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(54) **CENTRIFUGAL FAN**

ZENTRIFUGALLÜFTER

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Description

Field of the Art

[0001] The present invention relates to means for driving air which are used in ventilation installations, proposing a ventilation device with an improved support which determines an advantageous soundproofing embodiment.

State of the Art

[0002] In ventilation installations, on both the domestic and industrial level, it is important to prevent the noise that ventilation devices produce during operation from propagating through the structures supporting the installation, and this is conventionally resolved by providing ventilation devices with soundproofing solutions.

[0003] On the other hand, plug fan-type centrifugal fans are known and have been widely used in recent years as a ventilation module that can be coupled to ventilation boxes, air treatment units, in walls and drop ceilings with chambers for moving air, roof fans, etc.

[0004] Plug fan-type centrifugal fans comprise a front part with an air suction mouth, a motor-impeller assembly provided with blades the axis of rotation of which is arranged axially with respect to the air suction mouth and a support connecting the motor-impeller assembly with the front part.

[0005] The air is introduced axially into the ventilation device through the suction mouth due to the centrifugal force caused by the rotation of the blades of the impeller, and it is expelled from the ventilation device in a direction perpendicular to the axis of rotation of the impeller with a deflection angle in the direction of rotation of the impeller.

[0006] The supports used for connecting the motor-impeller assembly with the front part of the ventilation device are formed by tubular elements, quadrangular elements or bent metal sheets which, due to their configuration and arrangement, generate a certain degree of air distortion when the ventilation device is in operation.

[0007] EP2080912 relates to a centrifugal fan with support arms.

[0008] There is therefore a need for a ventilation device with an improved support which allows reducing those distortions and at the same time withstanding the vibrations produced during operation.

Object of the Invention

[0009] The invention relates to a centrifugal fan (the term ventilation device is also used herein interchangeably to denote the centrifugal fan) having an improved soundproofing performance.

[0010] The centrifugal fan comprises:

- a front part with a suction mouth through which air is introduced into the centrifugal fan,
- a motor and impeller assembly with blades having an axis of rotation arranged axially with respect to the suction mouth, the motor and impeller assembly being configured such that during use, the air is driven in a direction which is perpendicular to the axis of rotation with a deflection angle in the direction of rotation of the impeller, and
- support means for connecting the motor and impeller assembly with the front part comprising at least three arms having a flat laminar shape and extending in the direction in which the air is driven, wherein at least the part of the arms facing the direction in which the air is driven has a curvature.

[0011] The arms have a front face and side faces, wherein the front face has a smaller thickness than the side faces. Said front face of smaller thickness is facing the direction in which the air is driven, whereas the side faces are parallel to the direction in which the air is driven.

[0012] The arms have a first part connected to the motor and impeller assembly, a second part connected to the front part and a third part connecting the first part with the second part. The first part of each arm has a connection point for connecting with the arm located immediately adjacent thereto according to the opposite direction of rotation of the impeller, and a second connection point for connecting with the arm located immediately adjacent thereto according to the direction of rotation of the impeller. The connection of the arms to one another and the orientation thereof in the direction of rotation of the impeller allows the arms to withstand the torsional stresses generated by the motor and impeller assembly during the operation of the ventilation device without the arms deforming or producing a resonant effect.

[0013] Specifically, the flat laminar shape of the arms is such that the first part of the arms extends in a direction substantially perpendicular to the axis of rotation of the motor and impeller assembly, the second part extends in a direction substantially parallel to the axis of rotation of the motor and impeller assembly, and the third part connects the first part with the second part by way of a bend. The arms are preferably L-shaped.

[0014] The curvature of the arms is for reducing the noise caused by the passage of the blades.

[0015] A centrifugal fan is thereby obtained which, on one hand, due to the shape and orientation of its arms, minimizes the noise of the ventilation device due to the exposure to the expelled airflow to which the arms are subjected, whereas on the other hand, connecting the arms with one another and their orientation allows withstanding the torsional stresses generated by the motor and impeller assembly without the arms producing a resonant effect.

Description of the Drawings

[0016]

Figure 1 shows a perspective view of an embodiment of the ventilation device of the invention with four arms.

Figure 2 shows a side view of the ventilation device of Figure 1.

Figure 3 shows a top view of the ventilation device of Figure 1.

Figure 4 shows a sectioned side view of the ventilation device of Figure 1.

Figure 5 shows a schematic view of the orientation of the arms in the direction in which the air is driven out of the ventilation device.

Figures 6 to 11 show six different embodiments of the ventilation device of the invention.

Detailed Description of the Invention

[0017] As shown in the drawings, the ventilation device of the invention comprising a front part (1) with a suction mouth (2) for introducing air into the ventilation device, an assembly formed by a motor (3) and an impeller (4) provided with blades (5) for driving the suctioned air out of the ventilation device and arms (6) connecting the assembly formed by the motor (3) and the impeller (4) with the front part (1).

[0018] The motor (3) is partially integrated in the impeller (4) such that the arms (6) connect the part of the motor (3) projecting out of the impeller (4) with the front part (1) of the ventilation device in which the suction mouth (2) is located.

[0019] The axis of rotation of the motor (3) is coaxial with the axis of rotation of the impeller (4), and the axis of rotation of said assembly formed by the motor (3) and the impeller (4) is arranged axially with respect to the suction mouth (2).

[0020] Figure 4 shows the path the air follows through the ventilation device by means of arrows drawn with dashed lines. The rotation of the blades (5) of the impeller (4) causes the air to axially enter the ventilation device through the suction mouth (2) to then make a 90° turn and be driven out of the ventilation device in a direction (D) which is perpendicular (r) to the axis of rotation of the impeller (4) with a deflection angle (α) in the direction of rotation (G) of the impeller (4). The deflection angle (α) is comprised between 15° and 45°.

[0021] The schematic plan view of Figure 5 shows the direction (D) in which the air is driven out of the ventilation device. When the ventilation device is in operation, the outer profile of the blades (5) of the impeller (4) describes a circumference (c) depicted by a dashed line, such that when a blade (5) passes through a point (p) of said circumference (c) the air is driven with respect to said point (p) in the direction (D) which is perpendicular (r) to the axis of rotation of the impeller (4) with a deflection angle (α) in the direction of rotation (G) of the impeller (4).

[0022] To prevent the arms (6) from distorting the output air and to prevent unwanted noises from being generated, the invention has envisaged that the arms (6) will have a flat laminar shape with a main longitudinal axis (x) (depicted by dashed lines) extending in the direction (D) in which the air is driven (see Figure 3). The arms (6), therefore, have a rectangular section with a front face (F), a rear face (R) and two side faces (L). The front face (F) has a smaller thickness than the side faces (L), said front face (F) of smaller thickness facing the direction (D) in which the air is driven, whereas the side faces (L) of larger thickness are parallel to the direction (D) in which the air is driven without creating interferences with the air.

[0023] The arms (6) have a first part (6.1) which is connected to the assembly formed by the motor (3) and the impeller (4), a second part (6.2) which is connected to the front part (1) and a third part (6.3) connecting the first part (6.1) with the second part (6.2). The first part (6.1) of each arm (6) has a connection point (u) for connecting with the arm (6) located immediately adjacent thereto according to the opposite direction of rotation (G) of the impeller (4), and a second connection point (u') for connecting with the arm (6) located immediately adjacent thereto according to the direction of rotation (G) of the impeller (4). This connection of the arms (6) with one another, together with the orientation thereof in the direction (D) in which the air is driven, means that the arms (6) work like struts, and that the connection with the front part (1) of the ventilation device is much more rigid against torsional vibrations of the motor (3).

[0024] As seen in Figure 2, the arms (6) are L-shaped, wherein the first part (6.1) extends in a direction substantially perpendicular to the axis of rotation of the motor (3), the second part (6.2) extends in a direction substantially parallel to the axis of rotation of the motor (3), and the third part (6.3) connects the first part (6.1) with the second part (6.2) by way of a bend.

[0025] The front face (F) of the arms (6) facing the direction (D) in which the air is driven has a curvature which tends to reduce the noise generated by the blades (5) of the impeller (4). As seen in Figure 2, the third part (6.3) of the arm (6) connecting the first part (6.1) with the second part (6.2) has a radius of curvature (r3) allowing a gradual transition between the first part (6.1) and the second part (6.2). The third part (6.3) of the arm (6) is precisely the part of the arm exposed the most to the air driven by the impeller (4), so since said part has a curvature, a "guillotine" effect reducing the noise caused by the passage of the blades (5) is generated, which would not be the case if the transition between the first part (6.1) and the second part (6.2) was by way of a 90° bend and did not have a radius of curvature (r3).

[0026] The first part (6.1) and the second part (6.2) also have a slight radius of curvature, such that the curvature of the second part (6.2) also helps to reduce the noise of the blades (5) of the impeller (4), whereas since all the parts of the arm (6) have a curvature on the front face (F) thereof, the distribution of torsional vibrations that are transmitted to the arm (6) from the motor (3) is improved.

[0027] As shown in the drawings, the arms (6) are con-

nected to the motor (3) through a flat bar (7), although the arms (6) may be directly connected to the motor (3) or to a casing surrounding the impeller (4), without this altering the concept of the invention.

[0028] The embodiment of the ventilation device shown in Figures 1 to 5 has four arms (6), although the number of arms (6) will be selected depending on the size of the motor (3) and impeller (4) assembly, having to use at least three arms (6) for connecting the motor (3) and impeller (4) assembly with the front part (1).

[0029] Figures 6 to 11 show different configurations of the arms (6). Figures 6 and 9 show a three-arm configuration, Figures 7 and 10 show a four-arm configuration and Figures 8 and 11 show a six-arm configuration.

[0030] As shown in said Figures 6 to 11, the position of the arms changes depending on the direction of rotation (G) of the impeller, therefore when the impeller rotates in the counterclockwise direction the arms are arranged as shown in Figures 6, 7 and 8, whereas when the impeller (4) rotates in the clockwise direction the arms are arranged as shown in Figures 9, 10 and 11.

[0031] The arms (6) are arranged according to a symmetrical distribution with respect to the axis of rotation of the motor (3) and impeller (4) assembly allowing the torsional vibrations of the motor (3) to be uniformly distributed throughout all the arms (6). When three arms (6) are used, the arms (6) are connected with one another forming a 60° angle; when four arms (6) are used, the arms (6) are connected with one another forming a 90° angle; whereas when six arms (6) are used, the arms (6) are connected with one another forming a 120° angle.

Claims

1. A centrifugal fan comprising:

- a front part (1) with a suction mouth (2) through which air is introduced into the centrifugal fan,
- a motor (3) and impeller (4) assembly with blades (5) having an axis of rotation arranged axially with respect to the suction mouth (2), the motor (3) and impeller (4) assembly being configured such that during use, the air is driven in a direction (D) which is perpendicular to the axis of rotation with a deflection angle (α) in the direction of rotation (G) of the impeller (4), and
- support means for connecting the motor (3) and impeller (4) assembly with the front part (1), wherein the support means comprise at least three arms (6) having a flat laminar shape and extending in the direction (D) in which the air is driven, and wherein at least the part of the arms (6) facing the direction (D) in which the air is driven has a curvature.

2. The centrifugal fan according to the preceding claim, wherein the arms (6) have a front face (F) and side faces (L), wherein the front face (F) has a smaller thickness than the side faces (L), said front face (F) of smaller thickness is facing the direction (D) in which the air is driven, whereas the side faces (L) are parallel to the direction (D) in which the air is driven.

3. The centrifugal fan according to any one of the preceding claims, wherein the arms (6) have a first part (6.1) connected to the motor (3) and impeller (4) assembly, a second part (6.2) connected to the front part (1) and a third part (6.3) connecting the first part (6.1) with the second part (6.2), wherein the first part (6.1) of each arm (6) has a connection point (u) for connecting with the arm (6) located immediately adjacent thereto according to the opposite direction of rotation (G) of the impeller (4), and a second connection point (u') for connecting with the arm (6) located immediately adjacent thereto according to the direction of rotation (G) of the impeller (4).

4. The centrifugal fan according to the preceding claim, wherein the first part (6.1) of the arms (6) extends in a direction substantially perpendicular to the axis of rotation of the motor (3) and impeller (4) assembly, the second part (6.2) extends in a direction substantially parallel to the axis of rotation of the motor (3) and impeller (4) assembly, and the third part (6.3) connects the first part (6.1) with the second part (6.2) by way of a bend.

5. The centrifugal fan according to any one of the preceding claims, wherein the arms (6) are L-shaped.

6. The centrifugal fan according to any one of the preceding claims, wherein the arms (6) are arranged according to a symmetrical distribution with respect to the axis of rotation of the motor (3) and impeller (4) assembly.

Patentansprüche

1. Zentrifugallüfter, der aufweist:

- einen Vorderteil (1) mit einer Saugmündung (2), durch die Luft in den Zentrifugallüfter eingeleitet wird,
- eine Motor- (3) und Flügelrad- (4) Anordnung mit Flügeln (5) mit einer Drehachse, die in Bezug auf die Saugmündung axial angeordnet ist, wobei die Motor- (3) und Flügelrad- (4) Anordnung derart konfiguriert ist, dass die Luft während der Verwendung in eine Richtung (D) angetrieben wird, die mit einem Ablenkwinkel (α) in der Drehrichtung (G) des Flügelrads (4) senkrecht zu der Drehachse ist, und
- Halteeinrichtungen zum Verbinden der Motor-

(3) und Flügelrad- (4) Anordnung mit dem Vorderteil (1), wobei die Halteeinrichtungen wenigstens drei Arme (6) mit einer flachen laminaren Form, die sich in die Richtung (D), in welche die Luft angetrieben wird, erstrecken, aufweisen, und wobei wenigstens der Teil der Arme (6), welcher der Richtung (D), in welche die Luft angetrieben wird, zugewandt ist, eine Krümmung hat.

2. Zentrifugallüfter nach dem vorhergehenden Anspruch, wobei die Arme (6) eine Vorderfläche (F) und Seitenflächen (L) haben, wobei die Vorderfläche (F) eine kleinere Dicke als die Seitenflächen (L) hat, wobei die Vorderfläche (F) mit kleinerer Dicke der Richtung (D) zugewandt ist, in welche die Luft angetrieben wird, während die Seitenflächen (L) parallel zu der Richtung (D), in welche die Luft angetrieben wird, sind.

3. Zentrifugallüfter nach einem der vorhergehenden Ansprüche, wobei die Arme (6) einen ersten Teil (6.1), der mit der Motor- (3) und Flügelrad- (4) Anordnung verbunden ist, einen zweiten Teil (6.2), der mit dem Vorderteil (1) verbunden ist, und einen dritten Teil (6.3), der den ersten Teil (6.1) mit dem zweiten Teil (6.2) verbindet, haben, wobei der erste Teil (6.1) jedes Arms (6) einen Verbindungspunkt (u) zum Verbinden mit dem gemäß der entgegensetzten Drehrichtung (G) des Flügelrads (4) unmittelbar dazu angrenzenden Arm (6) und einen zweiten Verbindungspunkt (u') zum Verbinden mit dem gemäß der Drehrichtung (G) des Flügelrads (4) unmittelbar dazu angrenzenden Arm (6) hat.

4. Zentrifugallüfter nach dem vorhergehenden Anspruch, wobei der erste Teil (6.1) der Arme (6) sich in eine Richtung im Wesentlichen senkrecht zu der Drehachse der Motor- (3) und Flügelrad- (4) Anordnung erstreckt, der zweite Teil (6.2) sich in eine Richtung im Wesentlichen parallel zu der Drehachse der Motor- (3) und Flügelrad- (4) Anordnung erstreckt und der dritte Teil (6.3) den ersten Teil (6.1) durch einen Bogen mit dem zweiten Teil (6.2) verbindet.

5. Zentrifugallüfter nach einem der vorhergehenden Ansprüche, wobei die Arme (6) L-förmig sind.

6. Zentrifugallüfter nach einem der vorhergehenden Ansprüche, wobei die Arme (6) in Bezug auf die Drehachse der Motor- (3) und Flügelrad- (4) Anordnung gemäß einer symmetrischen Verteilung angeordnet sind.

Revendications

1. Ventilateur centrifuge comprenant :

- une partie avant (1) avec une bouche d'aspiration (2) à travers laquelle de l'air est introduit dans le ventilateur centrifuge,
- un ensemble de moteur (3) et d'hélice (4) avec des pales (5) ayant un axe de rotation agencé axialement par rapport à la bouche d'aspiration (2), l'ensemble de moteur (3) et d'hélice (4) étant configuré de sorte que, en cours d'utilisation, l'air soit entraîné dans une direction (D) qui est perpendiculaire à l'axe de rotation avec un angle de déflexion (α) dans la direction de rotation (G) de l'hélice (4), et
- des moyens de support pour relier l'ensemble de moteur (3) et d'hélice (4) à la partie avant (1), dans lequel les moyens de support comprennent au moins trois bras (6) ayant une forme laminaire plate et s'étendant dans la direction (D) dans laquelle l'air est entraîné, et dans lequel au moins la partie des bras (6) orientée dans la direction (D) dans laquelle l'air est entraîné présente une courbure.

2. Ventilateur centrifuge selon la revendication précédente, dans lequel les bras (6) présentent une face avant (F) et des faces latérales (L), dans lequel la face avant (F) présente une épaisseur inférieure à celle des faces latérales (L), ladite face avant (F) d'épaisseur inférieure est orientée dans la direction (D) dans laquelle l'air est entraîné, tandis que les faces latérales (L) sont parallèles à la direction (D) dans laquelle l'air est entraîné.

3. Ventilateur centrifuge selon l'une quelconque des revendications précédentes, dans lequel les bras (6) présentent une première partie (6.1) reliée à l'ensemble de moteur (3) et d'hélice (4), une deuxième partie (6.2) reliée à la partie avant (1) et une troisième partie (6.3) reliant la première partie (6.1) à la deuxième partie (6.2), dans lequel la première partie (6.1) de chaque bras (6) présente un point de liaison (u) pour se relier au bras (6) situé immédiatement adjacent à celui-ci dans la direction de rotation (G) inverse de l'hélice (4), et un deuxième point de liaison (u') pour se relier au bras (6) situé immédiatement adjacent à celui-ci dans la direction de rotation (G) de l'hélice (4).

4. Ventilateur centrifuge selon la revendication précédente, dans lequel la première partie (6.1) des bras (6) s'étend dans une direction sensiblement perpendiculaire à l'axe de rotation de l'ensemble de moteur (3) et d'hélice (4), la deuxième partie (6.2) s'étend dans une direction sensiblement parallèle à l'axe de rotation de l'ensemble de moteur (3) et d'hélice (4), et la troisième partie (6.3) relie la première partie (6.1) à la deuxième partie (6.2) au moyen d'un coude.

5. Ventilateur centrifuge selon l'une quelconque des re-

vendications précédentes, dans lequel les bras (6) sont en forme de L.

6. Ventilateur centrifuge selon l'une quelconque des revendications précédentes, dans lequel les bras (6) sont agencés dans une répartition symétrique par rapport à l'axe de rotation de l'ensemble de moteur (3) et d'hélice (4).

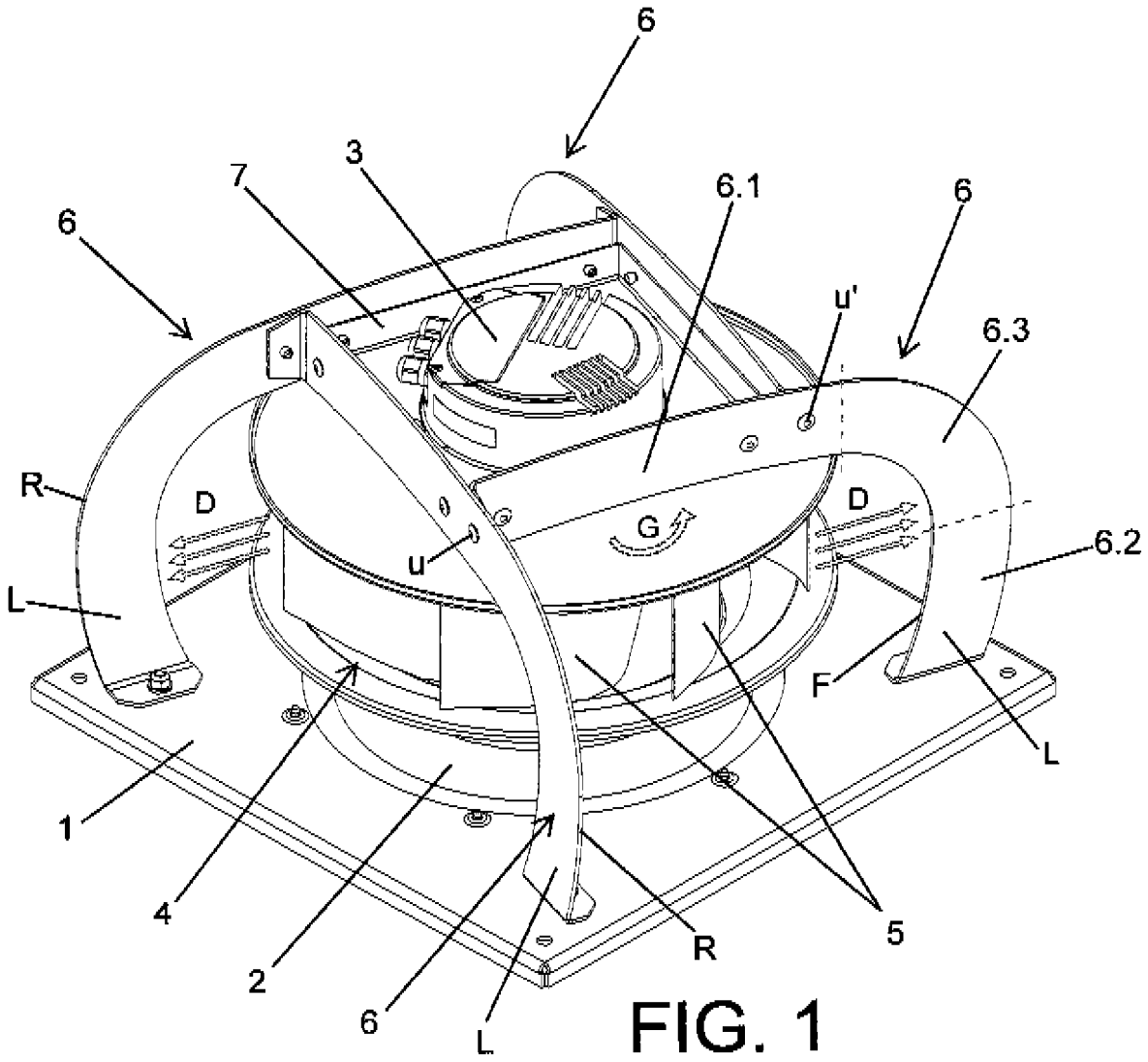

FIG. 1

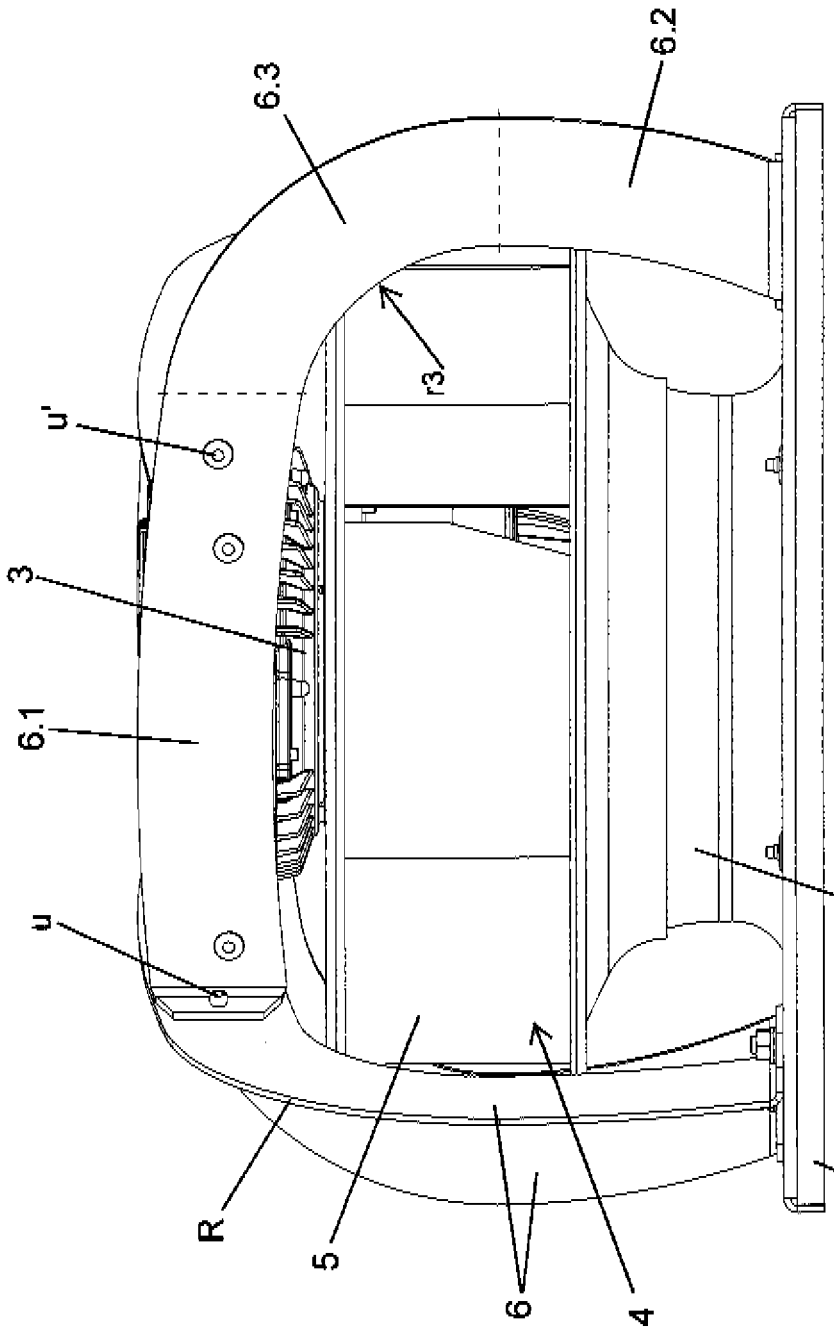

FIG. 2

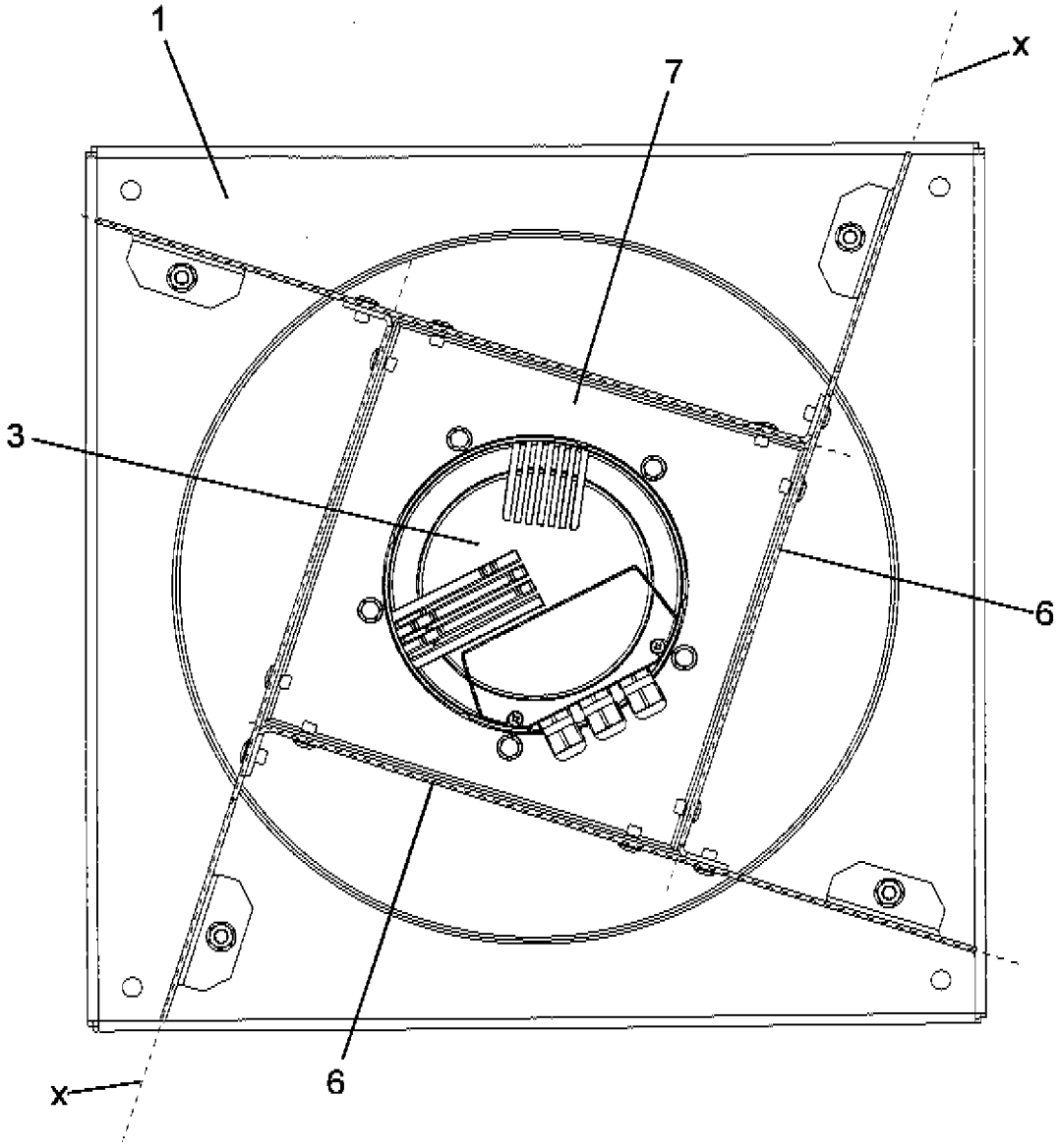

FIG. 3

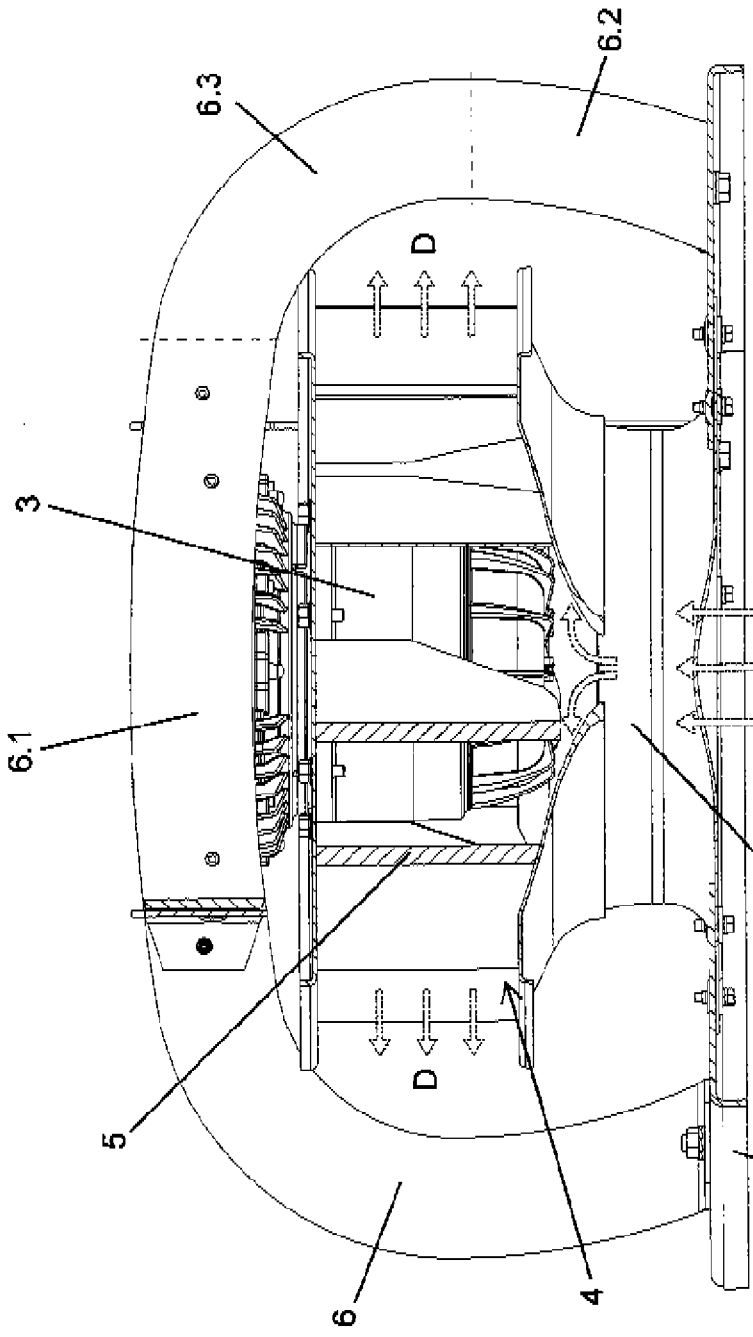

FIG. 4

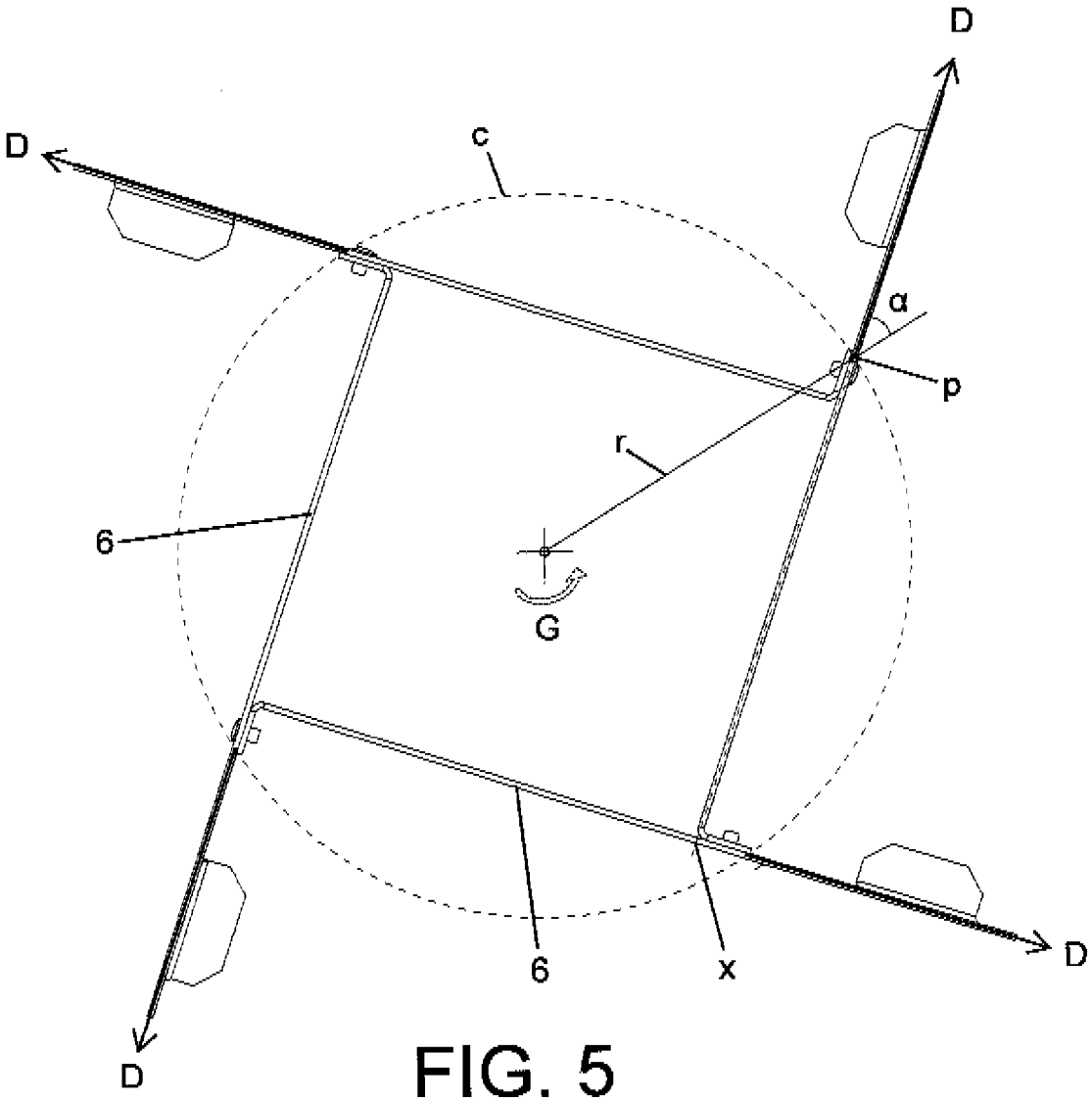

FIG. 5

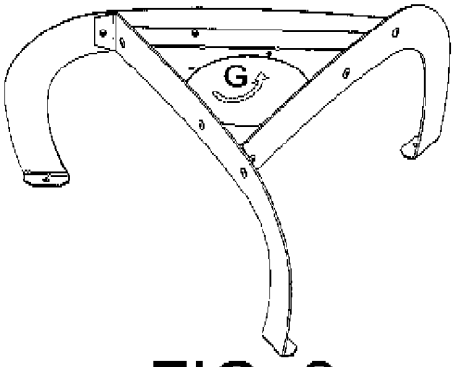

FIG. 6

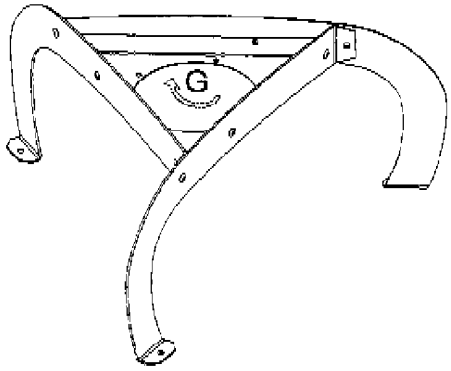

FIG. 9

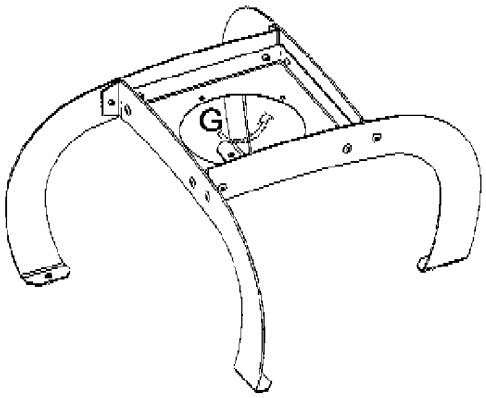

FIG. 7

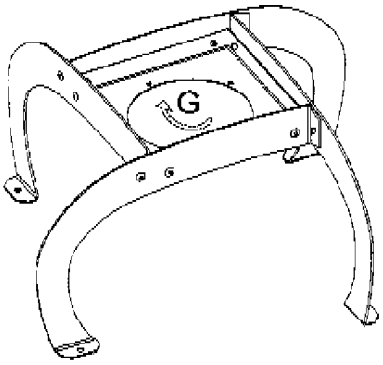

FIG . 10

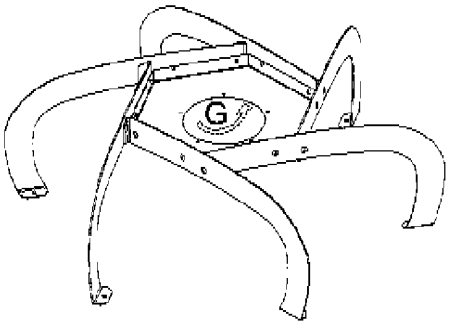

FIG. 8

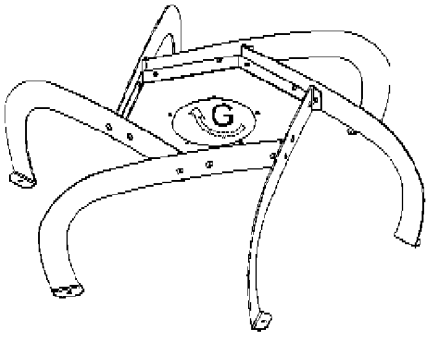

FIG . 11

REFERENCES CITED IN THE DESCRIPTION

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