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(54) **Air-gas mixer device, particularly for premix burner**

(57) An air-gas mixer device, particularly for the premix burner equipment of condensing boilers, comprising flow guide means for guiding an air-gas mixture into the intake section (3a) of a centrifugal fan (2) unit with a predetermined axis of rotation (X), said intake section being coaxial with said axis of rotation, said guide means including a Venturi effect conduit structure (5) with contiguous converging and diverging portions delimiting a constricted section to which the gas flow is fed for mixing with the air flow fed through the converging conduit portion, wherein said guide conduit structure (5) is axially symmetrically developed with a main axis of symmetry coinciding with said axis of rotation (X) and is defined by the rotation about said axis of a flat section with respective contiguous converging and diverging portions (5a, 5b), which is positioned radially and is spaced apart from the axis and on whose plane said axis of rotation (X) lies.

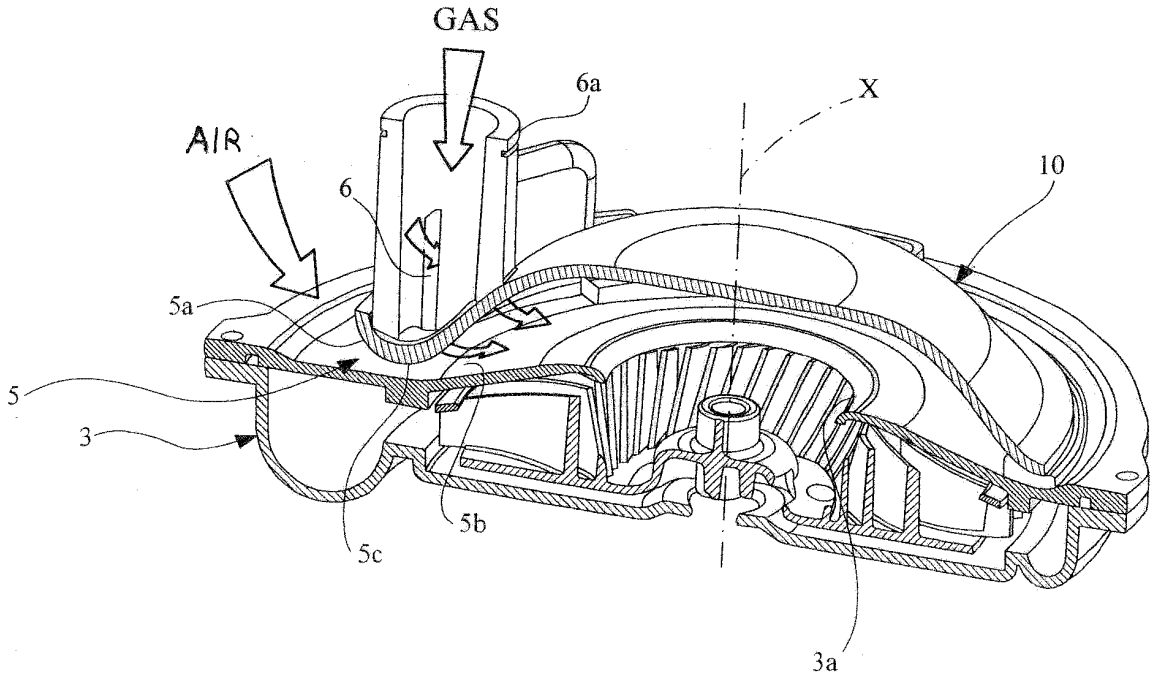

Fig. 1

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Description

AIR-GAS MIXER DEVICE, PARTICULARLY FOR PREMIX BURNER

EQUIPMENT

DESCRIPTION

[0001] The present invention relates to an air-gas mixer device, in particular for premix burner equipment, having the features mentioned in the preamble of the main claim No. 1.

[0002] Devices of the aforesaid type are used particularly in gas burner equipment for premix condensing boilers in which a combustible air-gas mixture is premixed upstream of the combustion head of the burner.

[0003] Typical applications provide for the use of mixers in which conduits are provided having variations of cross section which are suitable creating a pressure drop correlated to the flow rate of air which passes through the conduit in such a way as to generate a signal to the gas supply valve for the correct delivery of the fuel. For example, Venturi effect tubular conduits are known in which the gas is delivered at the constricted section of the conduit according to the pressure drop signal generated by the flow of air. Since it is generally necessary to calibrate the mixer device according to the specific power range of the boiler, provision is made for some parts of the geometry of the device to be exchangeable. For example, the Venturi effect tubular conduit may comprise a fixed outer casing and an inner Venturi conduit exchangeable for another conduit according to the powers required.

[0004] Other applications provide for the air-gas premixing, for example with Venturi conduits of the aforesaid type, to take place upstream of a fan unit intended to deliver, on the delivery side, the premixed air-gas flow to the burner. In the known solutions relating to this latter application, the combustible gas is typically injected in proximity to an axial region of the mixer device, which region is disposed coaxially with the axis of the impeller of a centrifugal fan associated with the premix device.

[0005] The invention lies preferably in this specific field of mixer devices incorporated in fan units, and has as its principal aim that of providing an air-gas mixer device structurally and functionally designed to improve the efficiency and simplify the adjustment thereof according to the power range required of the burner, and at the same time having a greater structural compactness compared with known solutions.

[0006] This and other aims which will become clear hereinafter are achieved by the invention by means of a mixer device produced in accordance with the attached claims.

[0007] Further features and advantages of the invention will become clearer from the following detailed description of a preferred exemplary embodiment thereof, illustrated by way of non-limiting example with reference to the appended drawings, in which:

- Figure 1 is a perspective view in partial section of a mixer device produced according to the invention in combination with a fan of a premix burner apparatus,
- Figure 2 is a side view in partial section of the device of Figure 1,
- Figure 3 is a front view of the device of the preceding Figures,
- Figure 4 is an exploded perspective view of a detail of the device according to the invention,
- Figure 5 is a perspective view of the detail of Figure 4, in the assembled state,
- Figure 6 is a further view in axial section of the device of the preceding Figures.

[0008] With reference to the drawings listed, the reference 1 indicates as a whole an air-gas mixer device, particularly designed for premix gaseous fuel burners, and produced according to the invention.

[0009] In particular, the device is arranged to receive the flows of air and gas admitted into the device, and to mix those flows so as to form a combustible air-gas mixture intended to be fed to the intake section of a centrifugal fan 2, which is itself arranged to deliver the fuel mixture on the delivery side to a combustion head of a gas burner, not shown. The invention preferably finds an application in the premixing of air-gas intended for the burners of condensing boilers.

[0010] According to the preferred configuration, illustrated in the appended drawings, the mixer device 1 and the fan are operatively associated with each other and are also disposed, in succession with each other, in an axial direction X. The axis X additionally forms the axis of rotation of the impeller 2a of the fan 2, which impeller is housed in a manifold 3, for example of the volute type, provided with an axial intake section 3a and a delivery section 3b, which is spaced apart from the axis X, at the outer diameter of the impeller. The intake section 3a is conveniently configured as a circular opening coaxial with the axial direction X.

[0011] The mixer device comprises guide means for the flow introduced into it which are of the centripetal type, that is to say, are designed to guide the flow, admitted in a position spaced apart from the axis X, in the direction of said axis with a substantially centripetal movement, towards the intake section 3a, as will become clear from the following detailed description.

[0012] Said guide means comprise a guide conduit structure indicated as a whole by 5, which has an axially symmetrical configuration, with the main axis of symmetry coinciding with the axis X, wherein said axially symmetrical configuration is defined by the rotation, about the axis X, of a flat section on whose plane the axis X itself lies. This section, illustrated in detail in Figure 2, is radially positioned with respect to the axis X, is spaced apart from said axis and has respective converging and

diverging portions, indicated respectively by 5a, 5b, between which a constricted section 5c is delimited. The direction of flow at the section 5c is therefore substantially radial to the axis X. With this configuration the flat section therefore defines the cross section of the axially symmetrical Venturi effect conduit 5, in which the portion 5a converges with respect to the flow direction (directed from the end furthest from the axis X towards the opposed axial region) and is also prolonged in the intermediate zone of constricted cross section 5c, which is itself prolonged in the diverging portion 5b coming out of the Venturi.

[0013] At the portion of constricted cross section, straddling between the converging and diverging portions of the Venturi, an opening 6 is provided, formed in the guide conduit 5, and through which the gas is injected in the mixing zone of the conduit itself. It is known that the intermediate zone of constricted cross section is that in which the flow of air passing through the Venturi is at the greater speed and the lower pressure, and the pressure drop signal generated serves to control the gas valve in a correlated manner to deliver a suitable gas flow rate in the mixing zone.

[0014] The opening 6 has an arcuate shape along the corresponding circumferential profile of the Venturi conduit, the opening being placed in communication with a tubular formation 6a via which the combustible gas is fed to the mixer.

[0015] The guide conduit 5 is delimited internally by a pair of surfaces 8, 9 axially opposed to each other in a position facing each other and configured in such a way as to define the sequence of the converging, constricted and diverging portions in order to ensure the Venturi effect. Conveniently, one of the two surfaces, that which is designated by 8, is defined by a part of the manifold 3 of the fan, while the opposed surface 9 is defined in a discoid body 10, separate from the volute manifold 3 and coaxially disposed on the manifold itself. Said body 10 is secured to the manifold so as to be rotatable, at least to a limited extent, about the axis X so that relative rotation, about the axis X, is permitted between the surfaces 8, 9 for the functional purpose which will become clear hereinafter.

[0016] Preferably, the axially symmetrical profile of the guide conduit 5 may involve only a portion of the entire circumferential profile, as illustrated in Figure 3, where A indicates the angle in which the Venturi effect section of the conduit 5 extends. A preferred choice provides for the angle A to be between 90° and 180°.

[0017] According to a further feature of the invention, the size of the passage cross section for the flow through the conduit 5, extending along the profile angularly delimited by the angle A, may be selectively reduced in order to adjust the flow rate of air admitted into the fan, consequently modulating the power in a predetermined range of values preselected according to the requirements of thermal power at the burner.

[0018] To this end, means for reducing the passage cross section are provided which comprise a wall 12 with cylindrical profile provided in the body 10, and suitable for co-operating with the profile of the constricted section 5c of the conduit 5 in order to intercept same, as a result of a relative rotational movement between the surfaces 8, 9, as shown in the drawings.

[0019] With particular reference to Figure 3, the reference 13 indicates the attachment region of the conduit which feeds the air from outside to the mixer, having a "segment" configuration extending along part of the circumferential profile of the conduit 5. In the operative position shown in Figure 5 there is no reduction of the flow. One or more relative angular positions may be provided between the surfaces 8, 9, correlated to respective different degrees of reduction, with which the mixer may be configured. For each of the adjustments provided there are further operative means for screw fixing or the like for fixing the manifold 5 and the body 10 to each other in the preselected relative position between the surfaces 8, 9. Figure 4 shows pairs of threaded holes 14, 14' provided in the manifold and co-operating with holes 15 provided in the body 10 for the aforesaid screw connection, once the preselected reduction configuration is identified.

[0020] As an alternative, approximately continuous adjustment of the degree of reduction may be provided, for example selectable between two or more predetermined end positions.

[0021] In operation, provision is therefore made for a predetermined reduction of the inlet section to the conduit 5 to be imposed via simple relative rotation between the body 10 and the manifold 3, which rotation is reflected between the surfaces 8, 9 in such a way that the wall 12 co-operates with the constricted section 5c, intercepting the latter along part of the circumferential profile to the desired level. Once this position is reached, the body 10 is secured to the manifold 3, by means of the aforesaid screw locking, thus predisposing the mixer to the correct predetermined operation.

[0022] For the purpose of structural simplification of the mixer, provision may be made for the upper body 10 to be formed in one piece, arranged to be rotatably secured to the manifold 3 about the axis X.

[0023] The reference 16 further indicates a projection with cylindrical profile rising vertically from the surface portion of the manifold 3 defining the conduit 5, said projection making it possible to increase the performance of the Venturi conduit, since it ensures a greater pressure drop in parity with losses of head. The invention thus achieves the aims proposed, providing the advantages mentioned with respect to the known solutions.

[0024] A principal advantages lies in the functional simplification introduced into the mixer according to the invention, in which, owing to an axially symmetrical configuration of the Venturi effect guide conduit, it is possible to provide for a reduction of the flow obtainable simply by rotating one component with respect to the structure of the manifold, without therefore requiring parts which can be substituted or interchanged according to the dif-

ferent powers required of the burner.

Claims

1. An air-gas mixer device, particularly for the premix burner equipment of condensing boilers, comprising flow guide means for guiding an air-gas mixture into the intake section (3a) of a centrifugal fan unit (2) with a predetermined axis of rotation (X), said intake section being coaxial with said axis of rotation, said guide means including a Venturi effect conduit structure (5) with contiguous converging and diverging portions delimiting a constricted section to which the gas flow is fed for mixing with the air flow fed through the converging conduit portion, **characterized in that** said guide conduit structure (5) is axially developed with a main axis of symmetry coinciding with said axis of rotation (X) and is defined by the rotation about said axis of a flat section with corresponding contiguous converging and diverging portions (5a, 5b), which is positioned radially and is spaced apart from the axis and on whose plane said axis of rotation (X) lies.

2. A device according to Claim 1, in which the size of the passage cross section for the flow through said axially symmetrical guide conduit (5) can be adjusted to reduce the flow which is guided to the fan unit (2).

3. A device according to Claim 2, in which the passage cross section for the flow through said conduit (5) extends over a limited angular portion (A) of the whole circumferential profile defined by the axial symmetry of the conduit, reduction means being provided to reduce selectively said passage cross section for the flow along said portion.

4. A device according to Claim 3, in which said guide conduit (5) is formed by a pair of opposing surfaces (8, 9) which are spaced apart axially in said axial direction, and which are shaped so as to define said passage cross section with contiguous converging and diverging portions, said reduction means being actuated by the rotation of said surfaces (8, 9) relative to each other about said axis (X).

5. A device according to any one of Claims 2 to 4, in which the reduction of the passage cross section for the flow through the conduit (5) can be adjusted in a substantially continuous way between at least one pair of predetermined minimum and maximum sizes of the cross section of the converging portion of the conduit (5).

6. A device according to any one of Claims 2 to 4, in which the reduction of the passage cross section for the flow through the conduit (5) can be adjusted in a discrete way, providing at least two settings corresponding to respective different sizes of the cross section of the converging portion of the conduit.

7. A device according to any one of the preceding claims, in which said surfaces (8, 9) defining the conduit can be fixed together removably in the predetermined operating position corresponding to the desired degree of reduction.

8. A device according to Claim 4, in which one (8) of said surfaces delimiting the guide conduit (5) is defined by a surface portion of a manifold (3) which houses the fan impeller, the other (9) of said surfaces being formed in a body (10) which can be mounted on the manifold (3) and can be rotated relative to the latter.

9. A device according to Claim 8, in which said body (10) which forms the fuel mixture guide conduit (5) in combination with the fan manifold (3) is made in one piece.

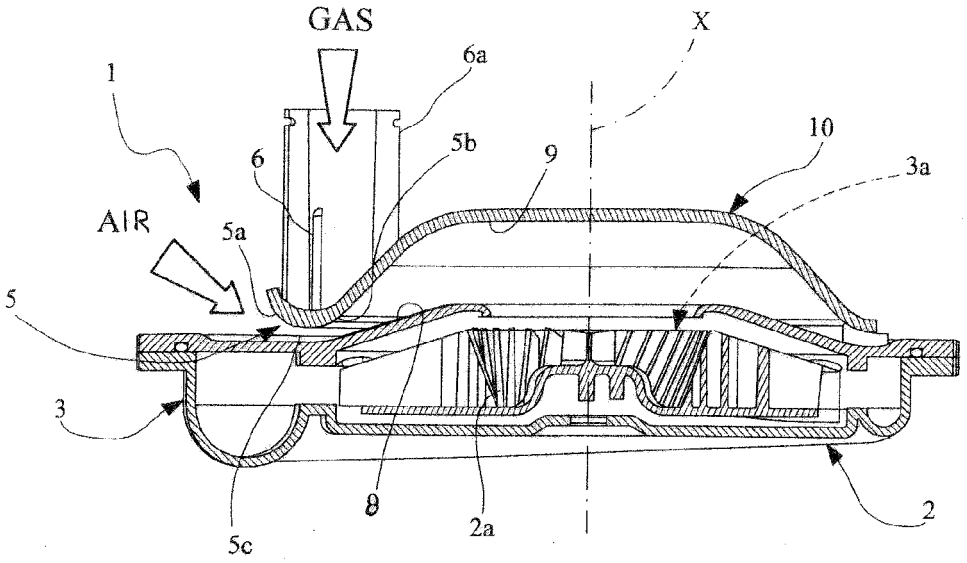


Fig. 2

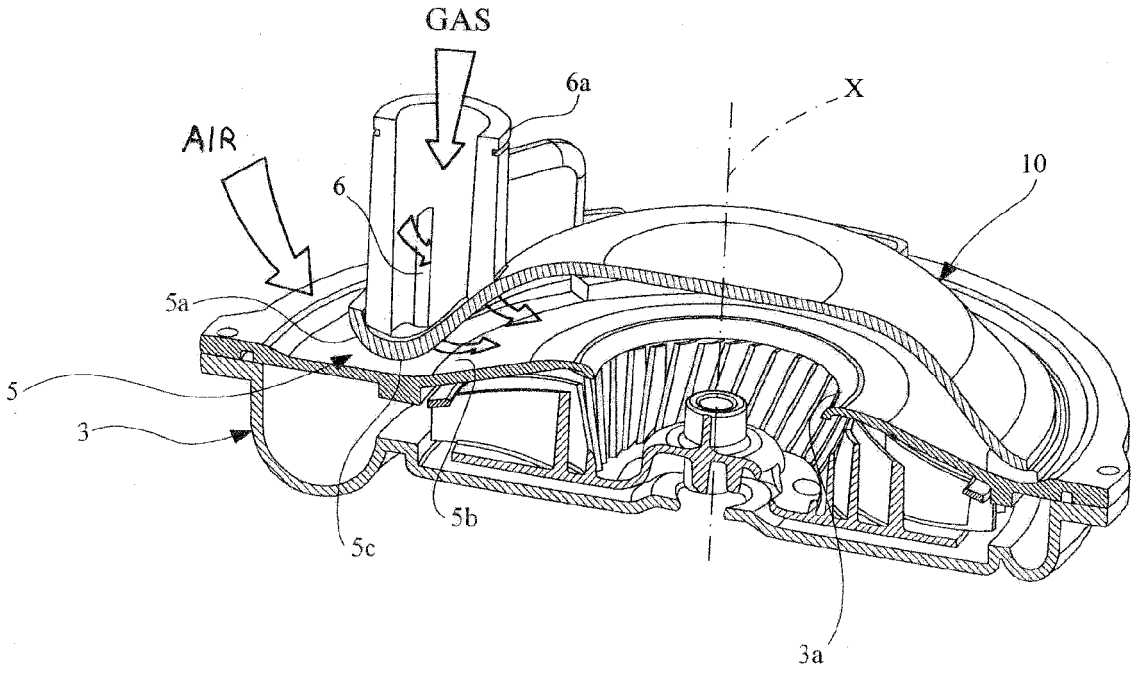


Fig. 1

Fig. 3

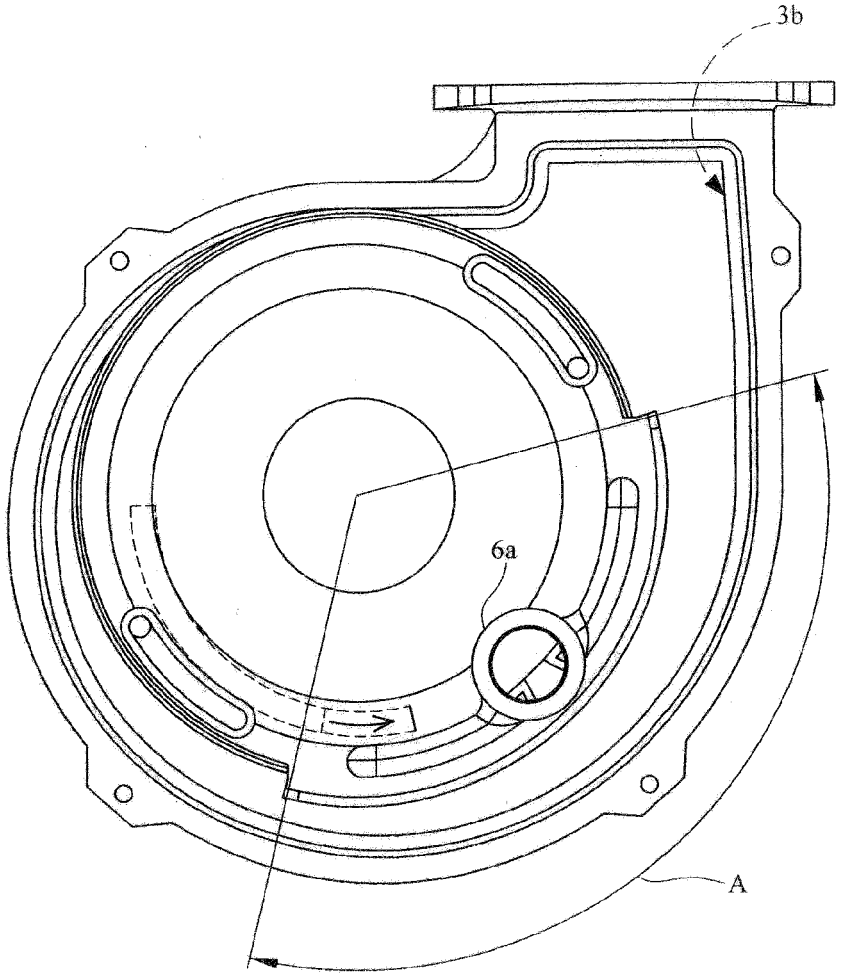
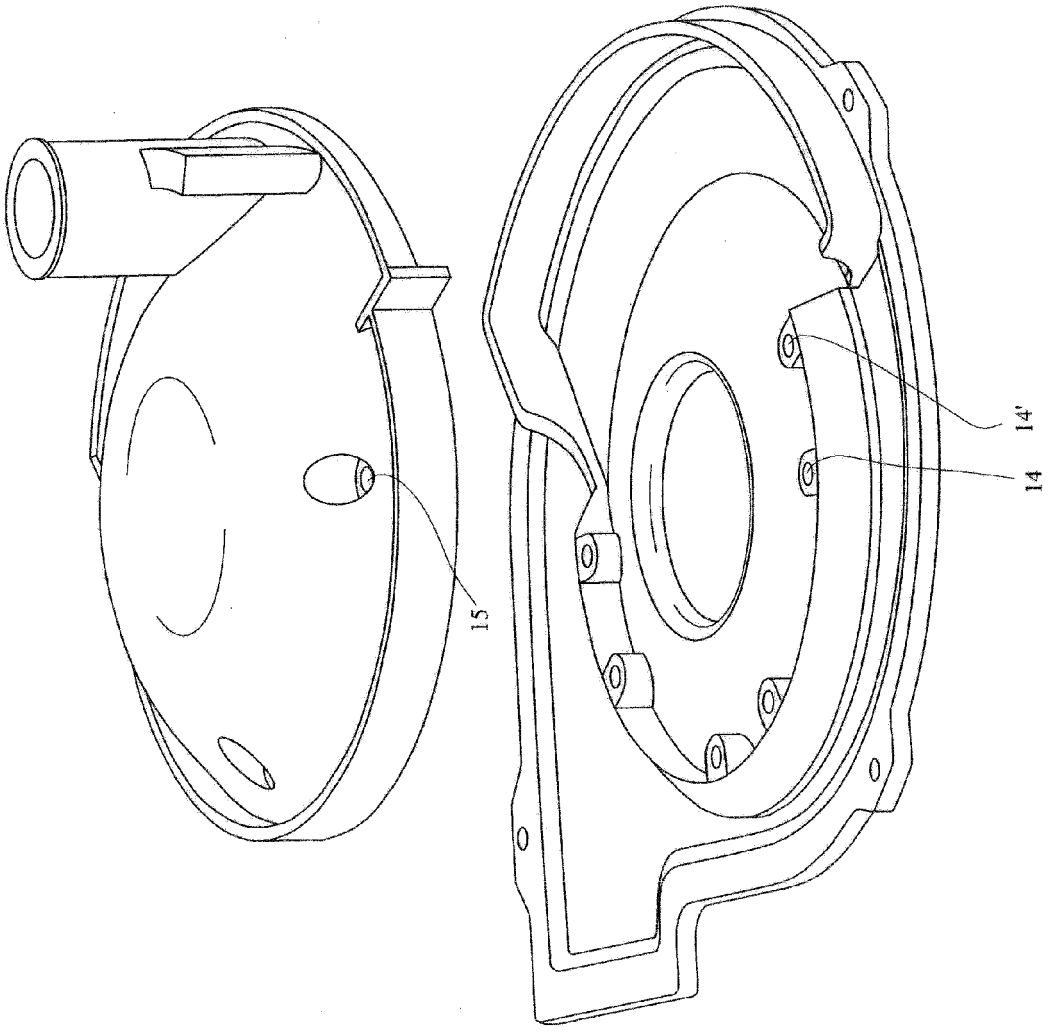


Fig. 4



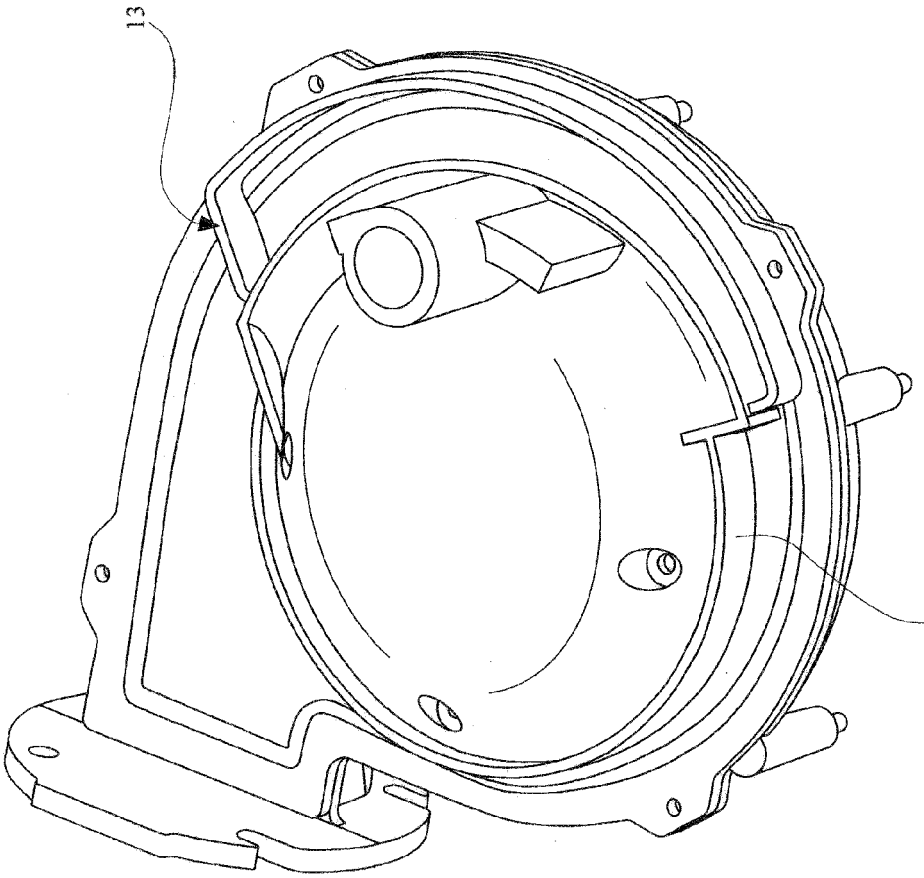


Fig. 5

Fig. 6