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(54) **Air diffuser with automatic temperature adjustment**

(57) The present invention relates to an air diffuser (1) with automatic temperature adjustment for air conditioning systems which assures correct air distribution and which basically consists of an outer casing (2) for discharging air to a series of orientable fins (3) through transmission means operated by means of a mechanism for automatic temperature adjustment comprising a first thermal fuse (5) fixed to the inner surface of the casing (2) and a second thermal fuse (6) vertically movable with respect to the first one.

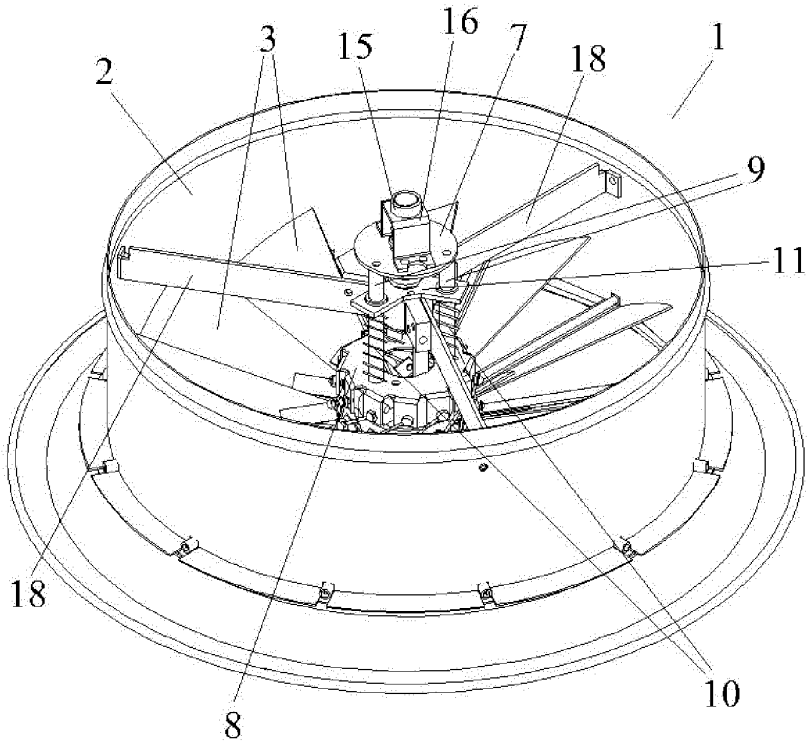

Fig. 2

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Description

Technical Field of the Invention

[0001] The present invention corresponds to the technical field of air diffusers that are used in air conditioning systems, specifically to air diffusers with automatic temperature adjustment, preferably intended for being placed in the ceiling.

Background of the Invention

[0002] Air conditioning systems improving the temperature conditions of a room by means of diffusing cold air during hot weather or diffusing hot air during cold weather are widely used today.

[0003] The air diffusers used depend on the type of system chosen and on the space to be conditioned. Ceiling diffusers are commonly used in the case of large spaces, sometimes along with wall diffusers, and they are placed in specific positions to be able to more effectively cover the entire space to be conditioned.

[0004] However, as it is known, in order to achieve an optimal, quick and effective conditioning of the room, it is necessary to take adequate account of the direction of diffusion of the projected air, since the behavior of the air will depend on the temperature thereof.

[0005] Therefore, when projecting cold air, it is best to project said cold air as horizontal as possible since it is heavier and tends to move downwards, displacing the existing hot air which is forced to move upwards at the same time. Greater performance distances will thus be achieved from a higher point, such that the hot air is displaced as it moves downward.

[0006] If the projected air is hot air, said hot air must be projected with an orientation towards lower positions so that it reaches such positions more easily and then moves upward due to the lower weight thereof, displacing the cold air downwards and so forth until achieving heat exchange that allows raising the temperature of the room. Therefore, an orientation close to the vertical is of interest in this case.

[0007] As a result, air conditioning systems generally provide systems for adjusting the direction of airflow so that they are more effective depending on the time of year in which they work.

[0008] In some cases, said adjustment is manual, so in said cases the adjustment may be rather complicated since there is a need to perform same at least twice a year when summer or winter starts. In addition to that, the drawback of human factor exists, since the adjustment can be erroneous or imprecise as it is performed manually.

[0009] As an improvement to such diffusers, there are other diffusers including automatic motorized mechanisms for adjusting said orientation of the released air. Nevertheless, they also have drawbacks because they are more complex and expensive systems, in addition to requiring high maintenance.

[0010] To solve these drawbacks, there is in the state of the art another type of diffuser such as the one defined in reference document ES 1063489-U, belonging the current applicant, which describes an air diffuser of the type referred to as "ceiling diffuser" for conditioning systems with automatic jet orientation depending on the temperature of the released air.

[0011] Said diffuser with a circular plan configuration has a diffusion group made up of concentric frustoconical elements having circular separations for releasing air between every two consecutive elements, furthermore including an automatic actuating mechanism made up of a thermo-expandable element enabled to drive in that displacement the group of frustoconical elements configuring the air jet outlet.

[0012] Therefore, when the air flowing through the diffuser is cold air the thermo-expandable element contracts, causing the release of said cold air through the circular separations existing between the frustoconical elements, with an orientation identical to that of the frustoconical surfaces between which it runs.

[0013] When the thermo-expandable element expands due to the release of hot air, the assembly of frustoconical diffusion elements moves upward, the outlet edges of the different concentric frustoconical elements being located at a higher level than that of the perimetral edge of the casing, which causes the air to receive a last orientation due to the final cylindrical section of the casing, as it leaves through the frustoconical elements, producing a much more vertical jet direction.

[0014] Nevertheless, although such diffuser complies with the objective for which it was designed, it still has certain drawbacks with respect to both cold and hot air diffusion.

[0015] Specifically, when the thermo-expandable element is compressed, the cold air leaves with an inclination fairly distant from the horizontal, whereby the reach of this jet both in height and in distance is fairly reduced, resulting in low effectiveness and requiring a greater number of diffusers to be able to obtain a more effective and quick result.

[0016] An even greater drawback is the case in which the thermo-expandable element expands, with the diffusion assembly raised, i.e., in the position in which hot air is discharged, since it is not capable of vertically penetrating the room displacing the cold air located in the lower portion of the room. This is due to the fact that said air always follows the same inclination as the frustoconical elements. Furthermore, although the portions of the jet leaving through the outermost frustoconical elements hit the casing and change direction increasing verticality, they do not completely achieve same, turbulences reducing the effectiveness of the air jet also appearing, causing the jet to lose direction as well as its speed of release.

[0017] There is therefore a need in the state of the art for an air diffuser for air conditioning apparatus which

can be adjusted automatically and which assures correct air distribution.

Description of the Invention

[0018] The air diffuser with automatic temperature adjustment for air conditioning systems of the invention, preferably intended for being placed in ceilings, solves the problems of the art mentioned above and assures correct cold and hot air distribution, assuring in the latter case correct vertical penetration.

[0019] To that end, the diffuser of the invention comprises an outer casing having in the air discharge zone a central support and a series of orientable fins each of them connected at one end to said central support and at another end to the inner surface of the casing.

[0020] The diffuser further comprises a mechanism for automatic temperature adjustment capable of generating a movement depending on the temperature changes and transmission means for transmitting said movement to the orientable fins, such that these fins adopt a substantially horizontal inclination when the diffuser discharges cold air or a substantially vertical inclination when the diffuser discharges hot air.

[0021] The direction of the discharged air is thus modified with the diffuser without having to move the entire inner assembly of the diffuser, but rather the orientable fins alone, while at the same time an improved and more effective air orientation is achieved as a result of the structure and arrangement thereof.

[0022] Specifically, with cold air the orientable fins are oriented with an inclination close to the horizontal increasing the height of the air jet, achieving greater reach of the projected air in the room. This generates greater effectiveness since the cold air of each diffuser will displace the hot air of a larger room surface.

[0023] In the case of hot air, the orientable fins are arranged with a virtually vertical inclination, so the jet also moves vertically downward, without interferences that generate turbulences, losses or direction changes, increasing the penetrability thereof and allowing the hot air to reach the lowest levels, generating heat exchange with the cold air in a quicker and more effective manner.

Brief Description of the Drawings

[0024] For the purpose of aiding to better understand the features of the invention according to a preferred practical embodiment thereof, a series of drawings is provided as an integral part of said description in which with the following is depicted in an illustrative and non-limiting manner:

Figure 1 shows a bottom perspective view of the diffuser in the case in which cold air is released for a preferred embodiment of the invention.

Figure 2 shows a top perspective view of the diffuser in the case in which cold air is released for a preferred embodiment of the invention.

Figures 3.1 and 3.2 show the plan view and the elevational view of the diffuser, respectively, in the case in which cold air is released for a preferred embodiment of the invention.

Figures 4.1 and 4.2 show a view of sections A-A' and B-B', respectively, of Figure 3.1.

Figure 5 shows a detailed view of the thermal fuses in the case in which cold air is released for a preferred embodiment of the invention.

Figures 6.1 and 6.2 show a perspective view of the diffuser without the casing and without the springs and of a detail of the transmission means for transmitting the movement of the second fuse to the orientable fins, respectively, in the case in which cold air is released for a preferred embodiment of the invention.

Figure 7 shows a bottom perspective view of the diffuser in the case in which hot air is released for a preferred embodiment of the invention.

Figure 8 shows a top perspective view of the diffuser in the case in which hot air is released for a preferred embodiment of the invention.

Figures 9.1 and 9.2 show the plan view and the elevational view of the diffuser, respectively, in the case in which hot air is released for a preferred embodiment of the invention.

Figures 10.1 and 10.2 show a view of sections C-C' and D-D', respectively, of Figure 3.1.

Figure 11 shows a detailed view of the thermal fuses in the case in which hot air is released for a preferred embodiment of the invention.

Figure 12.1 and 12.2 show a perspective view of the diffuser without the casing and without the springs and of a detail of the transmission means for transmitting the movement of the second fuse to the orientable fins, respectively, in the case in which hot air is released for a preferred embodiment of the invention.

Detailed Description of a Preferred Embodiment of the Invention

[0025] In view of described drawings, it can be observed how in a preferred embodiment of the invention, the air diffuser 1 with automatic temperature adjustment, for air conditioning systems and intended for being placed preferably in the ceiling, proposed herein, has an outer casing 2 having a circular section with a series of orientable fins 3 in a radial arrangement and a central support 4 in the air discharge zone.

[0026] In this preferred embodiment of the invention, as shown in Figures 1, 3.1, 6.1, 7 and 9.1, the diffuser comprises a total of twelve radial orientable fins 3 each of them connected at one end to the central support 4 and at another end to the inner surface of the casing 2.

[0027] This diffuser 1 has in turn a mechanism for automatic temperature adjustment which, as can be ob-

served in Figures 4.1, 4.2, 6.1, 10.1, 10.2 and 12.1, comprises at least a first fixed thermal fuse 5 located in the central axis of the casing 2 and such that the upper end thereof is located coinciding with the upper section of the casing 2 and a second thermal fuse 6 movable with respect to the first one.

[0028] This second thermal fuse 6 has a first position in which it is located aligned with respect to the first thermal fuse 5 and in contact with it, and a second position in which it is moved vertically upwards away from the first thermal fuse 5.

[0029] The mechanism for automatic temperature adjustment in turn comprises fixing means for fixing the position of the first thermal fuse 5 with respect to the inner surface of the casing 2, a plate 7 with a central hole in which there is fitted the lower end of the second thermal fuse 6, a part having a planar upper surface 8 located between the central support 4 and the first thermal fuse 5 and transmission means for transmitting the movement of the second thermal fuse to the twelve radial orientable fins 3.

[0030] In this preferred embodiment of the invention, the part having a planar upper surface 8 has a cylindrical shape with an open lower base and a closed upper base, and is connected to the plate 7 by means of three connecting posts 9 having a first spring 10 around each of them, as well as means for abutting with said first springs 10. It also comprises connection means for connecting the plate 7 with the second thermal fuse 6.

[0031] In this preferred embodiment of the invention, as shown in Figures 2 and 8, the means for abutting with said first springs 10 of the three connecting posts 9 are formed by a star-shaped part 11 which, in this preferred embodiment of the invention, has three tips as there are three connecting posts 9.

[0032] This star-shaped part 11 has a central hole in which the first thermal fuse 5 is securely fitted and a through hole in each tip for each of the connecting posts 9. The first springs 10 of said connecting posts 9 are located on the lower portion of the star-shaped part 11, such that when the three connecting posts 9 move upwards, the movement of the first springs 10 are limited by this star-shaped part 11 and they are in a compressed position.

[0033] In this preferred embodiment of the invention, as shown in Figures 6.1, 6.2, 12.1 and 12.2, the transmission means for transmitting the movement of the second thermal fuse 6 to the radial orientable fins 3 are formed by rods 12 pivoting about a rivet 13 for attaching the first end thereof with one of the orientable fins 3, respectively, and about a rivet 13 for attaching the second end thereof with the side surface of the part having a planar upper surface 8.

[0034] Likewise, the air diffuser 1 with automatic temperature adjustment presented herein comprises safety means formed by a second spring 14 which is located between the plate 7 and a safety abutment 15 which the second thermal fuse 6 has at the upper end thereof.

[0035] Said plate 7 is connected to the second thermal fuse 6 by connection means formed by a fastening element 16 connected on the lower portion thereof to the plate 7 and on the upper portion thereof to the safety abutment 15 existing in the upper end of the second thermal fuse 6.

[0036] As shown in Figures 4.1 and 10.1, in this preferred embodiment of the invention the fixing means for fixing the first thermal fuse 5 to the inner surface of the casing 2 are formed by a cylindrical part 17 that is fitted around said first thermal fuse 5 and three radial bars 18 located with a first end fastened to the surface of said cylindrical part 17 and said first ends being located equidistant to one another, whereas the second end is fastened to the inner surface of the casing 2.

[0037] That being said, Figures 1 to 6.2 show the diffuser in the case in which it is projecting cold air 20.

[0038] In those conditions, the temperature adjustable material 19 of the thermal fuses 5, 6, contracts as it contacts with low temperature air and the second movable thermal fuse 6 is in contact with the first thermal fuse 5, as shown in Figure 5.

[0039] Therefore, the second thermal fuse 6 does not exert any force on the plate 7 and said plate also does not exert any force on the part having a planar upper surface 8 to which it is attached by means of the three connecting posts 9, therefore, the three first springs 10 located around each of the three connecting posts 9, respectively, are in stand-by and do not exert any force on the transmission means, as shown in Figure 6.2, therefore, the part having a planar upper surface 8 is in the lowest position, the rods 12 do not pivot nor exert any force on the orientable fins 3, which are in the position with inclination closest to the horizontal, as can be seen in Figures 4.1 and 4.2.

[0040] Since the orientable fins 3 are in this position of inclination close to the horizontal, the projected air 20 has an inclination identical to that of the orientable fins 3, i.e., close to the horizontal, whereby the air 20 reaches higher levels of the room as well as greater distances around the diffuser 1.

[0041] On the other hand, Figures 7 to 12.2 show the diffuser 1 in the case in which the released air 20 projected by the diffuser is hot air.

[0042] In this case, due to the high temperature of the released air 20, the temperature adjustable material 19 of the thermal fuses 5, 6, expands, as shown in detail in Figure 11, where the separation of the second thermal fuse 6 from the first thermal fuse 5 can be seen, which in this preferred embodiment of the invention is generated by a movement 21 thereof by a maximum value of 13 mm.

[0043] As the temperature adjustable material 19 expands and moves the second thermal fuse 6 upward, it in turn generates the movement of the plate 7 which is fastened to said second thermal fuse 6.

[0044] With the upward movement of the plate 7, as shown in Figure 10.2, the three connecting posts 9 con-

nected at their upper end to said plate 7 and the part having a planar upper surface 8 to which said three connecting posts 9 are connected at their lower end, move upwards. The first springs 10 existing around the three connecting posts 9 are compressed since they cannot move due to the obstacle imposed to them by the star-shaped part 11, and they are responsible for returning both the plate 7 and the part having a planar upper surface 8 to their position when the temperature of the released air 20 decreases.

[0045] As the part having a planar upper surface 8 moves upward, the rods 12 forming the transmission means for transmission to the orientable fins 3 pivot about the points for attaching said rods 12 with a fin 3 and with the part having a planar upper surface 8, respectively.

[0046] This movement generates the rotation of the orientable fins 3 which take a vertical position, whereby the air jet 20 is projected vertically, achieving greater reach towards lower levels.

[0047] In the case in which the thermal fuses 5, 6 overheat generating a movement 21 of the second fuse that is greater than desired, the safety means defined above and shown in Figures 4.1, 4.2, 10.1 and 10.2, and which are formed by a second spring 14 between the plate 7 and the safety abutment 15 of the upper end of the second thermal fuse 6, limit said movement 21.

Claims

1. Air diffuser (1) with automatic temperature adjustment for air conditioning systems comprising an outer casing (2) having in the air discharge zone a central support (4) and a series of orientable fins (3) each of them connected at one end to said central support (4) and at another end to the inner surface of the casing (2), **characterized in that** it further comprises:

   - a mechanism for automatic temperature adjustment generating a movement depending on air temperature changes; and
   - transmission means for transmitting said movement to the orientable fins (3),

   such that said orientable fins (3) adopt a substantially horizontal inclination when the diffuser discharges cold air or a substantially vertical inclination when the diffuser discharges hot air.

2. Air diffuser (1) with automatic temperature adjustment according to claim 1, **characterized in that** the mechanism for automatic temperature adjustment comprises at least a first thermal fuse (5) fixed to the inner surface of the casing (2) and a second thermal fuse (6) vertically movable with respect to the first one, and the movement of which is transmitted through the transmission means to the orientable fins (3).

3. Air diffuser (1) with automatic temperature adjustment according to claim 1 or 2, **characterized in that** the transmission means for transmitting the movement of the mechanism for automatic temperature adjustment to the orientable fins (3) are formed by pivoting rods (12) which are attached at one of their ends to said orientable fins (3).

4. Air diffuser (1) with automatic temperature adjustment according to any of the preceding claims, **characterized in that** the outer casing (2) has a circular section.

5. Air diffuser (1) with automatic temperature adjustment according to any of the preceding claims, **characterized in that** the orientable fins (3) have a radial arrangement.

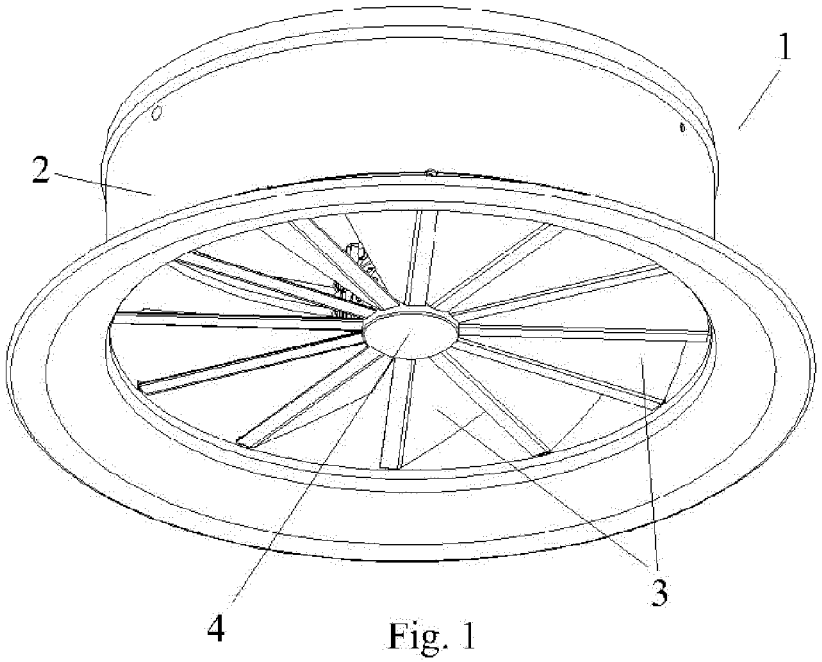

Fig. 1

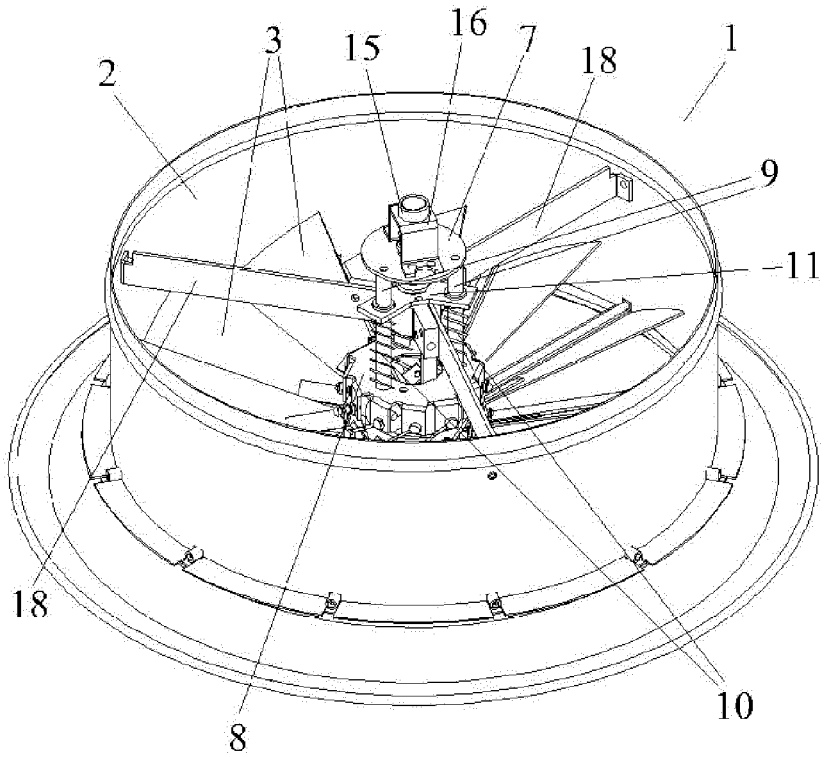

Fig. 2

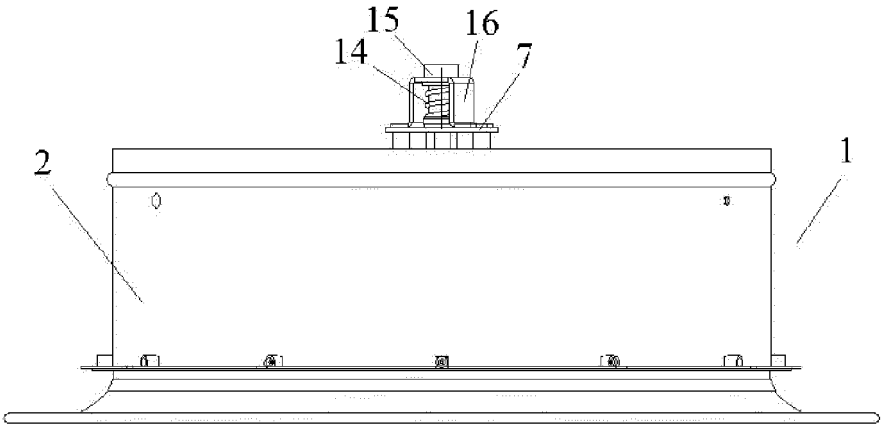

Fig. 3.2

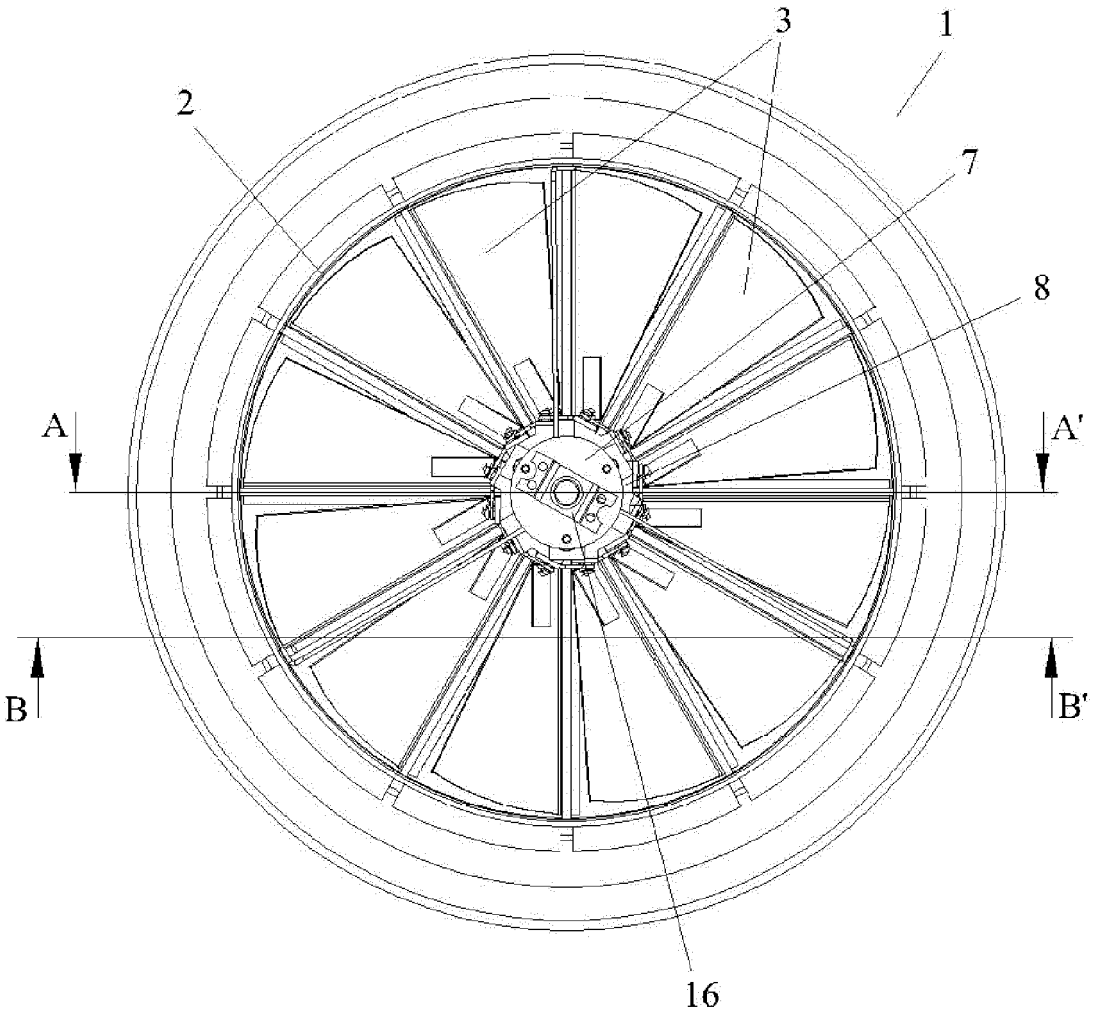

Fig. 3.1

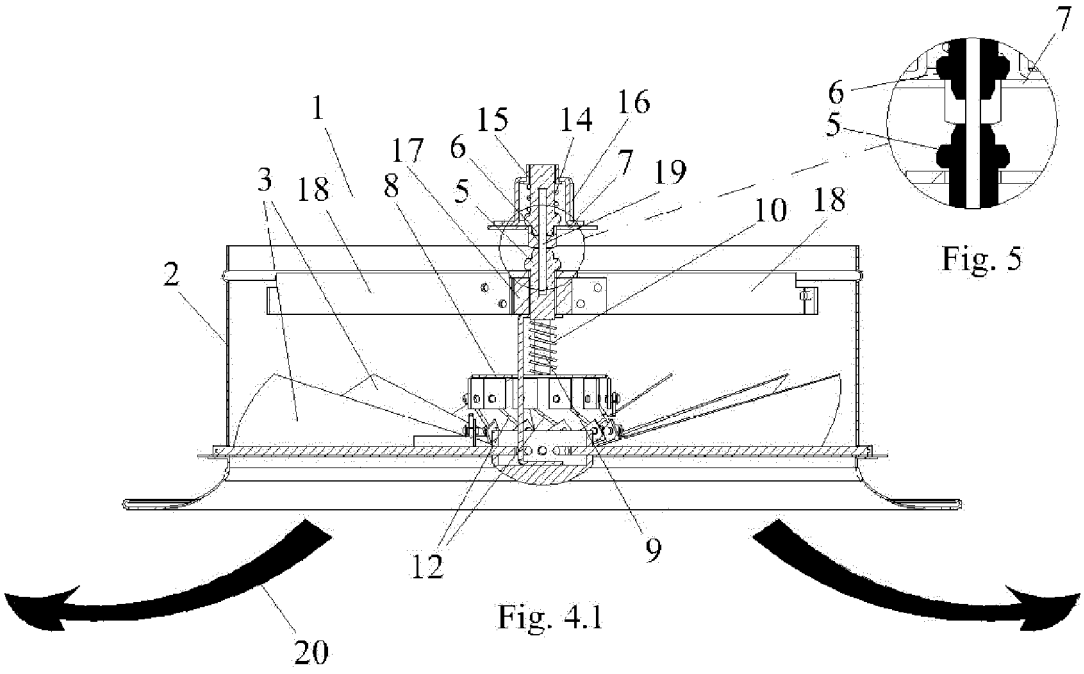

Fig. 4.1

Fig. 5

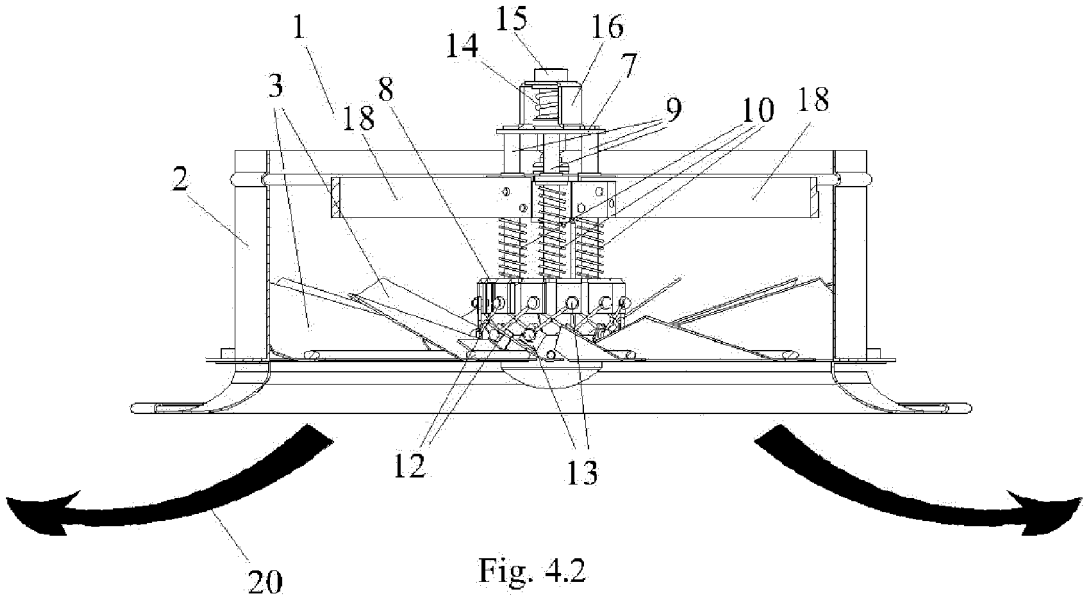

Fig. 4.2

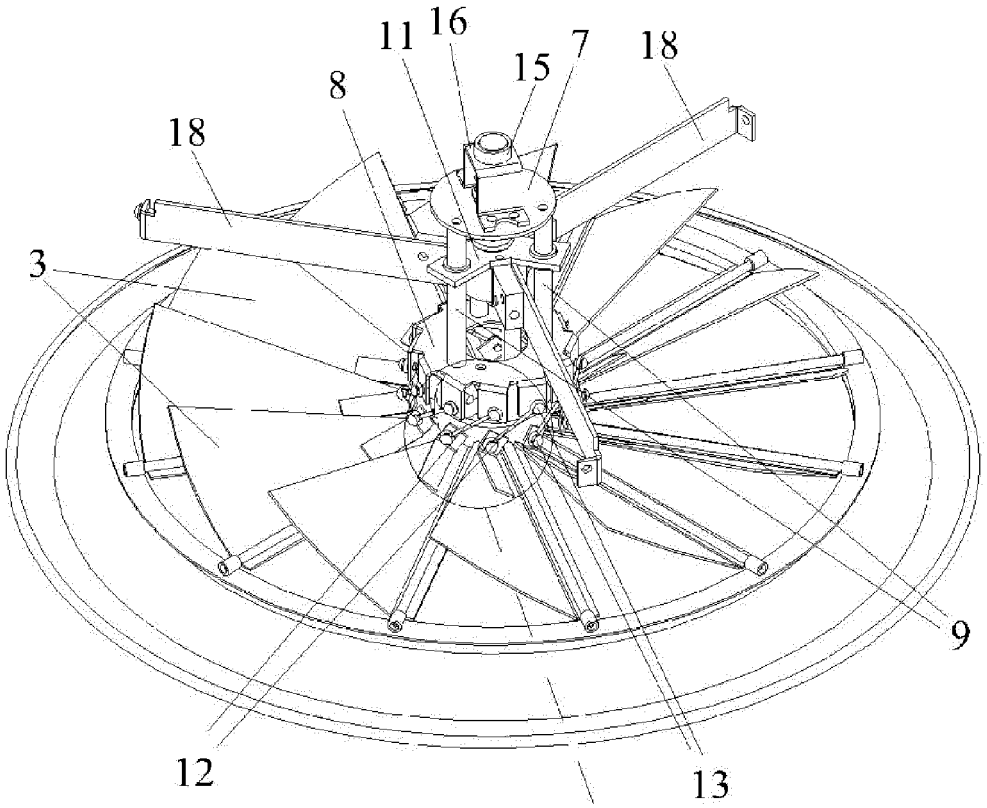

Fig. 6.1

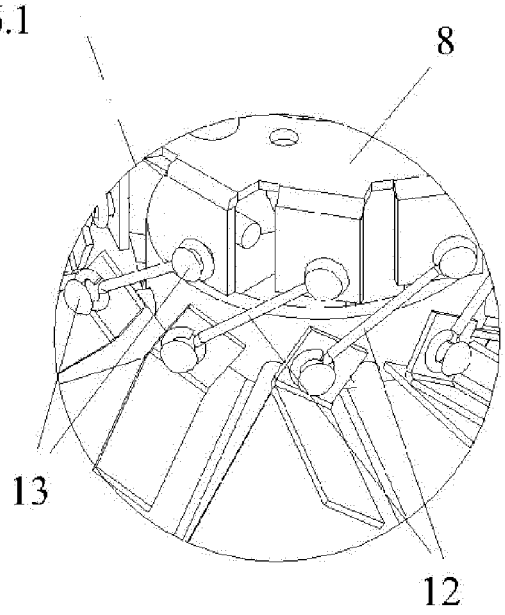

Fig. 6.2

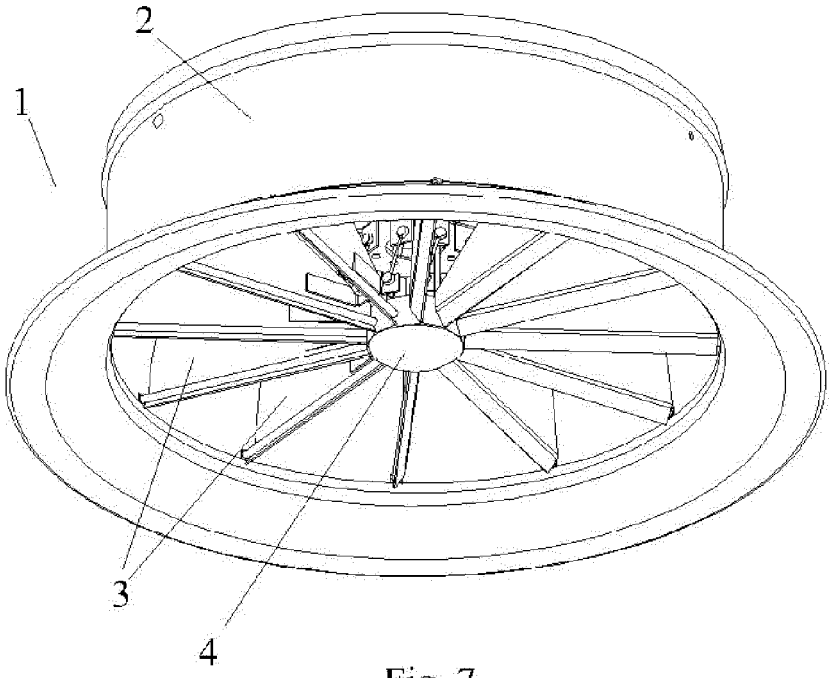

Fig. 7

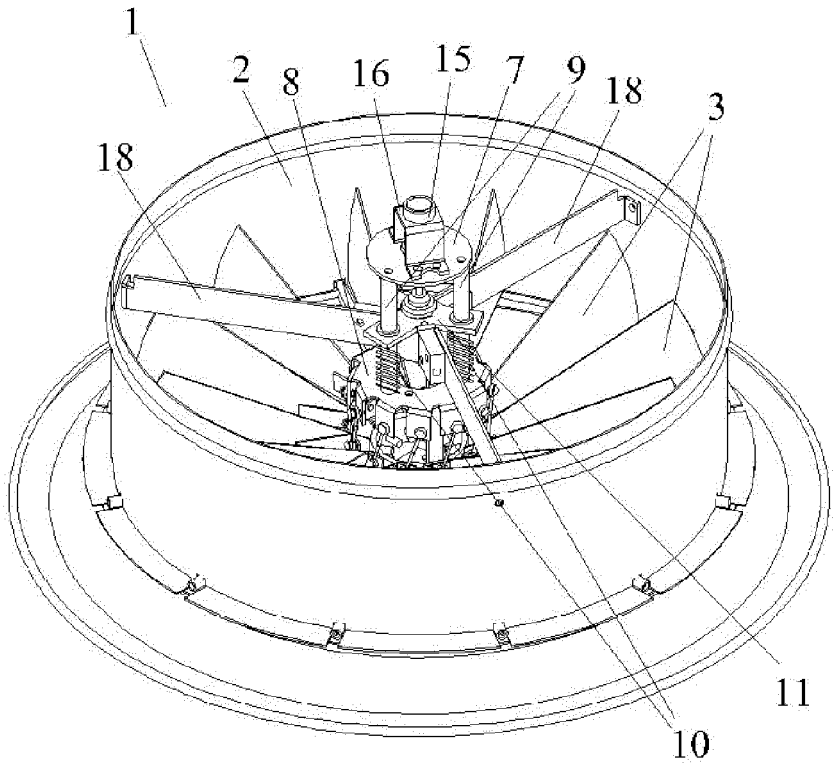

Fig. 8

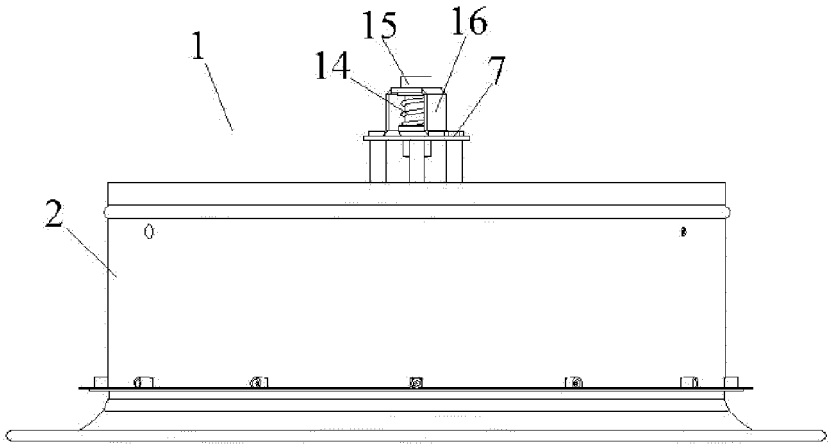

Fig. 9.2

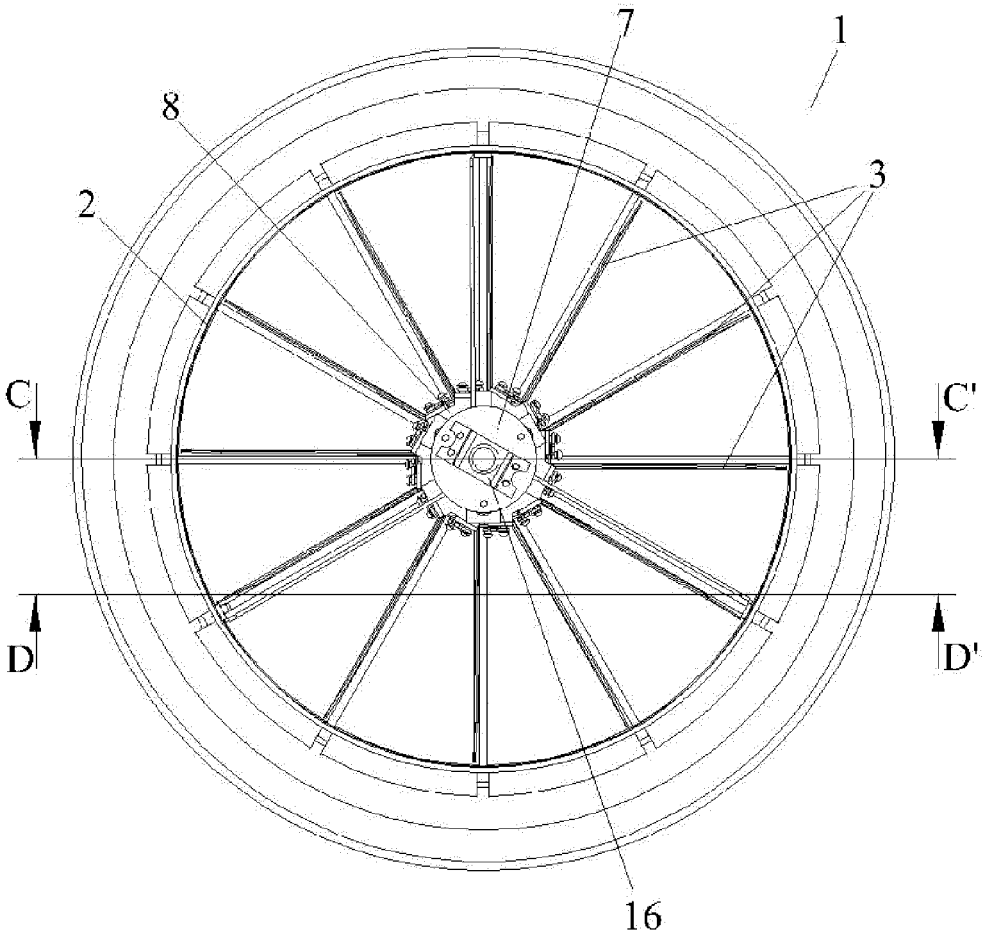

Fig. 9.1

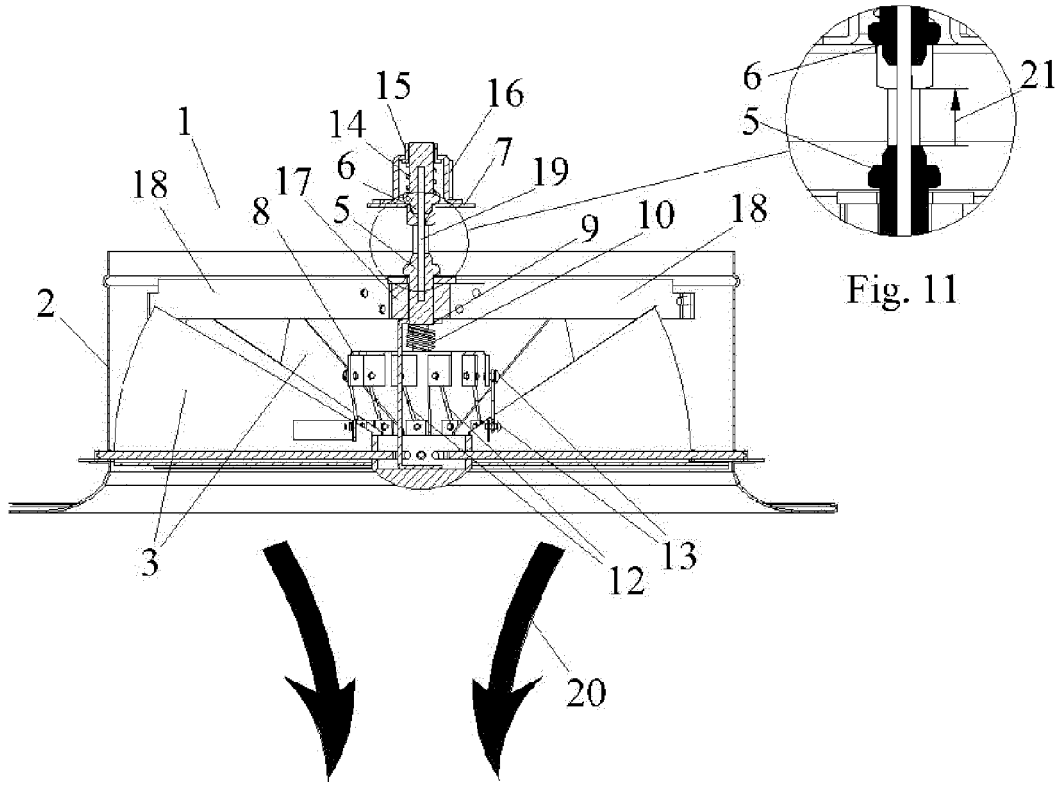

Fig. 11

Fig. 10.1

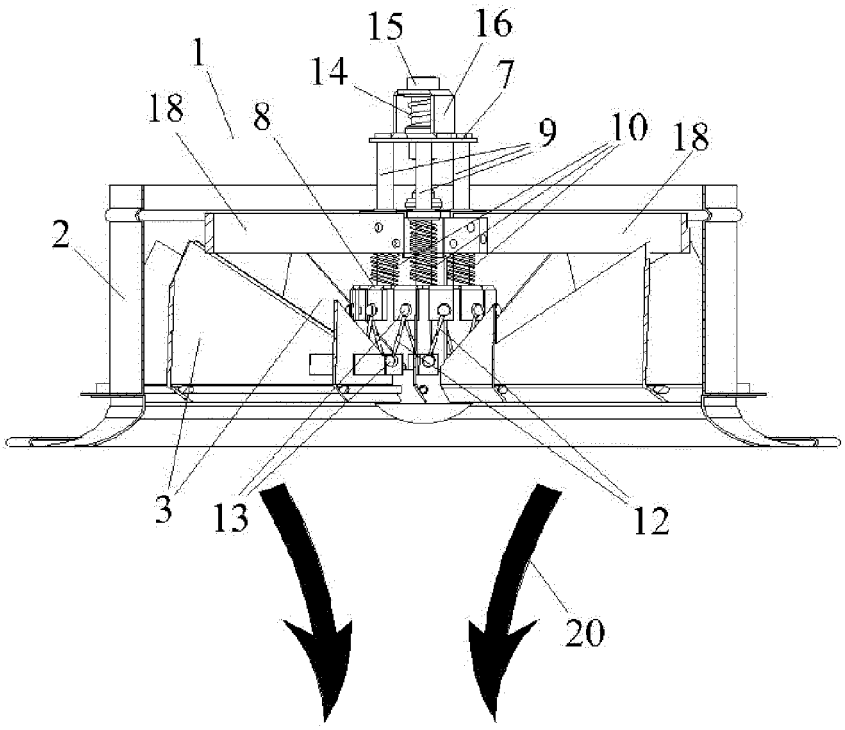

Fig. 10.2

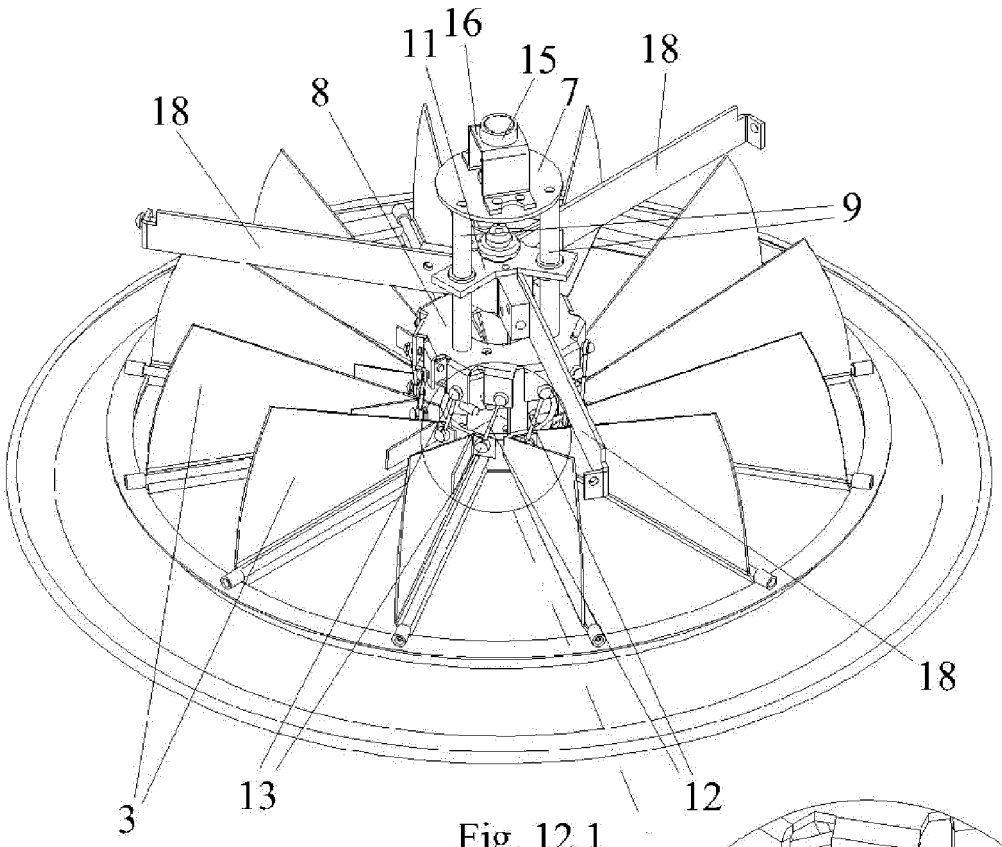

Fig. 12.1

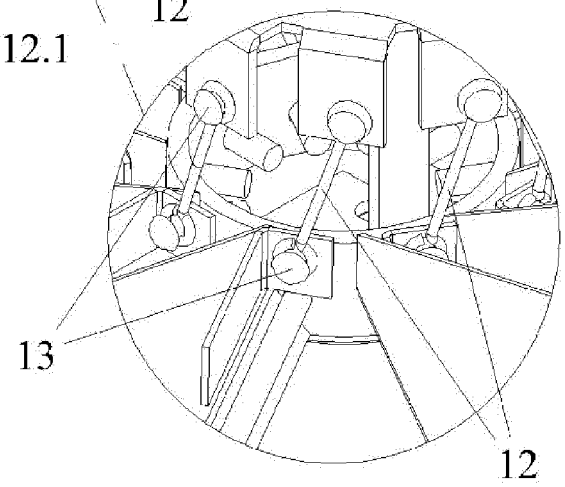

Fig. 12.2

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EUROPEAN SEARCH REPORT

Application Number
EP 14 38 2248

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	24 October 2014	Decking, Oliver

CATEGORY OF CITED DOCUMENTS

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