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(54) An air-gas mixer device for gas burners with pre-mixing

(57) This is a description of a mixing device for combustible gas burners comprising a fan unit (2) with bladed impeller (3) driven around an axis of rotation (X) and having an axial intake section (5) and a radially opposed delivery section (6), a Venturi tube (11) coaxial with the axis of rotation (X), having a first portion (12) converging into a minimum cross section (13) and a second portion (14) diverging from the minimum cross section (13) and extending the first portion (12), the diverging portion (14) developing as far as the level of the intake section (5), the portions (12, 14) being reciprocally separated at the level of the minimum cross section (13), the first portion (12) having a respective first section at the level of the end profile having dimensions smaller than the corresponding dimensions of a second section associated to the second portion (14) at the level of the minimum cross section (13) of the Venturi.

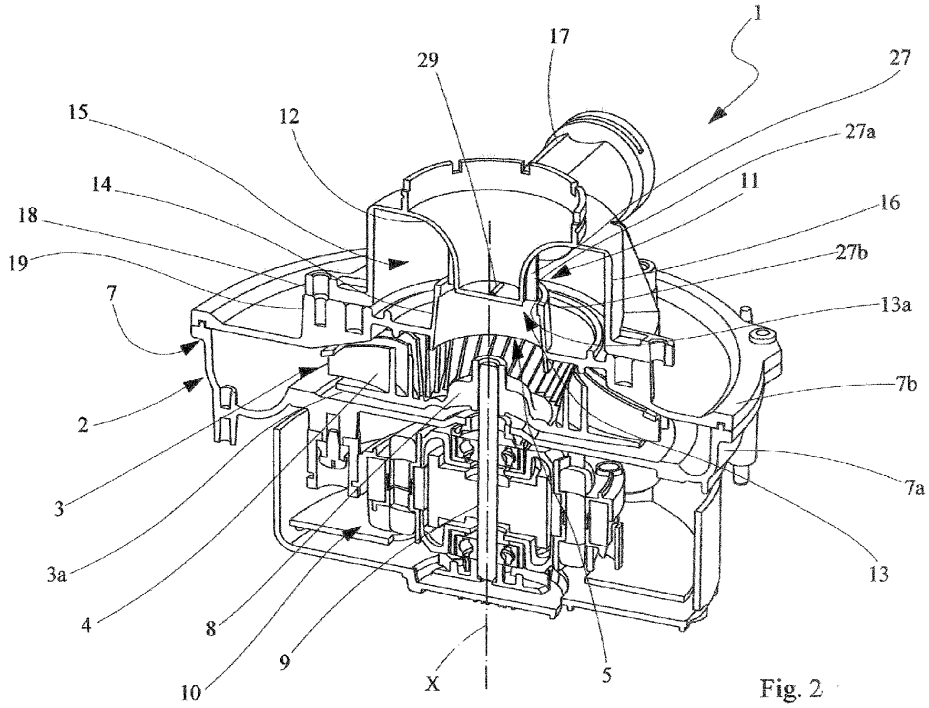

Fig. 2

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Description

[0001] The present invention relates to a mixer device for combustible gas burners having the characteristics as set out in the preamble to main claim no. 1. The invention falls particularly, albeit not exclusively, in the technical field of boilers for domestic use intended for the heating of rooms and/or the heating of domestic hot water.

[0002] In this sector, the combustion process within the boiler takes place between air and combustible gas, and air is drawn into the boiler by a fan. Before entering the fan the intake air flows into a mixer and draws the combustible gas by generating a vacuum. In a first known type, said mixer takes the form of a converging tube and the vacuum is generated in the minimum cross section, the gas being injected into the flow of air through a tube that is coaxial to the converging tube.

[0003] In other known systems, a diverging tube of suitable length, through which a Venturi tube is substantially produced, is inserted downstream of the minimum cross section. The amount of gas drawn by the vacuum is controlled by means of a throttle valve, which maintains the gas to air ratio constant on variation of the number of fan revolutions.

[0004] In this second known type, the gas supply system to the mixer envisages a chamber for channelling the gas, defined in a boxlike casing mounted on the mixer, coaxially extending to the Venturi, externally thereto, provided with a pipe union for attaching to the gas line, and wherein the chamber communicates with the minimum cross section of the Venturi tube for the inlet of the gas into the mixer.

[0005] One of the main problems encountered in the air-gas mixing of the aforesaid devices is linked to the need to maintain the most uniform possible proportionality between the amount of gas and air supplied to the burner, a proportionality that is on the contrary influenced by the fact that the fluids in question (air and gas), having different properties, in particular density and viscosity, tend to change their motion regime in passing from the laminar to turbulent regime that takes place in the mixing phase, exposing the mixed air-gas flow to possible deviation from the aforesaid proportionality characteristics.

[0006] One main aim of the invention is that of making available in the fan unit an integrated mixing device that is structurally and functionally designed to regularise the flows and uniform the speed of the air-gas fluids in the mixing zone.

[0007] Another aim is that of offsetting any flow detachment phenomena at the level of the edge profiles of the tubes for the channelling of air and gas inside the device.

[0008] These and other aims, which will become clear below are achieved by the invention by means of a mixing device produced in accordance with the below claims.

[0009] Further characteristics and advantages of the invention will become clearer from the following detailed description of a preferred embodiment thereof, illustrated by way of a non-limiting example, with reference to the accompanying drawings, wherein:

- figure 1 is a partial, perspective view of a mixing device according to the present invention,
- figure 2 is a perspective view in partial cross section of the device of figure 1,
- figure 3 is a perspective view in partial cross section of a detail of the device of the foregoing figures,
- figure 4 is a perspective view in partial cross section of a further detail of the device of the foregoing figures,
- figure 5 is a further partial perspective view of the device of the foregoing figures,
- figure 6 is a magnified view, in enlarged scale, of a detail of figure 5,
- figure 7 is a perspective view of the device of the foregoing figures with components shown in full assembly,
- figure 8 is an exploded prospective view of the device of the invention in addition to a valve group associated thereto.

[0010] With reference to the aforementioned figures, 1 globally indicates an air-combustible gas mixer device, produced in accordance with the present invention and prepared to be associated to a heating device such as a boiler, not shown.

[0011] A burner, again not shown, is envisaged in the boiler, in a manner that is in itself known, said burner being powered by the combustible air-gas mixture preventively mixed in mixer device 1.

[0012] The device comprises a fan unit 2 with an impeller 3, driven around an axis of rotation X, which is provided with radial blades 4 extending between an axial intake section 5 and a radially opposed delivery section 6. The impeller 3 is housed in a manifold 7, within which sections 5 and 6 are defined.

[0013] Each of the impeller blades 4 is mounted on a base surface 3a of the impeller 3, transversely extending to axis X, and is elongated in a central hub 8 for connection with the rotation shaft 9 driven by an electric motor, globally indicated by 10, and conveniently of the brushless type.

[0014] The manifold 7 of the impeller is made in two parts which can be tightened to each other, one of which, indicated by 7a, is shaped like a spiral volute, while the other part, indicated by 7b, is designed for the closure of the spiral volute and presents a discoid shape that interests the front portion of the fan in which the intake section 5 of the fan is obtained.

[0015] Upstream of the intake section 5 of the fan, from which the air from the fan is drawn and directed to the burner, the mixing device comprises a Venturi tube 11, coaxially arranged with the axis X and comprising a first portion 12 converging into a minimum section 13 and a diverging portion 14, stretching from section 13, extending the portion 12 and terminating at the level of intake

section 5.

[0016] The two portions of tube 12, 14 are structurally independent of each other and also present end profiles of the respective circular end sections, facing each other, having different diameters, the diameter of the circular end profile of the converging portion 12 being less than the diameter of the corresponding circular end profile of the diverging portion 14, contiguous thereto at the level of the minimum cross section of the tube 11. Between the aforementioned profiles, a passage 13a having an annular section that is concentric to axis X is identified, through which the flow of gas is channelled into the mixing tube 11. More in particular, the gas, supplied by a suitable gas line and for example delivered by a suitable throttle valve, is channelled into a gas supply chamber 15 annularly extending outside the tube 11, coaxially thereto. In greater detail, the chamber 15 is substantially defined by the annular space extending to externally surround the tube 11, a space which is radially comprised between the tube itself and an opposing lateral wall 16 having a cylindrical profile, a radial pipe union 17 for the supply of gas to chamber 15 being envisaged in wall 16.

[0017] The wall 16 is connected at one of its axial ends to the converging tubular portion 12, while it is extended at its opposite end in a counter-flange 18 arranged for a reciprocal tightening with a flange 19 provided in part 7b of manifold 7.

[0018] As well as being structurally independent of portion 12, the diverging portion 14 of tube 11 is integral with part 7b of manifold 7 of the fan, in the area affected by flange 19. In addition, the converging portion 12 is, on the other hand, obtained integral with the counter-flange 18. More in particular, the counter-flange 18, the wall 16 with the pipe union 17, and the converging portion 12 of the pipe 11 are obtained in one piece with each other to produce a box-like body, which when tightened onto the fan, by means of the reciprocal tightening of flange 19 and counter-flange 18, defines, together with portion 7b of the manifold, the chamber 15 for the supply of gas into the mixer.

[0019] For the tightening of the aforesaid flanges a plurality of tightening holes are envisaged (for example, threaded blind holes 25a envisaged in the flange 19 and through holes 25b envisaged in the counter-flange 18), for the engagement of the respective tightening screws 26, which are circumferentially arranged at a regular angular interval in a predetermined number, and at corresponding positions on both the flange and counter-flange Thanks to the plurality of aforesaid tightening holes, the counter-flange 18 can be tightened with a chosen angular positioning relative to the flange 19, so that the box-like gas supply body can take one of a series of positions that are angularly distinct from each other, to change the relative orientation of the pipe union 17 with respect to the manifold 7 of the fan. A plurality of possible relative positionings are thus available between the pipe union and the delivery section of the manifold, which facilitates the mounting of the device on the basis of the plant engineering constraints and dimensions for each application. The figures represent six fastening holes (25a, 25b) for each flange, said decision however representing a preferred, but non-limiting, configuration.

[0020] Returning to the tube 11, in order to regularise the flow of gas in the air inlet zone in the flow of air at the level of the passage 13a, the mixer device is provided with a plurality of finned appendages 27 having axial development, which are elongated in parallel to the direction of the X axis and are circumferentially arranged in proximity to the outer surface of the converging portion 12 of tube, to extend at the level of the annular passage 13a for the channelling of the gas into the minimum cross section of the tube 11. Such axial finning is thus suitable for guiding the flow of gas channelled into the Venturi tube and substantially uniforming the motion regime thereof with the motion regime of the flow of air axially fed through the first converging section of the Venturi tube, so as to maintain independent of the flow rates the proportion of the air-gas so as to keep the proportion of air-gas of the mixture independent from the flows.

[0021] The appendages 27 are preferably shaped like plate-like fins obtained integral with the converging portion 12 of the Venturi tube external thereto. The fins 27 are conveniently radially arranged with respect to the axis of rotation X from the outer surface of the converging portion 12, presenting flat, opposing faces and are arranged at regular angular intervals. Tests carried out by the Applicant have shown that a plurality of at least six fins 27 is sufficient for obtaining effective results in the regularisation of the flow of gas at the level of the mixing zone. A plurality with a number of fins equal to or greater than eight in any case represents a preferred, albeit non-limiting, choice.

[0022] The radial extension of the finned appendages 27 is comprised in the radial space delimited by the end profiles of the first (12) and second (14) portion of the tube 11, at the level of the minimum cross section thereof.

[0023] A preferred shape of the fin also envisages that said fin has a edge 27a having a rectilinear profile, on the part opposite the leading edge with the converging tubular portion 12, said edge 27a extending in parallel to said axial direction and being connected at its ends with a pair of opposing lateral edges 27b, perpendicular thereto and having a radial extension in respect of axis X.

[0024] The device is also provided with a second plurality of finned appendages 29, located inside the converging portion 12 of the tube 11, at the level of the end profile section of said converging portion. Conveniently, the fins 29 of said second plurality are obtained integral with the first converging portion 12 of the tube 11 and exert the principal function of contrasting the detachment of the flow of air at the level of the end edge thus uniforming the motion regime of the flow of air in proximity of the mixing zone, thus also preventing noise generation.

[0025] With reference to figure 6, a preferred, albeit non-limiting, choice envisages four finned appendages

29 arranged at regular intervals (90° from each other so as to result aligned in pairs along the two diametric lines of the orthogonal section between the two) in the transverse end section of the converging portion 12 of tube, at the level of the minimum cross section 13 thereof.

[0026] 30 indicates a support plate for a valve unit, only schematically represented and marked by 31, adapted to supply the flow of gas to the chamber 15 of the mixer. The support plate 30 is susceptible to interposition between the flange 19 and the counter-flange 18 to be affixed to the mixing device following the aforesaid tightening. 30a indicates an attachment appendage extending at a right angle from the plate 30 and having a through hole 30b for the housing of an attachment 31a envisaged on the valve 31, for the affixing thereof with a tightening nut indicated by 32 and only schematically illustrated in the drawings.

[0027] 35 also indicates a manifold body of the air part intended for affixing onto the box-like body of the gas part, suitable for channelling the flow of air entering through an inlet 35a in the converging portion of the tube 11. A plurality of possible positions, with variable orientation in respect of the fan, are also envisaged for the manifold 35, so as to facilitate the installations operations for the device.

[0028] The invention thus achieves the proposed aims while achieving the stated advantages on known solutions.

Claims

1. Mixer device for combustible gas burners, comprising:

   - a fan unit (2) with bladed impeller (3) driven around an axis of rotation (X) and having an axial intake section (5) and a radially opposed delivery section (6),
   - a Venturi tube (11), coaxial with said axis of rotation (X), having a first portion (12) converging into a minimum cross section (13) and a second portion (14) diverging from said minimum cross section (13) and extending the first portion (12), the diverging portion (14) developing as far as the level of the intake section (5),

   said portions (12, 14) being reciprocally separated at the level of said minimum cross section (13), the first portion (12) having a respective first section at the level of the end profile having smaller dimensions than the corresponding dimensions of a second section associated to the second portion (14) at the level of the minimum cross section (13) of the Venturi, so as to define an annular passage (13a) between the adjacent end profiles of the first and second portion to supply a flow of channelled gas into a supply chamber (15) annularly extending outside the Venturi (11) and coaxial thereto,

   characterized in that it comprises a plurality of axial appendages (27), elongated in parallel to the direction of the axis of rotation (X) and circumferentially arranged in proximity of the outer surface of the first converging portion (12) of said tube to extend at the level of the annular passage (13a) for the channelling of the gas into the minimum cross section (13) of the Venturi tube, in order to axially guide the flow of gas channelled into the Venturi tube (11) and substantially uniform the motion regime thereof with the motion regime of the flow of air axially fed through the first converging portion (12) of the Venturi tube.

2. Device according to claim 1, wherein said appendages (27) are shaped like plate-like fins obtained integral with the first converging portion (12) of the Venturi tube external thereto.

3. Device according to claim 2, wherein said finned appendages (27) are radially arranged with respect to said axis of rotation (X) from the outer surface of the converging portion (12) of said tube and present flat opposing faces.

4. Device according to claim 2 or 3, wherein at least six finned appendages (27), arranged at a regular angular interval, are envisaged.

5. Device according to one of the preceding claims, wherein the radial extension of said appendages (27) is comprised in the radial space delimited by the end profiles of the first (12) and second portion (14) of the Venturi (11) in the minimum cross section (13) thereof.

6. Device according to one of the preceding claims, comprising a second plurality of finned appendages (29) located inside the converging portion (12) of said tube (11), at the level of the end profile section of said converging portion (12)of tube.

7. Device according to claim 6, wherein the finned appendages (29) of said second plurality are obtained integral with the first converging portion (12) of said tube (11).

8. Device according to claim 6 or 7, wherein at least four finned appendages (29), arranged at regular angular intervals in the end transverse section of the converging portion (12) of the Venturi, are envisaged at the level of the minimum cross section (13) of said Venturi tube (11).

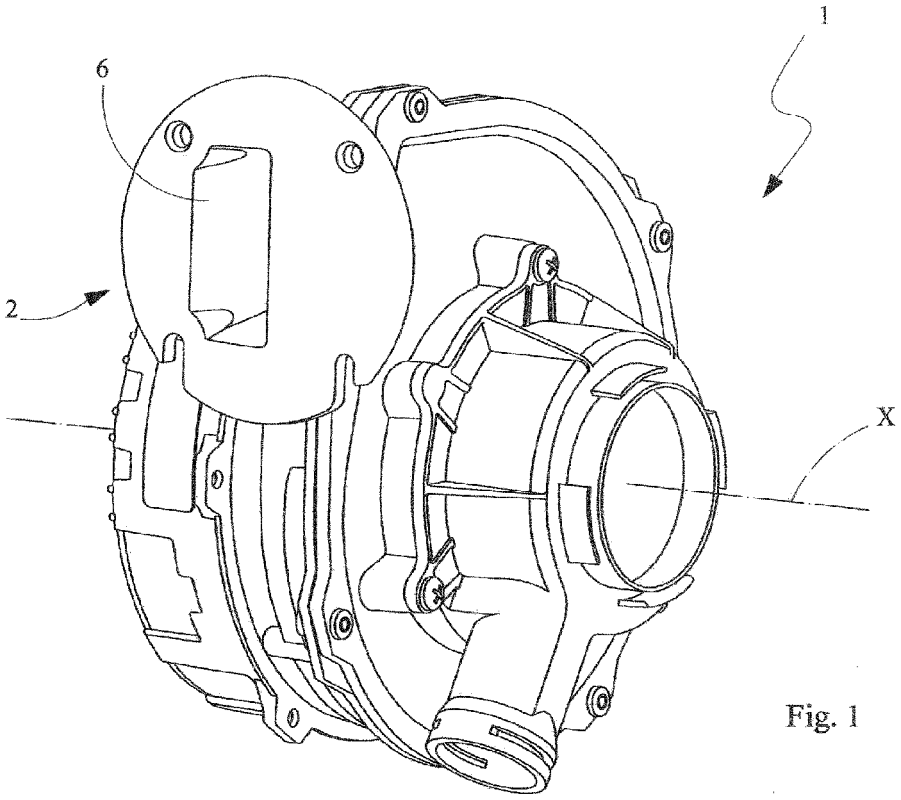
1
6
2
X

Fig. 1

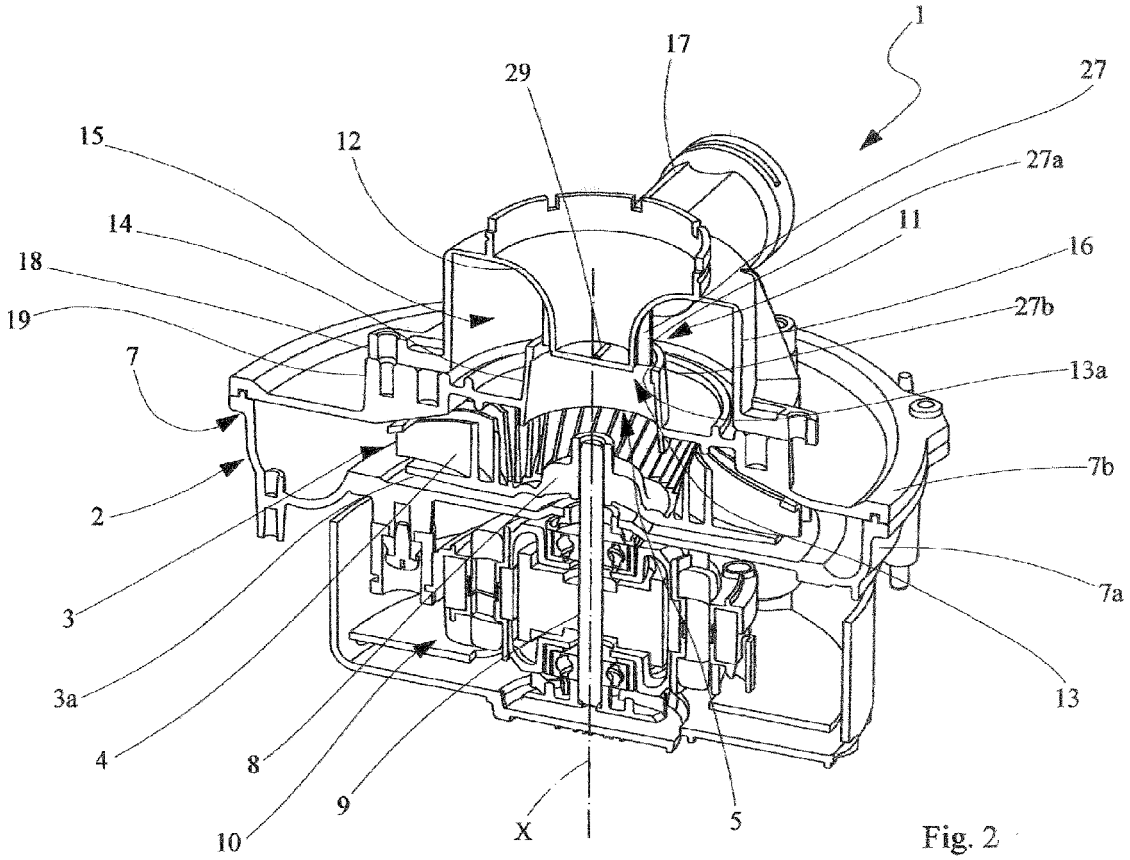
1
17
29
27
15
12
27a
14
11
16
18
27b
19
13a
7
7b
2
7a
3
13
3a
4
8
9
10
X
5

Fig. 2

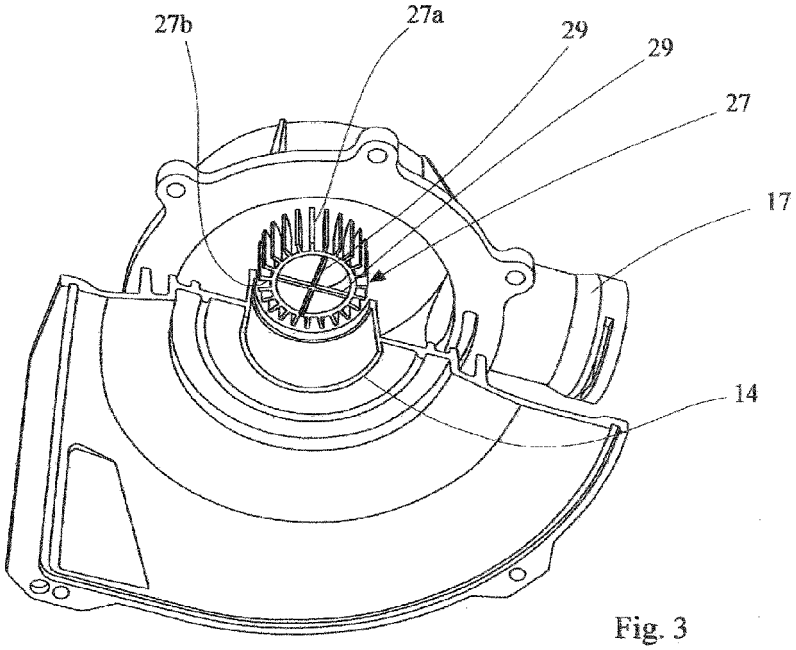

Fig. 3

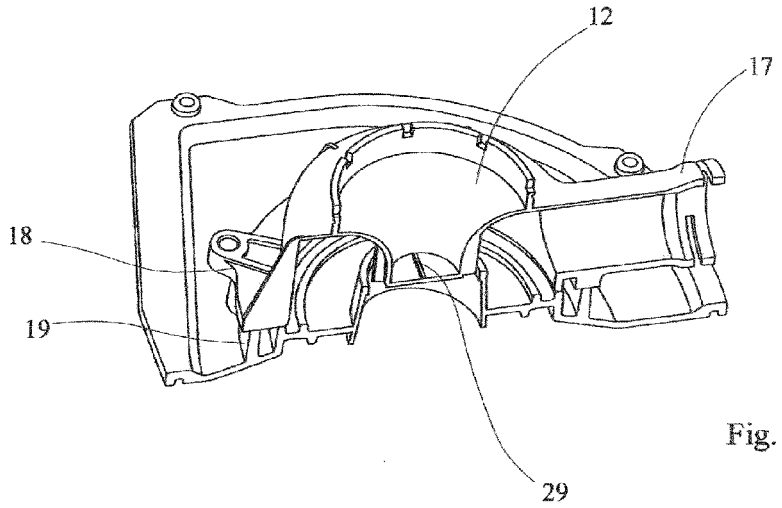

Fig. 4

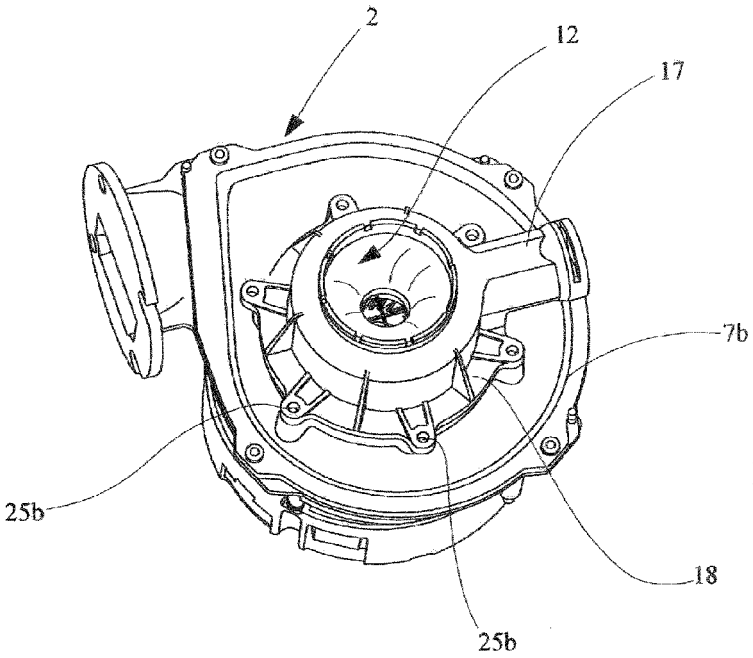

Fig. 5

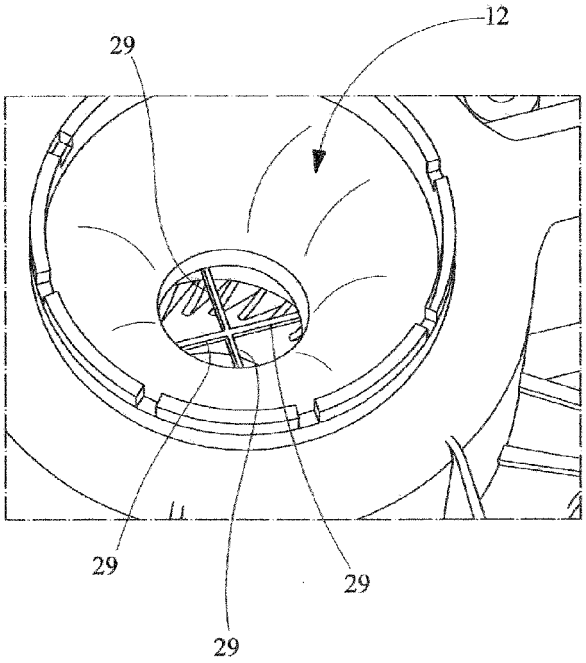

Fig. 6

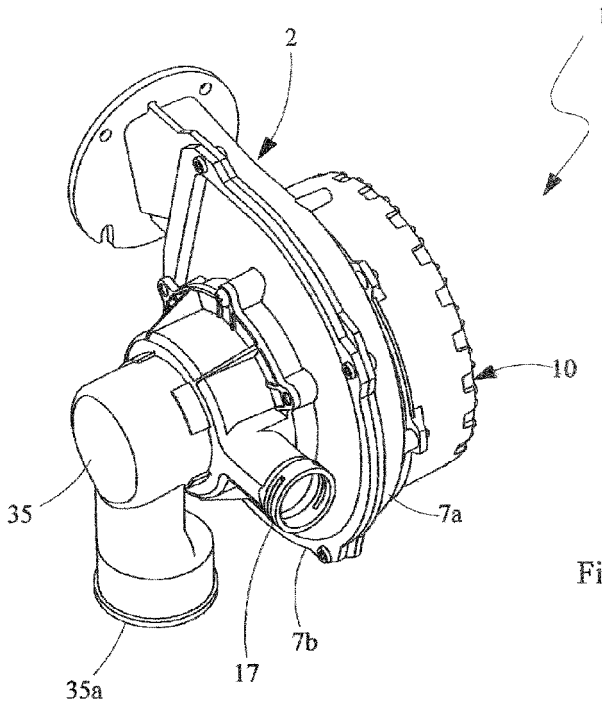

Fig. 7

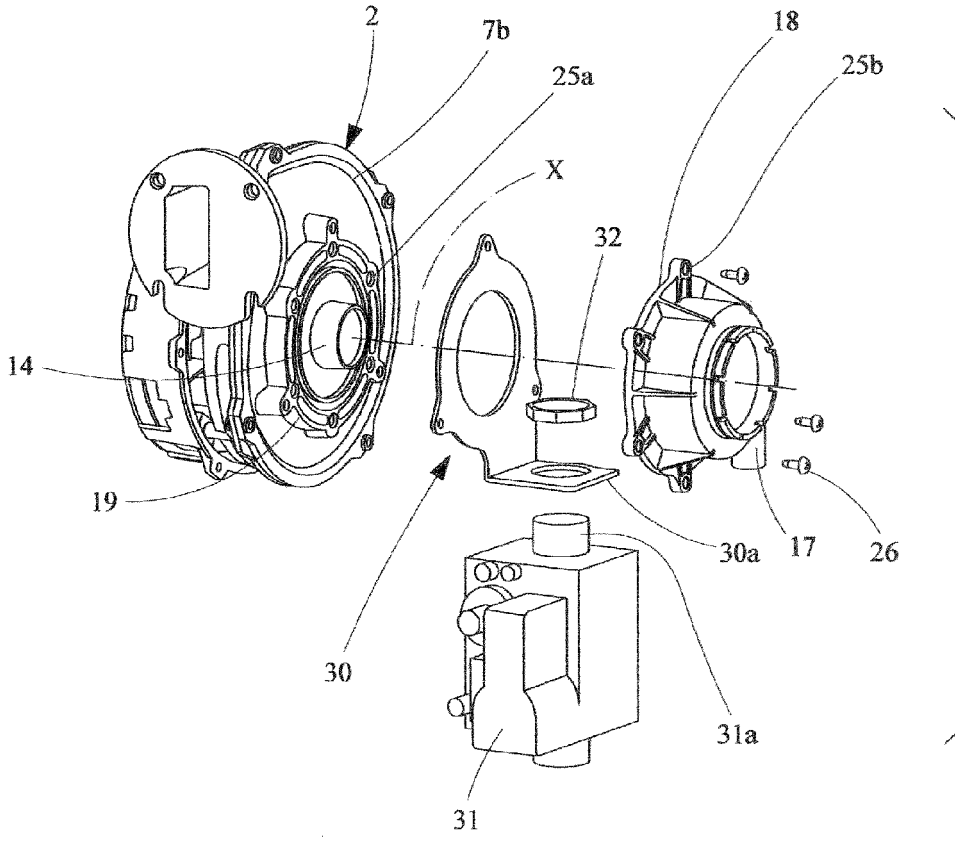

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 12 19 3782

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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
The Hague	8 February 2013	Harder, Sebastian

CATEGORY OF CITED DOCUMENTS

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