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(54) A generator set

(57) A generator set (1) comprises an endothermic engine (2) with its own drive shaft (3), an electrical generator (4) connected to said drive shaft (3) and coaxial to the endothermic engine (2), a fan (7) keyed on the drive shaft (3) and co-operating with a case (8) to define a cooling block (9) conveying cool air axially on the electrical generator (4) and on a head of the endothermic engine (2), a sound-proofing enclosure (10) containing the endothermic engine (2), the electrical generator (4) and the cooling block (9), a supplementary fan (11) keyed

on the drive shaft (3) and positioned internally to the sound-proofing enclosure (10) and externally to said case (8), a conduit (12) positioned internally to the sound-proofing enclosure and co-operating with said supplementary fan (11) to convey a flow of cool air into an air filter (13) of the endothermic engine (2).

Known sound-proofed direct-transmission generator sets have limited performance, because they are not provided with any system for cooling of the air filter or of the outer surface of the endothermic engine.

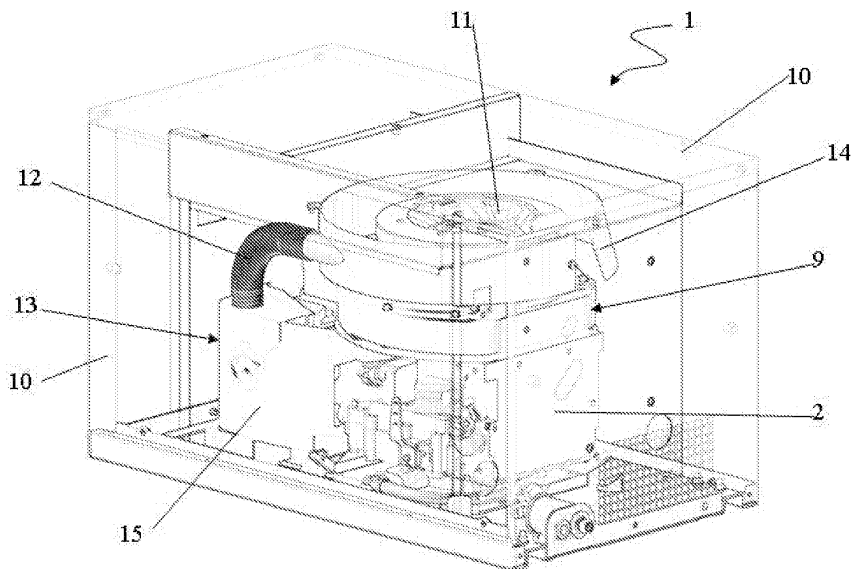


FIG. 1

Description

[0001] The present invention relates to a generator set comprising:

- an endothermic engine with its own drive shaft;
- an electrical generator connected to said drive shaft and coaxial to the endothermic engine;
- a fan keyed on the drive shaft and co-operating with a case to define a cooling block conveying cool air axially on the electrical generator and on a head of the endothermic engine;
- a sound-proofing enclosure containing the endothermic engine, the electrical generator and the cooling block.

[0002] The present invention refers to the sector of sound-proofed generator sets, in which the electrical generator and the endothermic engine are boxed within a sound-proofed enclosure. In particular, in the constructive type of the generator set in question (or the alternator) is fastened directly on the drive shaft of the endothermic engine (direct transmission), thus being coaxial relative thereto.

[0003] For this kind of generator sets, the problem of effectively cooling the endothermic engine is particularly important. To sound-proof the generator set, it is necessary to reduce all spaces around the engine and use, for the enclosure, sound-proofing material, with the consequent limitation of the aeration of the engine and penalisation of its cooling.

[0004] Known technical solutions for cooling sound-proofed direct transmission generator sets employ a cooling block serving the purpose of conveying cool air (i.e., air drawn from outside the enclosure) on the endothermic engine and on the alternator in axial direction, i.e. in the direction of the drive shaft. In this way, the cooling of the alternator and of the head of the endothermic engine is assured.

[0005] In particular, said cooling block comprises a fan keyed on the drive shaft and positioned within a case. The case serves the purpose of conveying the air flow generated by the fan, addressing it axially towards the head of the engine. Said case is so shaped as to prevent dispersions of said air flow on the outer surface of the engine or in radial direction.

[0006] Therefore, said generator sets define a hollow space, between the endothermic engine and the sound-proofing enclosure, in which is present, disadvantageously, air that is substantially motionless and hot (because it is in contact with the outer surface of the endothermic engine). This entails a limitation with regard to the performance of the generator set.

[0007] An additional disadvantage of known technical solutions is that they do not provide for effective cooling of some critical parts of the endothermic engine, such as in particular the air filter and the oil sump, which, due to sound-proofing needs, are positioned within the sound-

proofing enclosure and hence have their heat exchange surfaces in contact with said hollow space.

[0008] An object of the present invention is to eliminate the aforesaid drawbacks and to make available a sound-proofed, direct transmission generator set with a particularly effective cooling system, able to assure particularly high performance levels.

[0009] Said object is fully achieved by the generator set of the present invention, which is characterised by the content of the claims set out below and in particular in that it comprises, in combination:

- a supplementary fan keyed on the drive shaft and positioned within the sound-proofing enclosure and outside said case;
- a conduit positioned inside the sound-proofing enclosure and co-operating with said supplementary fan to convey a flow of cool air into an air filter of the endothermic engine.

[0010] This and other characteristics shall become more readily apparent from the description that follows of a preferred embodiment, illustrated purely by way of non limiting example in the accompanying drawing tables, in which:

- figure 1 shows a perspective, partially see-through view of a generator set according to the present invention;
- figure 2 shows a partially open view of the generator set of figure 1;
- figure 3 shows a portion of the generator set of figure 2;
- figure 4 shows a partially exploded view of the generator set of figure 3;
- figure 5 shows a further exploded view of the generator set of figure 4;
- figure 6 shows the generator set of figure 3, together with a schematic representation of the ventilation flows;

[0011] In the figures, the reference number 1 indicates a generator set according to the present invention.

[0012] The generator set 1 comprises an endothermic engine 2 with its own drive shaft 3 and an electrical generator 4 connected to said drive shaft 3 and coaxial to the endothermic engine 2. In particular (with reference to figure 5), the electrical generator 4 comprises a rotor 5 and a stator 6, according to a known construction type. The rotor 5 is multi-polar with permanent magnets and rotates outside the stator to which it is coaxial.

[0013] Moreover, the generator set 1 comprises a cooling fan 7 keyed on the drive shaft 3 and co-operating with a case 8 to define a cooling block 9 conveying cool air axially on the electrical generator 4 and on a head of the endothermic engine 2. In particular, the case 8 is substantially constituted by a shell that houses the fan 7 and has an upper opening to enable the fan 7 to aspirate air

from above and a lower opening, whose edge is substantially in contact with an upper surface of the endothermic engine 3, i.e. with the surface corresponding to the head of the endothermic engine itself, said upper opening enabling to orient (and concentrate) on said lower surface the air flow generated by the fan 7.

[0014] Moreover, the generator set 1 comprises a sound-proofing enclosure 10 containing the endothermic engine 3, the electrical generator 4 and the cooling block 9. Said sound-proofing enclosure 10 is made of sound-absorbing material, such as self-extinguishing polyurethane foam impregnated with inorganic charges.

[0015] The generator set 1 also comprises, originally, a supplementary fan 11 keyed on the drive shaft 3 and positioned internally to the sound-proofing enclosure 10 and externally to the case 8. Moreover, the generator set 1 originally comprises a conduit 12 positioned internally to the sound-proofing enclosure 10 and co-operating with said supplementary fan 11 to convey a flow of cool air into an air filter 13 of the endothermic engine 2.

[0016] The generator set 1 further comprises, originally, a supplementary case 14 co-operating with said supplementary fan 11 to convey a flow of cool air on an outer surface of the endothermic engine 2.

[0017] It should be noted that the supplementary fan 11 is positioned inside the sound-proofing enclosure 10 so that the cooling block 9 is interposed between said supplementary fan 11 and the endothermic engine 2. In practice the supplementary fan 11 is positioned above the fan 7 and is coaxial thereto (in particular, the two fans are keyed on the same drive shaft 3).

[0018] The generator set 1 further comprises a box body 15 housing the air filter, according to a known constructive mode. Said box body 15, originally, defines an opening operatively connected to said conduit 12 to receive the air flow generated by the supplementary fan 11.

[0019] Said supplementary case 14, in particular, is so shaped as to maximise a forced circulation of cool air in a hollow space defined between the outer surface of the endothermic engine 2 and the sound-proofing enclosure 10.

[0020] In this regard, it should be noted that, under operating conditions, in said hollow space, in the absence of said forced circulation (obtained originally thanks to the supplementary fan 11 and to the supplementary case 14, appropriately shaped), there would be substantially motionless, hot air (i.e. at a temperature of about 60°C whilst inside the case 8 the air typically has a temperature of 40 ÷ 45°C (considering a temperature of 30 ÷ 35°C for cool air, i.e. the air present outside the sound-proofing enclosure 10).

[0021] In the preferred embodiment, illustrated herein, the supplementary fan 11 is able to exert a pressing action in radial direction on the cool air drawn from outside the sound-proofing enclosure 10. The flow of air generated in radial direction by the supplementary fan 11 is then conveyed by the supplementary case 14 so that a first of portion of said flow is channelled into the conduit

12 and a second portion laps the outer surface of the endothermic engine 2 (as shown schematically in figure 6).

[0022] It should also be noted that the generator set 1 comprises a voltage rectifier and a voltage inverter (indicated by the reference number 16 in figure 2), electrically connected to the electrical generator 4, to assure a voltage output from the electrical generator 4 that is particularly stable in terms of frequency and clean in terms of harmonic distortion.

[0023] It should also be noted that the presence of the supplementary fan 11 enables to increase the total flow of cooling air, in particular substantially to double said flow. The fans 7 and 11 have similar dimensions, because their diameter is limited by the need to limit the bulk of the generator set, and they rotate at the same velocity, i.e. at the velocity of rotation of the drive shaft 3 whereon they are keyed.

[0024] Moreover, the supplementary fan 11 enables, in combination with the conduit 12, to implement, originally, a forced ventilation on the air filter of the endothermic engine 2, said forced ventilation being carried out with cool air (cool because it is drawn from outside sound-proofing enclosure 10).

[0025] Therefore, the generator set of the present invention allows, thanks to an innovative ventilation system, particularly high performance levels. Moreover, the generator set of the present invention is particularly silent, because it does not comprise supplementary openings defined by the sound-proofing enclosure 10, but rather, the supplementary fan 11 is positioned inside the sound-proofing enclosure 10 itself.

Claims

1. Generator set (1) comprising:

- an endothermic engine (2) with its own drive shaft (3);
- an electrical generator (4) connected to said drive shaft (3) and coaxial to the endothermic engine (2);
- a fan (7) keyed on the drive shaft (3) and co-operating with a case (8) to define a cooling block (9) conveying cool air axially on the electrical generator (4) and on a head of the endothermic engine (2);
- a sound-proofing enclosure (10) containing the endothermic engine (2), the electrical generator (4) and the cooling block (9),

characterised in that it comprises, in combination:

- a supplementary fan (11) keyed on the drive shaft (3) and positioned within the sound-proofing enclosure (10) and outside said case (8);
- a conduit (12) positioned inside the sound-

proofing enclosure (10) and co-operating with said supplementary fan (11) to convey a flow of cool air into an air filter (13) of the endothermic engine (2).

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2. A generator set as claimed in claim 1, comprising a supplementary case (14) co-operating with said supplementary fan (11) to convey a flow of cool air on an outer surface of the endothermic engine (2).

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3. A generator set as claimed in claim 1, wherein the supplementary fan (11) is positioned inside the sound-proofing enclosure (10) in such a way that the cooling block (9) is interposed between said supplementary fan (11) and the endothermic engine (2).

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4. A generator set as claimed in claim 1, wherein the supplementary fan (11) is coaxial to the fan (7) of the cooling block (9).

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5. A generator set as claimed in claim 1, comprising a box body (15) housing the air filter (13) and defining an opening operatively connected to said conduit (12).

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6. A generator said as claimed in claim 2, wherein said supplementary case (14) is so shaped as to maximise a forced circulation of cool air in a hollow space defined between said outer surface of the endothermic engine (2) and the sound-proofing enclosure (10).

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7. A generator set as claimed in claim 1, wherein said supplementary fan (11) is able to exercise a pressing action in radial direction on the cool air drawn from outside the sound-proofing enclosure (10).

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8. A generator set as claimed in claim 1, comprising a voltage rectifier and a voltage inverter (16), electrically connected to the electrical generator (4).

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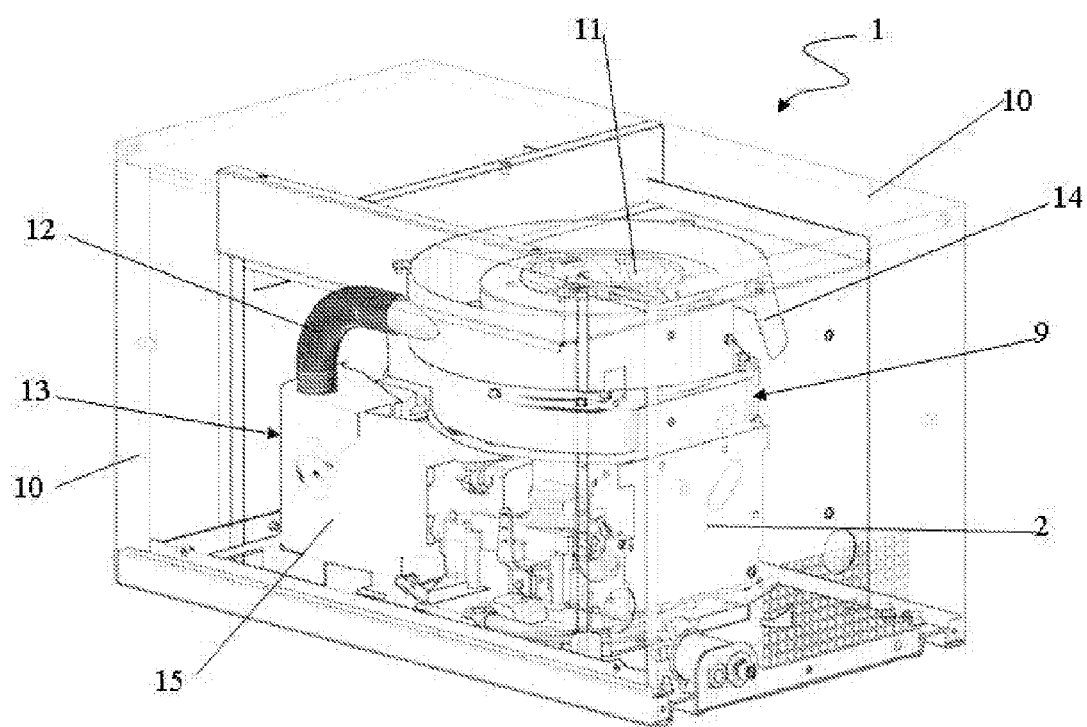


FIG. 1

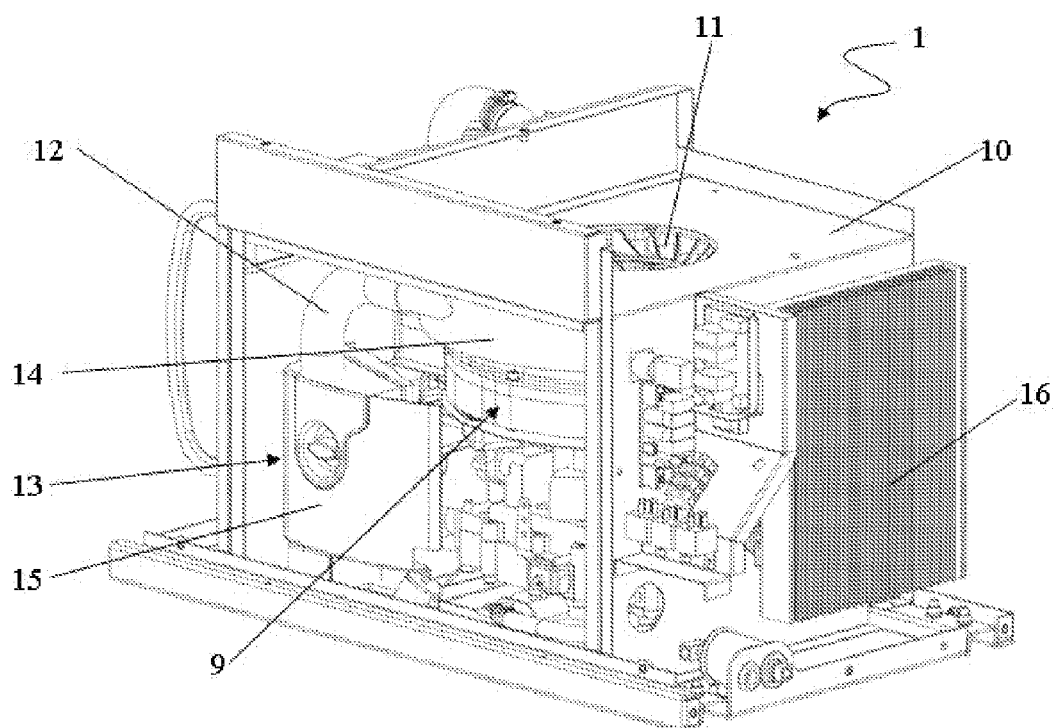


FIG. 2

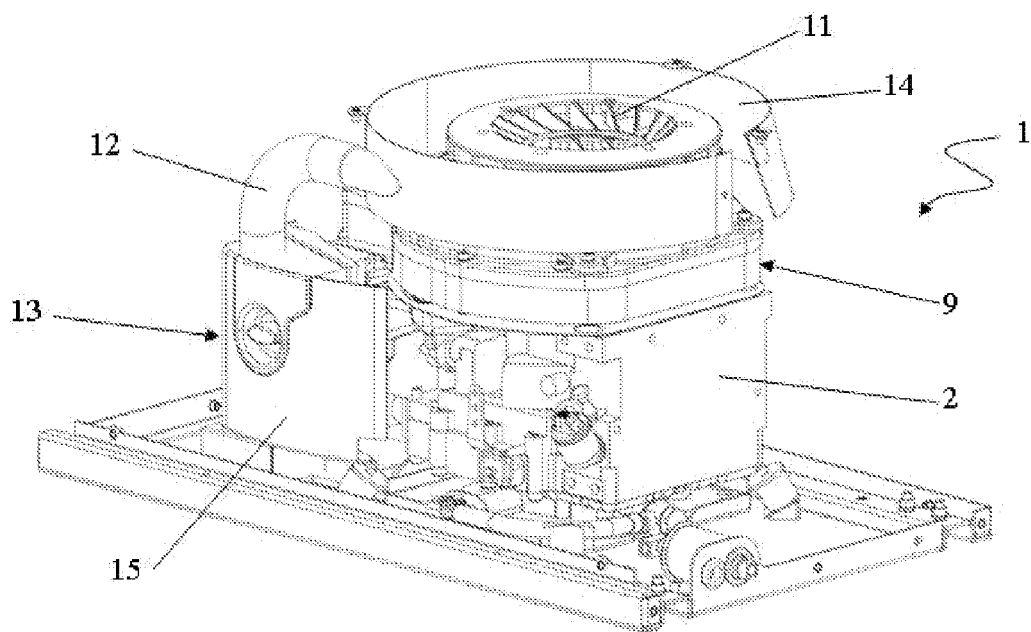


FIG. 3

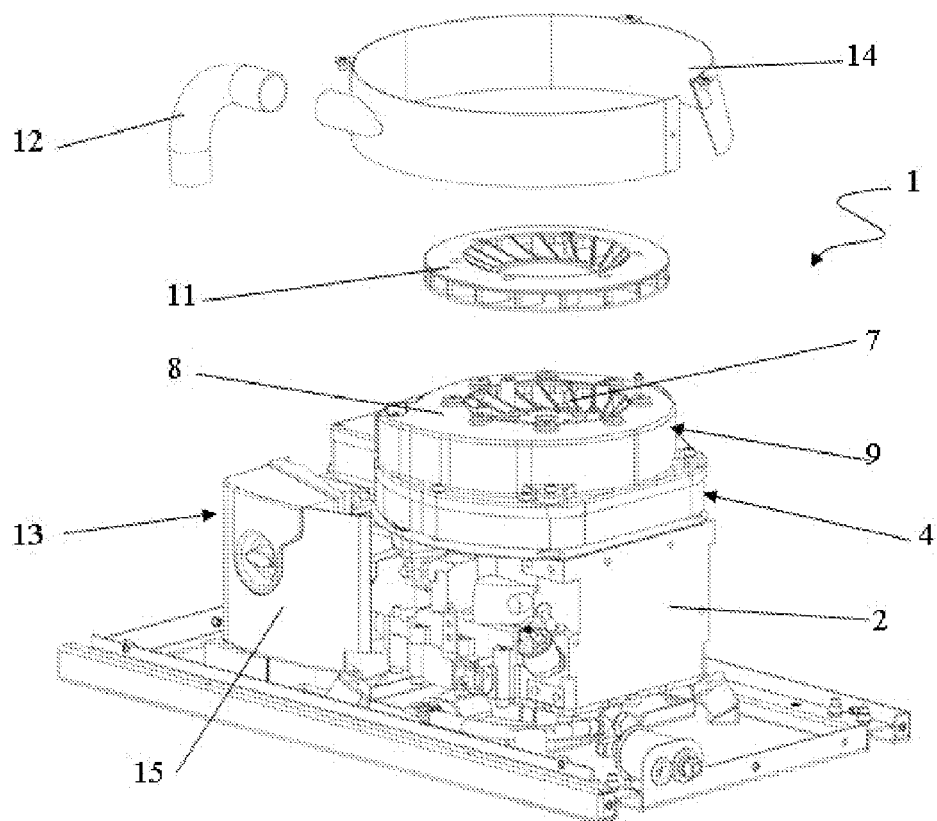


FIG. 4

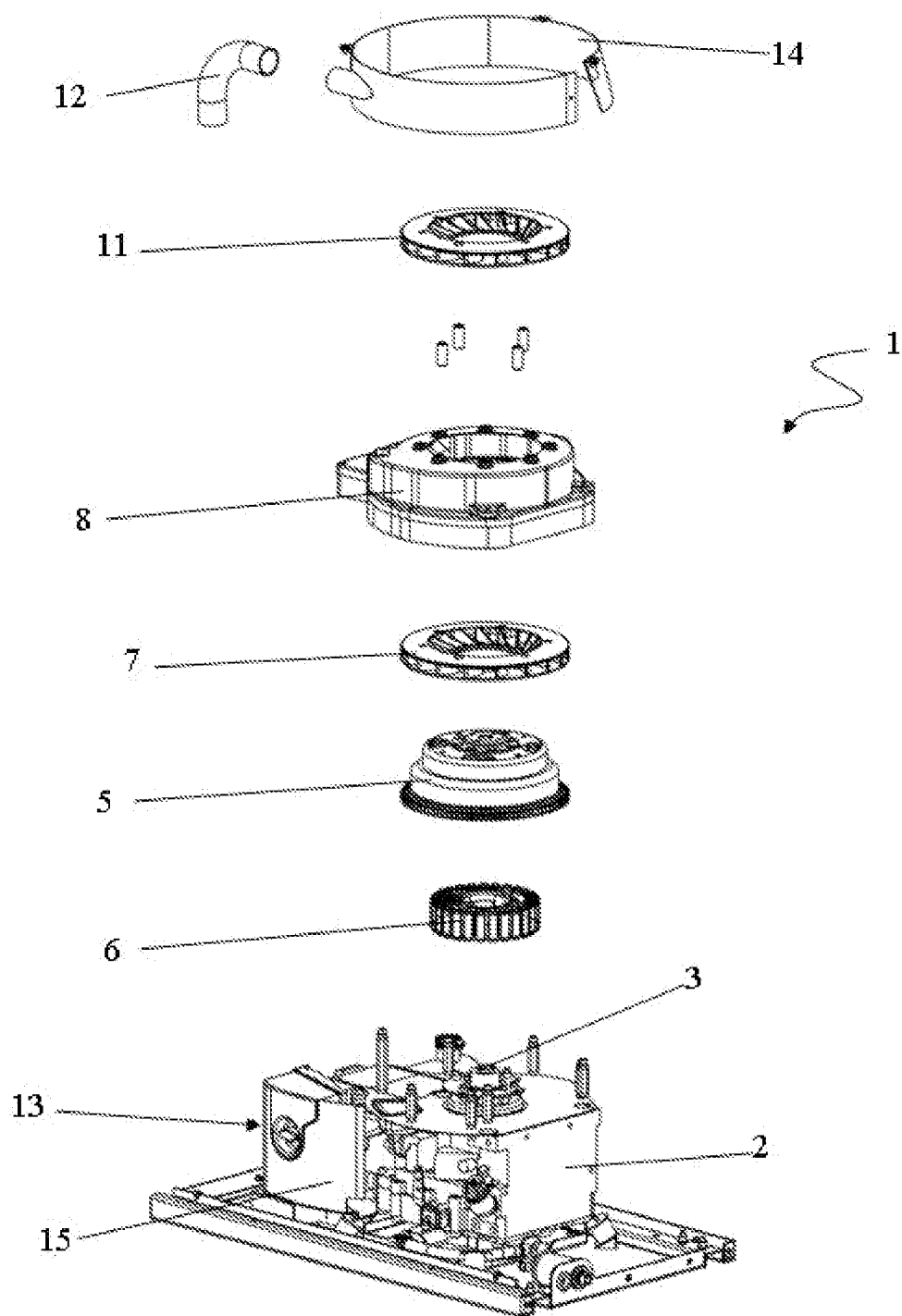


FIG. 5

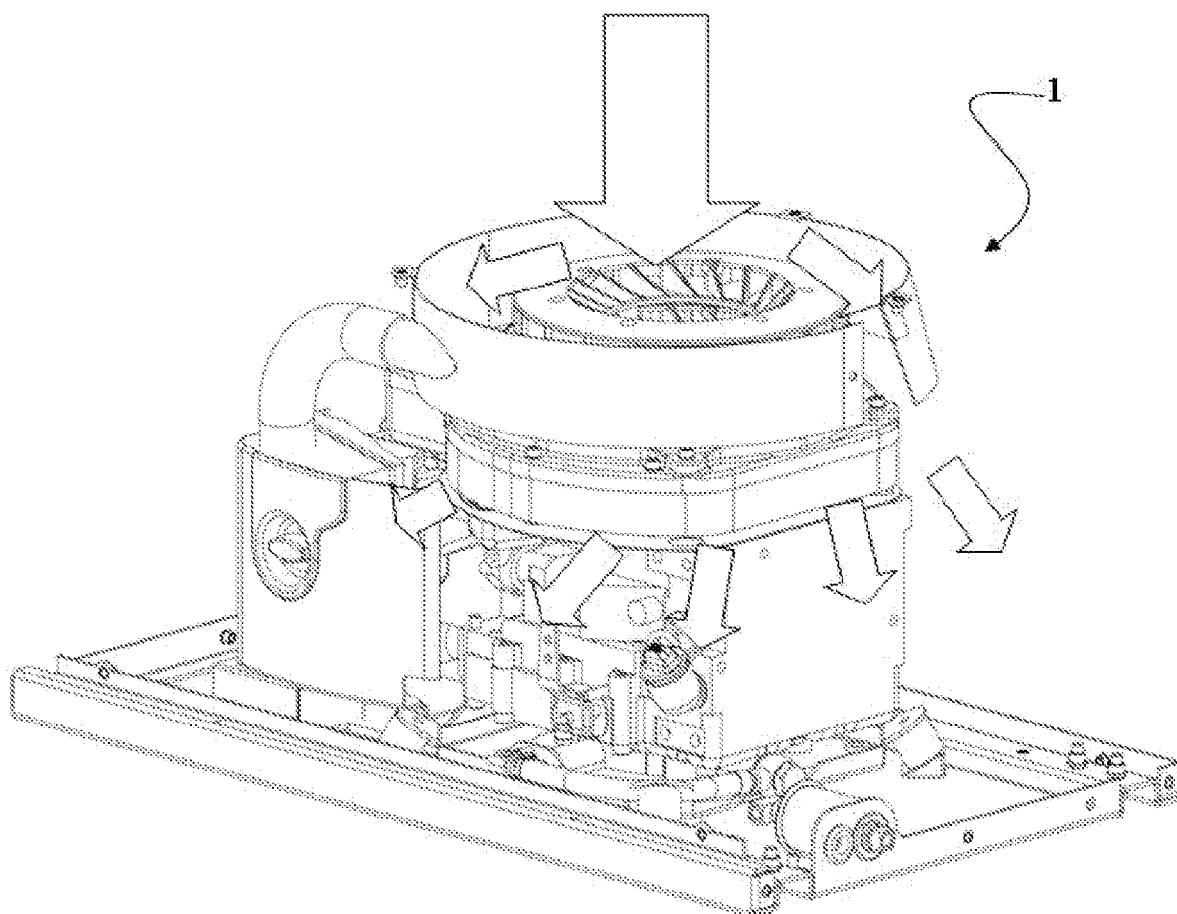


FIG. 6