041] Figure 10 is a detailed view of an embodiment of the supply air nozzle having a nozzle detent 7 and a flange 11. The figure shows more clearly how the flange extends from the perimeter of the supply air nozzle and further than the nozzle detent 7.

[0042] The supply air jets may be directed by inserting a supply air nozzle into each opening of a bottom plate of the supply air device. Each of the supply air nozzles may be rotated about their central axis for directing the air jets from the supply air device. The direction of each air jet may be locked by engaging at least one nozzle detent with one opening detent of the corresponding opening.

[0043] The air jets may be directed by rotating each of the supply air nozzles manually. In an embodiment, at least two of the supply air nozzles are connected to each other so that they may be rotated simultaneously, i.e. in series. In an embodiment, a row of supply air nozzles is connected to each other so that they may be rotated simultaneously.

[0044] In an embodiment, the supply air device comprises rotating means to rotate the supply air nozzles automatically without user. The rotating means may comprise fixing means to connect the rotating means to the supply air nozzles and a motor or actuator to move the fixing means so that the supply air nozzles are rotated. The motor or the actuator may be controlled by a com-

puter at a distance from the supply air device itself so that the user may adjust the air jets without being in the room.

In an embodiment, each of the supply air nozzles may comprise own rotating means with a motor or actuator. However, the rotating means may have only one motor or actuator that is used for rotating several supply air nozzles at the same time.

[0045] Although the invention has been the described in conjunction with a certain type of device, it should be understood that the invention is not limited to any certain type of device. While the present inventions have been described in connection with a number of exemplary embodiments, and implementations, the present inventions are not so limited, but rather cover various modifications, and equivalent arrangements, which fall within the purview of prospective claims.

Claims

1. A supply air device (1) comprising a frame structure (2) having a bottom plate (3) facing a room, into which the supply air is arranged to be discharged from the supply air device, wherein

   - the bottom plate comprises circular openings (4), and
   - rotatable supply air nozzles (5) are arranged within each opening (4),

   characterized in that

   - the perimeter of each circular opening (4) comprises plurality of opening detents (6), and
   - the perimeter of each supply air nozzle (5) comprises at least one nozzle detent (7) engageable with the opening detents, wherein
   - the supply air nozzle is rotatable about its central axis between positions where at least one nozzle detent is engaged with opening detents.

2. The supply air device according to claim 1, **characterized in that** the perimeter of each circular opening (4) comprises at least three opening detents (6).

3. The supply air device according to claim 1, **characterized in that** the number of opening detents (6) is 4-36.

4. The supply air device according to any of preceding claims, **characterized in that** the number of nozzle detents (7) is equal to the number of opening detents (6) .

5. The supply air device according to any of preceding claims, **characterized in that** the shape of the opening detent (6) is triangular.

6. The supply air device according to any of preceding claims, **characterized in that** the shape of the opening detents (6) is curved.

7. The supply air device according to any of preceding claims, **characterized in that** the shape of the nozzle detent (7) corresponds the shape of the opening detent (6) .

8. The supply air device according to any of preceding claims, **characterized in that** the air supply nozzle comprises air directing plate (9) for directing the air jet from the air supply nozzle.

9. The supply air device according to any of preceding claims, **characterized in that** each of the supply air nozzles is arranged to be rotated individually whereby the air jet from each supply air nozzle is directed individually.

10. The supply air device according to any of preceding claims, **characterized in that** the opening detents (6) are spaced equally.

11. The supply air device according to claim 1, **characterized in that** supply air nozzle (5) comprises a flange (11) and at least one elastic fixing member (12), which flange and at least one elastic fixing member are adapted to take a hold on the bottom plate (3) while allowing the rotation of the supply air nozzle.

12. The supply air device according to claim 11, **characterized in that** the flange (11) is arranged to cover the nozzle detents (7) and the opening detents (6) when the supply air nozzle (5) is arranged within an opening (4).

13. A method for directing supply air jets from the supply air device according to any of preceding claims, wherein the method comprises steps of:

   - inserting a supply air nozzle (5) into each opening (4) of a bottom plate (3) of the supply air device (1),
   - directing the air jets from the supply air device by rotating each of supply air nozzles (5) about their central axis,
   - locking the supply air nozzles (5) direction by engaging at least one nozzle detent (7) of each supply air nozzle (5) with one opening detent (6)

of the corresponding opening (4).

14. The method according to claim 12, wherein directing the air jets is done by rotating plurality of the supply air nozzles (5) in series.

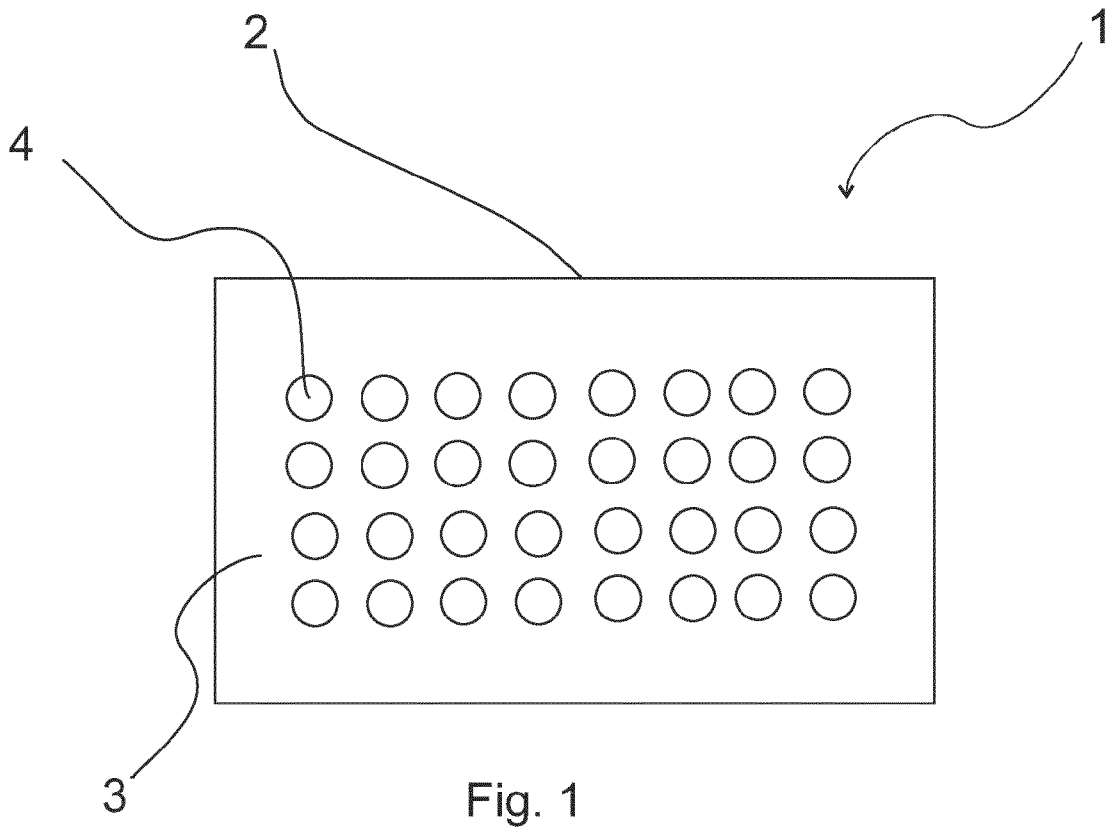


Fig. 1

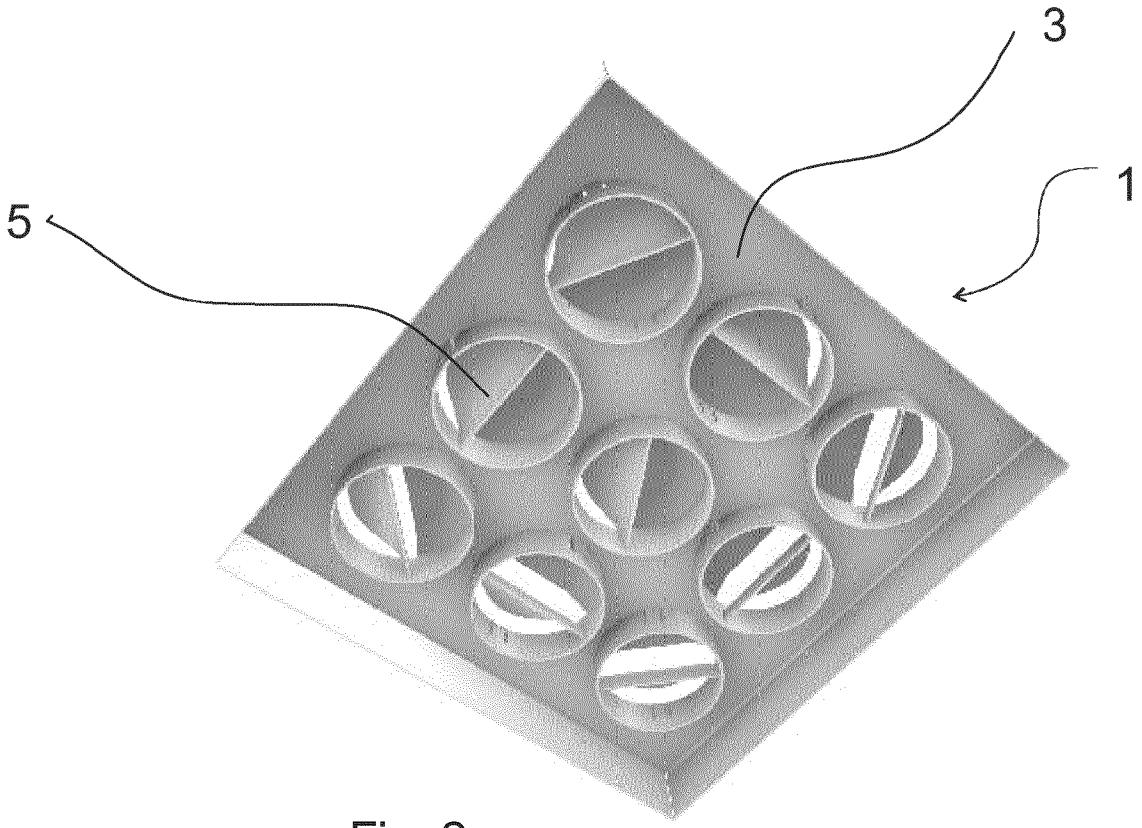


Fig. 2

Fig. 3

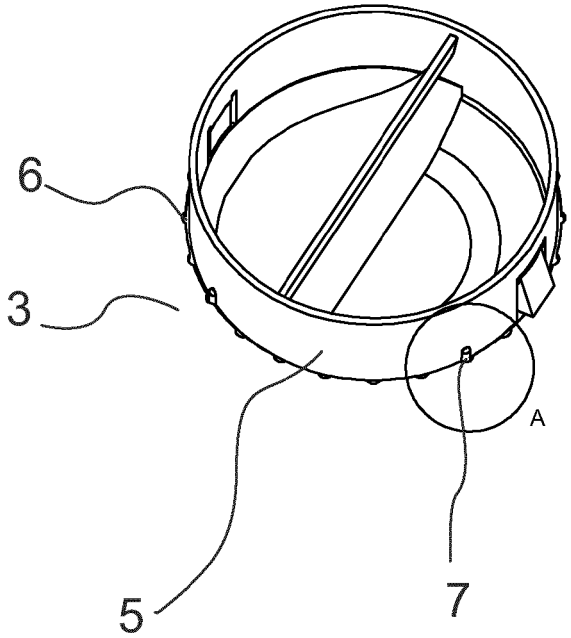
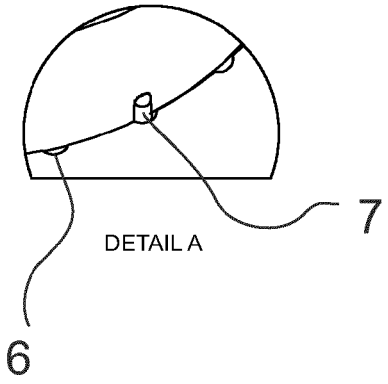


Fig. 4



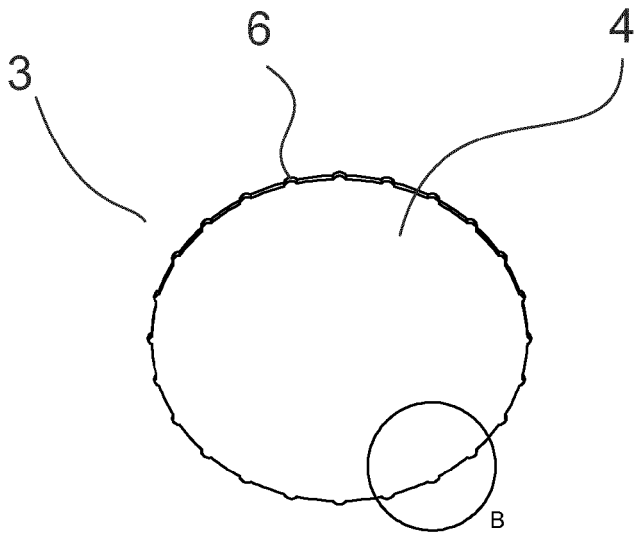


Fig. 5

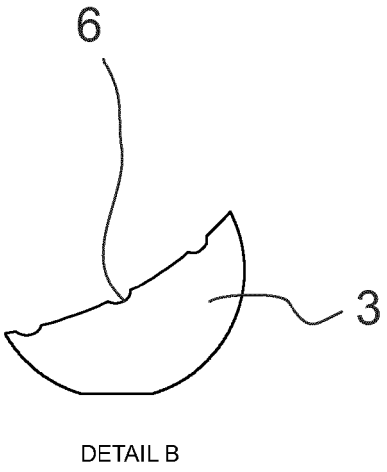


Fig. 6

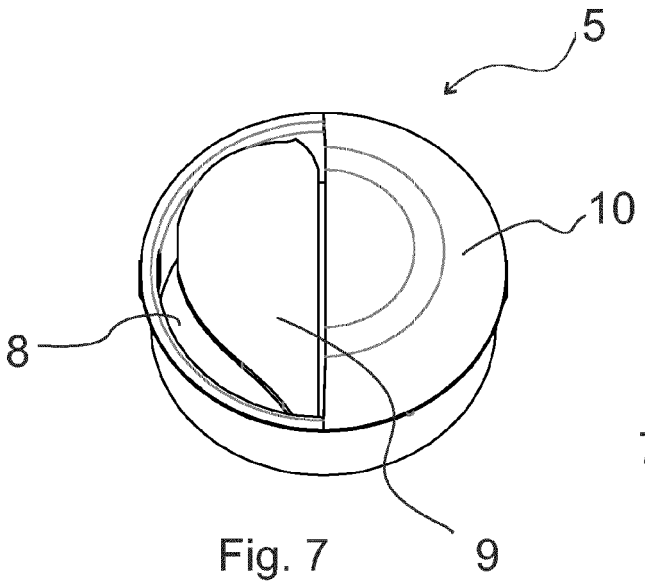


Fig. 7

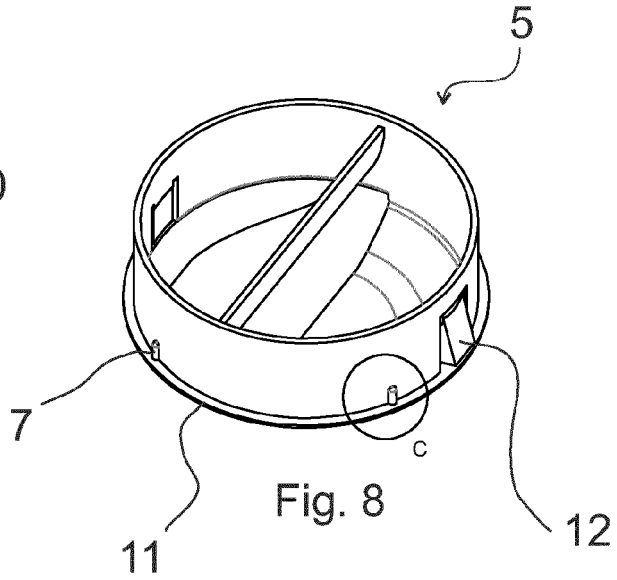


Fig. 8

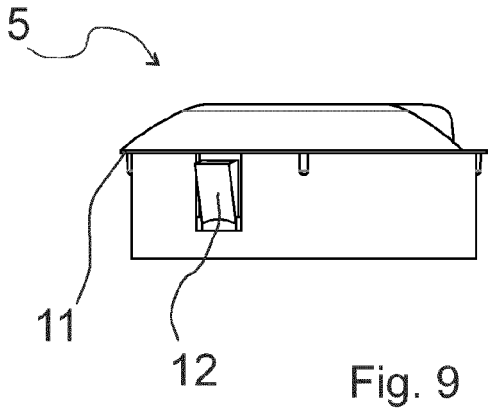
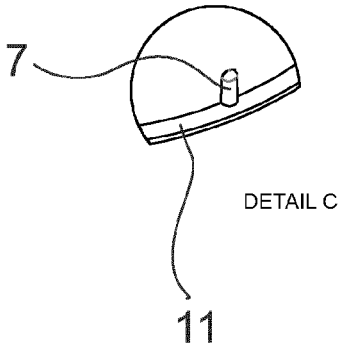


Fig. 9

Fig. 10



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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 August 2019	Salaün, Eric

CATEGORY OF CITED DOCUMENTS

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