(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 597 369 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
29.05.2013 Bulletin 2013/22

(51) Int Cl.:
F23D 14/64 *(2006.01)* ***F23L 5/02*** *(2006.01)*
F23D 14/46 *(2006.01)*

(21) Application number: **12193596.9**

(22) Date of filing: **21.11.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **24.11.2011 IT PD20110372**

(71) Applicant: **LN 2 S.R.L. a socio unico**
62010 Montecassiano (MC) (IT)

(72) Inventors:
- **Tanoni, Francesco**
  62100 Macerata (IT)
- **Ranalli, Antonio**
  62010 Montefano (MC) (IT)

(74) Representative: **Fabris, Stefano et al**
Cantaluppi & Partners S.r.l.
Piazzetta Cappellato Pedrocchi, 18
35122 Padova (IT)

(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 porting (14) terminating at the level of the intake section (5), a chamber (15) for the supply of the flow of gas to the device being defined coaxially to the Venturi tube (11), externally thereto and in fluid communication with the minimum cross section (13) of the Venturi, so that the flow of air fed along the first portion (12) of the Venturi tube is mixed with the flow of gas fed through the chamber (15) to the minimum cross section (13) of the Venturi.

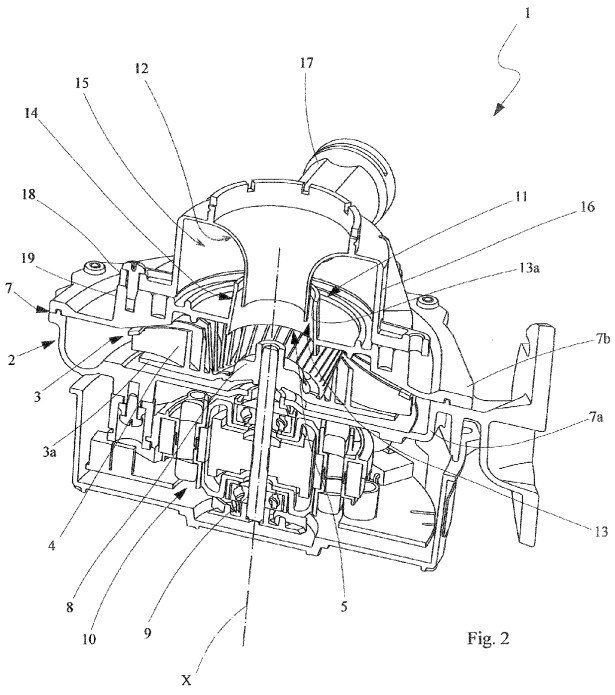

Fig. 2

EP 2 597 369 A1

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 fan speed (number of revolutions per minute).

[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 tube, externally thereto, provided with a pipe union attached 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 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 simplify the components necessary for integration of the devices, thus facilitating the assembly thereof while at the same time ensuring, for plant engineering requirements, a variability of possible positionings and/or orientations between the gas connection and the mixer, in order to facilitate the installation of the device on the basis of the plant engineering constraints and dimensions normally existing in the installation of said devices.

[0006] These and other aims are achieved by the invention by means of an air-gas mixing device produced in accordance with the accompanying claims.

[0007] 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 mixer device produced according to the invention,
- figure 2 is a perspective view in partial cross section of the device of figure 1,
- figure 2A is a view corresponding to the view of figure 2 in a variant embodiment of the device,
- figure 3 is a perspective view of the device of the foregoing figures,
- figure 4 is an exploded perspective view of the device of the foregoing figures,
- figures 5 and 6 are schematic views with illustrated possible relative positionings between the components of the device according to the invention,
- figure 7 is an exploded perspective view of further details of the device,
- figure 8 is a perspective view with the components of figure 7 illustrated in assembled form,
- figure 9 is a perspective view of the device in a variant embodiment of a detail of the device itself,
- figure 10 is a partial perspective view in cross section of the device of figure 9.

[0008] 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.

[0009] 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.

[0010] 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.

[0011] Each of the impeller blades 4 is mounted on a base surface 3a of the impeller 3, transversely extending to axis X, and is extended into 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.

[0012] 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.

[0013] 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 tubular Venturi tube 11, coaxially arranged with axis X and comprising a first portion 12 converging into a minimum cross section zone 13 and a diverging portion 14, stretching from the zone of section 13, extending the portion 12 and terminating at the level of intake section 5.

[0014] 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 smaller

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, an annular passage 13a 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.

[0015] The wall 16 is connected at one of its ends axial to the converging tubular portion 12, while it is lengthened 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.

[0016] According to a main characteristic of the invention, 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. Such a boxlike body can be conveniently made of plastic material.

[0017] 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 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, as represented in figure 5 (the dotted line indicates the possible positionings), 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.

[0018] 30 also 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.

[0019] 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, so as to facilitate the installations operations for the device, as illustrated in figure 6 (the dotted line represents possible positionings of the collector 35).

[0020] Figures 9 and 10 illustrate a variant embodiment of the manifold 35 of the air part, said manifold incorporating a silencer to reduce noise. In this variant, the tubular silencer is produced in two half shells 36a, 36b assembled together with respective coupling elements, all indicated by 37. To ensure the correct joining of the silencer onto the boxlike body of the gas part in the silencer inlet zone, a series of projections 38, circumferentially arranged at regular intervals, are envisaged externally to an inlet collar 39 projecting from the boxlike body on the gas side, the projections and the collar being integrated into said body and jointly defining a seat for housing and retaining a circular end profile 40 of the silencer. One preferred embodiment envisages four projections 38 placed at 90° from one other, through which the correct junction of the coupling parts is ensured.

[0021] Returning to the tube 11, in order to regularise the flow of gas in the inlet zone of the flow of air at the level of the passage 13a, the mixer device is provided, in a variant embodiment illustrated in figure 2A, 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.

[0022] 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, embodiment. The radial extension of the finned appendices 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.

[0025] A preferred, albeit non-limiting, embodiment envisages four finned appendages 29 arranged at regular angular intervals (90° from each other) in the transverse end section of the converging portion 12 of the tube, at the level of the minimum cross section 13 thereof.

[0026] 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) having a 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) terminating at the level of the intake section (5),
   - a chamber (15) for supplying the flow of gas to the device being coaxially defined at the Venturi tube (11), external thereto and in fluid communication with the minimum cross section (13) of the Venturi, so that the flow of air fed along the first portion (12) of the Venturi tube (11) is mixed with the flow of gas fed through said chamber (15) to the minimum cross section (13) of the Venturi tube, to direct the mixed air and gas flow through the diverging portion (14) of the Venturi tube as far as the intake section (5) of the fan (2), **characterized in that** the first (12) and second portion (14) of the Venturi tube (11) are structurally independent of each other, and **in that** said second diverging portion (14) is obtained integral with a front flange (19) of the fan in which the intake section (5) is defined and said first converging portion (12) is obtained integral with a counter-flange (18) susceptible to affixing to said flange (19), by means of the sealed connection between said flange (19) and counter-flange (18) the chamber (15) for supplying gas to the mixer remaining defined.

2. Device according to claim 1, wherein said counter-flange (18) can be tightened with a chosen angular position relating to the flange (19), so that said chamber (15) can take one of a series of positions that are angularly distinct from each other, on the basis of the number of tightening holes (25a, 25b) at regular angular intervals envisaged in the flange (19) and in the counter-flange (18) for corresponding tightening screws (26).

3. Device according to one of the preceding claims, wherein said chamber (15) is substantially defined by the annular space extending outside the Venturi tube (11), radially comprised between the Venturi tube and an opposing lateral wall (16) having a cylindrical profile, a radial pipe union (17) being provided in said wall (16) for the supply of gas to the chamber (15), said wall (16) being respectively connected, at the opposing axial ends, to the converging portion (12) of the Venturi tube (11) and to the counter-flange (18).

4. Device according to claim 3, wherein said converging portion (12), said lateral wall (16), said counter-flange (18) and said pipe union (17) are obtained in one piece with each other.

5. Device according to one of the preceding claims, wherein the flow of gas is channelled into the Venturi tube (11) through an annular passage (13a) defined between the end profiles of the first (12) and second portion (14) of the Venturi tube located at the level of the minimum cross section (13) of said Venturi tube.

6. Device according to claim 3, wherein the diameter of the circular end profile of the first converging por-

tion (12) is smaller than the diameter of the circular end profile of the second diverging portion (14) and adjacent to the first portion, at the level of the minimum cross section (13).

7. Device according to one of the preceding claims, wherein a support plate (30) is envisaged for a valve unit (31) to supply the flow of gas to the mixer, said plate (30) being susceptible of interposition between the flange (19) and the counter-flange (18) so that it can be affixed to the mixer following the reciprocal tightening of the flange and counter-flange.

8. Device according to claim 4, wherein said converging portion (12), said lateral wall (16), said counter-flange (18) and said pipe union (17) are obtained in one piece in a boxlike body defining at least part of said gas supply chamber (15), the boxlike body being susceptible to connecting to a tubular silencer adapted to channel the flow of air into said converging portion (12), joining means being envisaged between the boxlike body and the silencer, said joining means comprising a plurality of projections (38) arranged on the boxlike body and circumferentially positioned at intervals in a concentric configuration with a collar (39) of the boxlike body for the fitting of an end profile (40) of the silencer conduit, said projections (38) being positioned outside the collar (39) so as to define a respective plurality of seats for housing and retaining said profile in the joint of the silencer and the boxlike body.

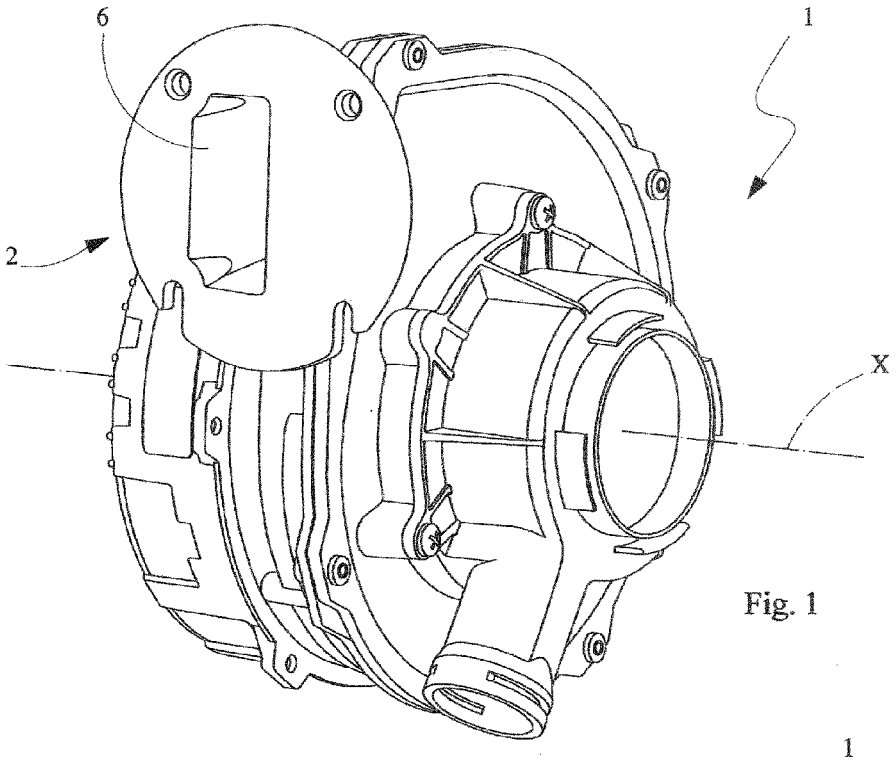

Fig. 1

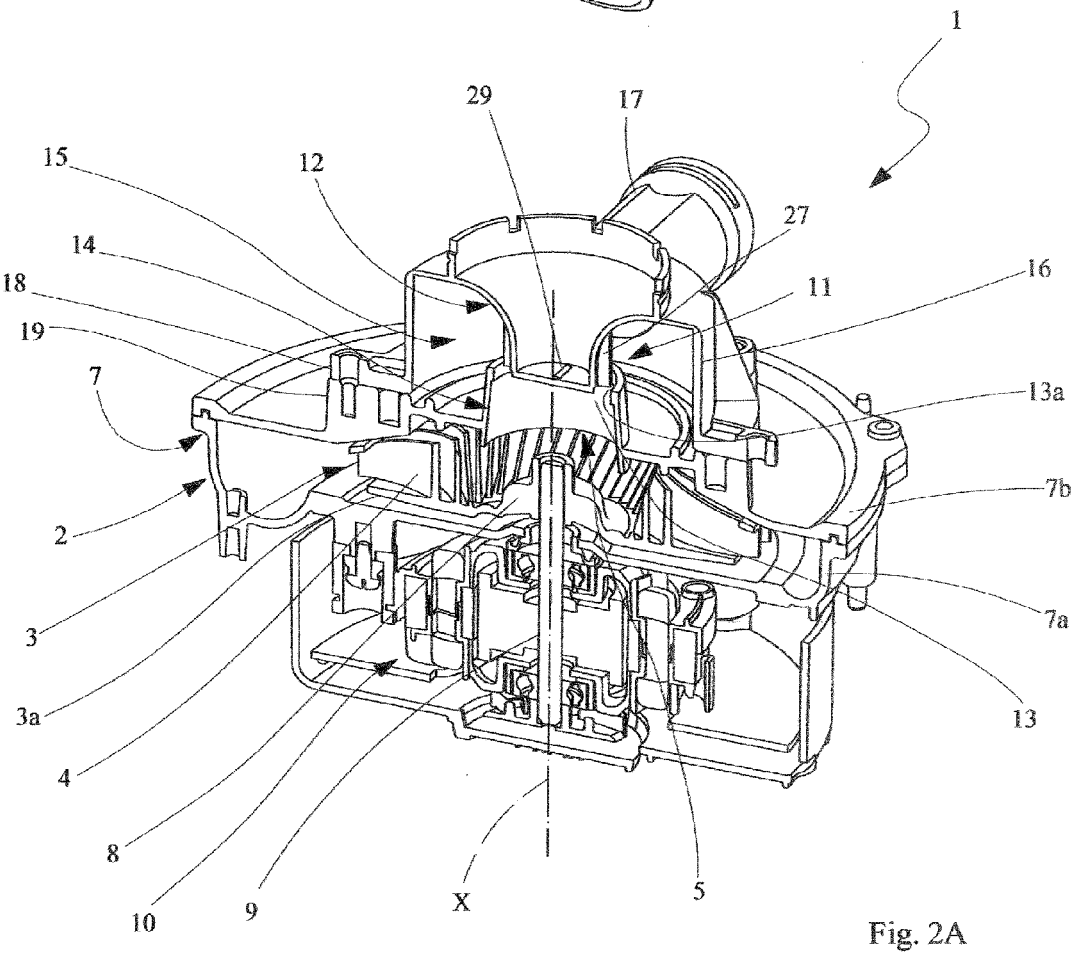

Fig. 2A

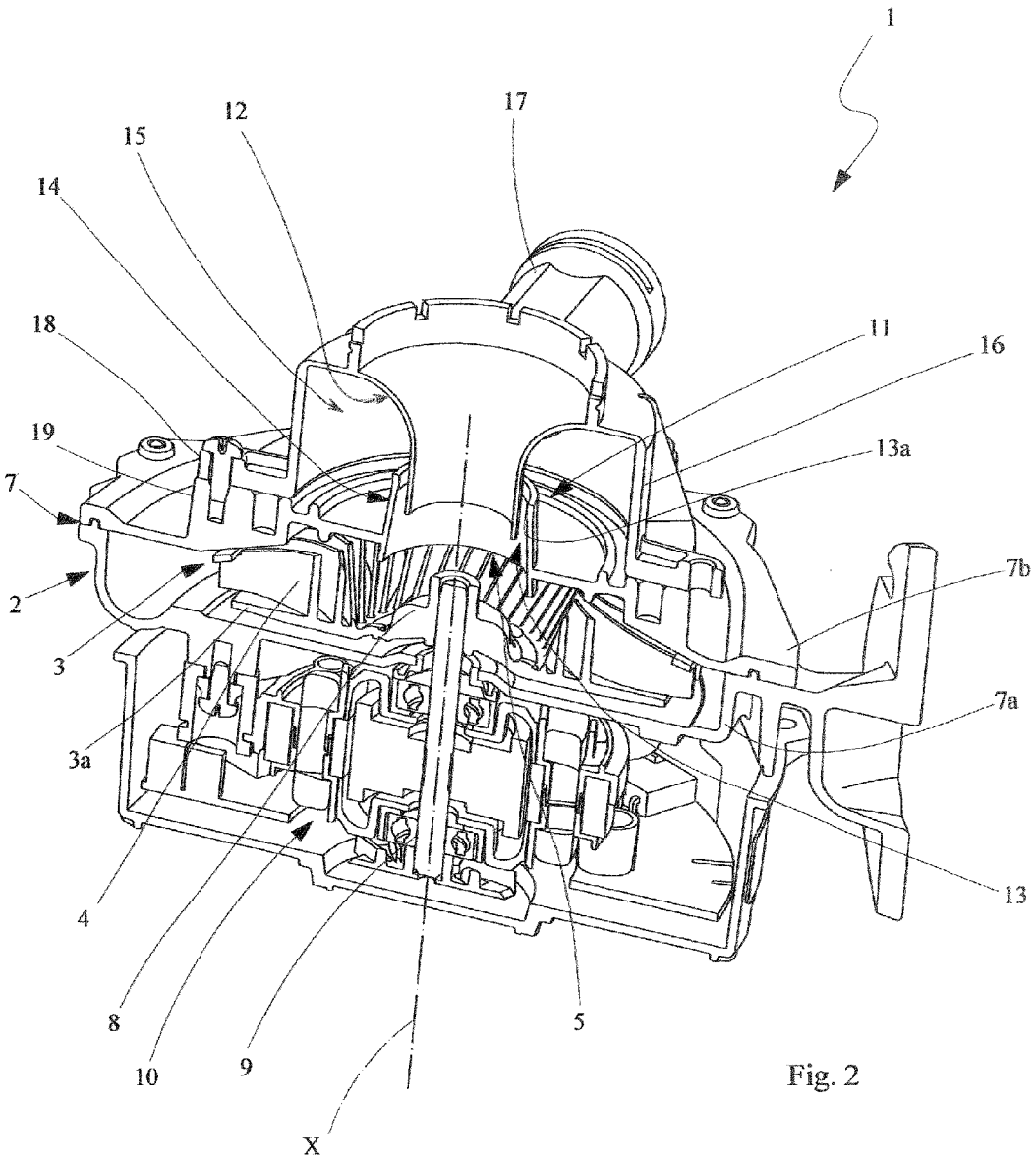

Fig. 2

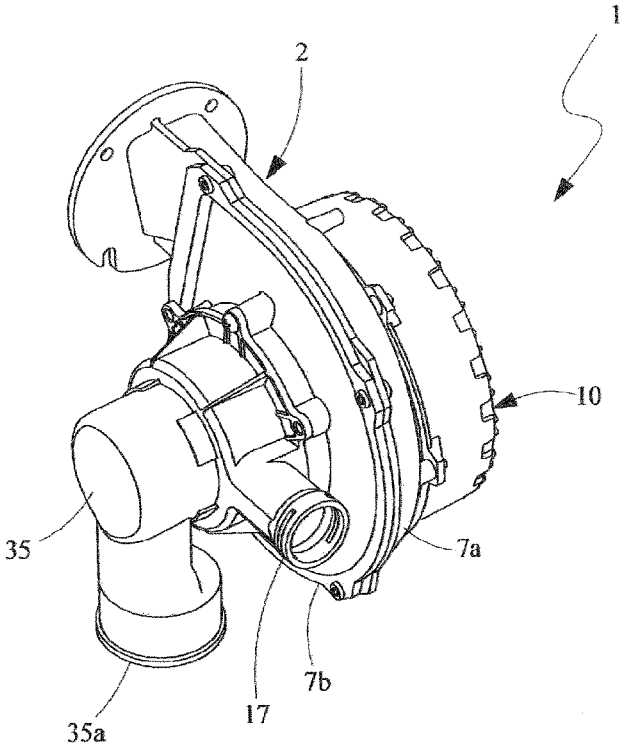

Fig. 3

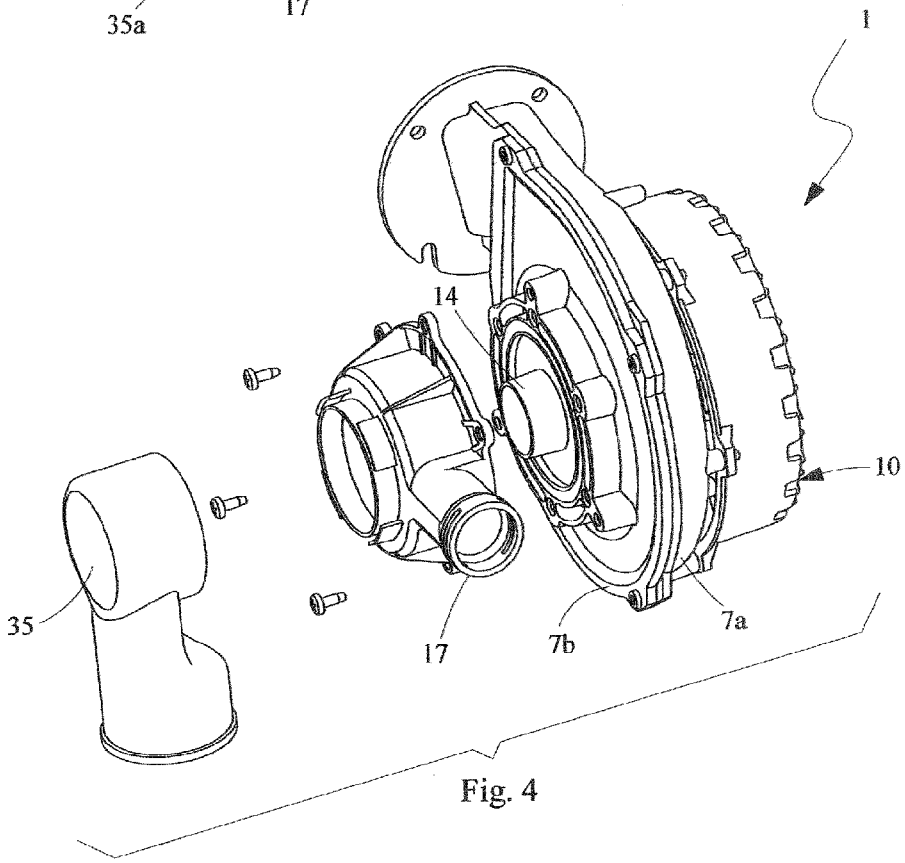

Fig. 4

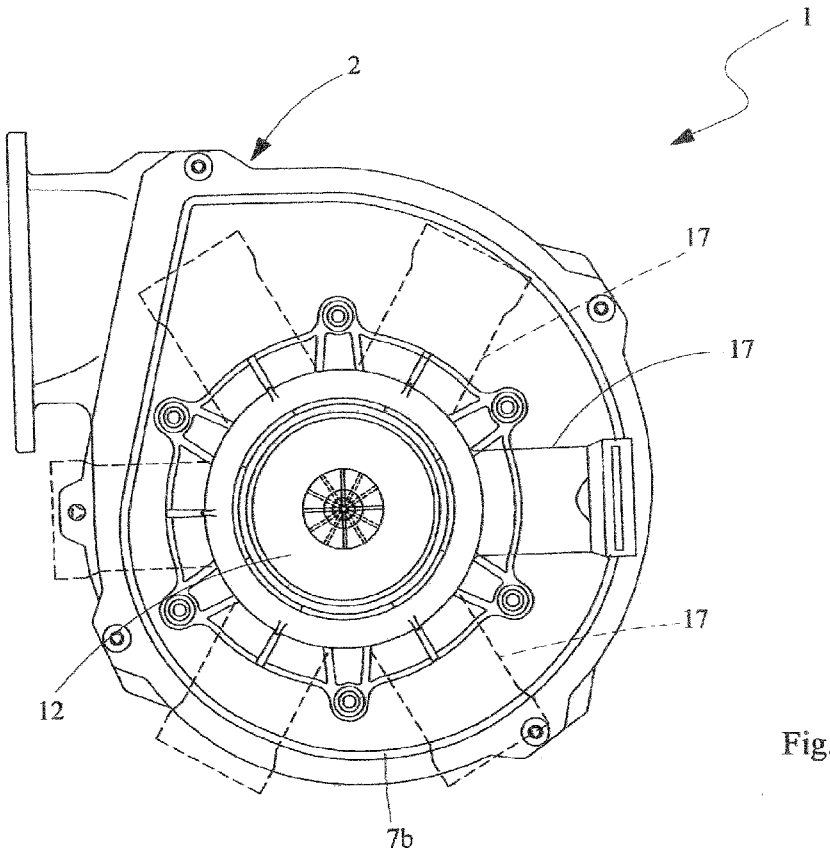

Fig. 5

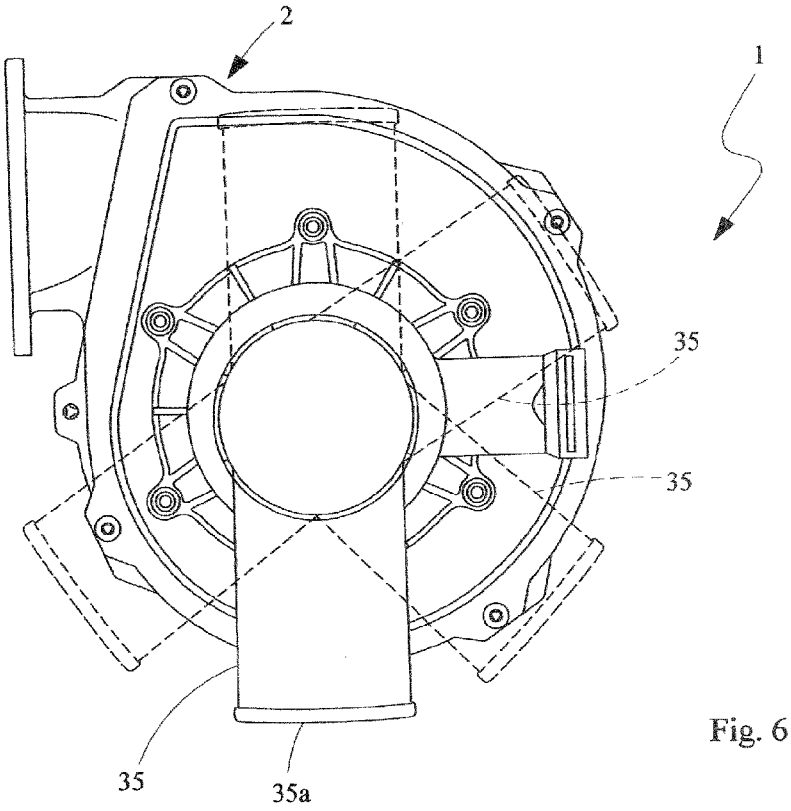

Fig. 6

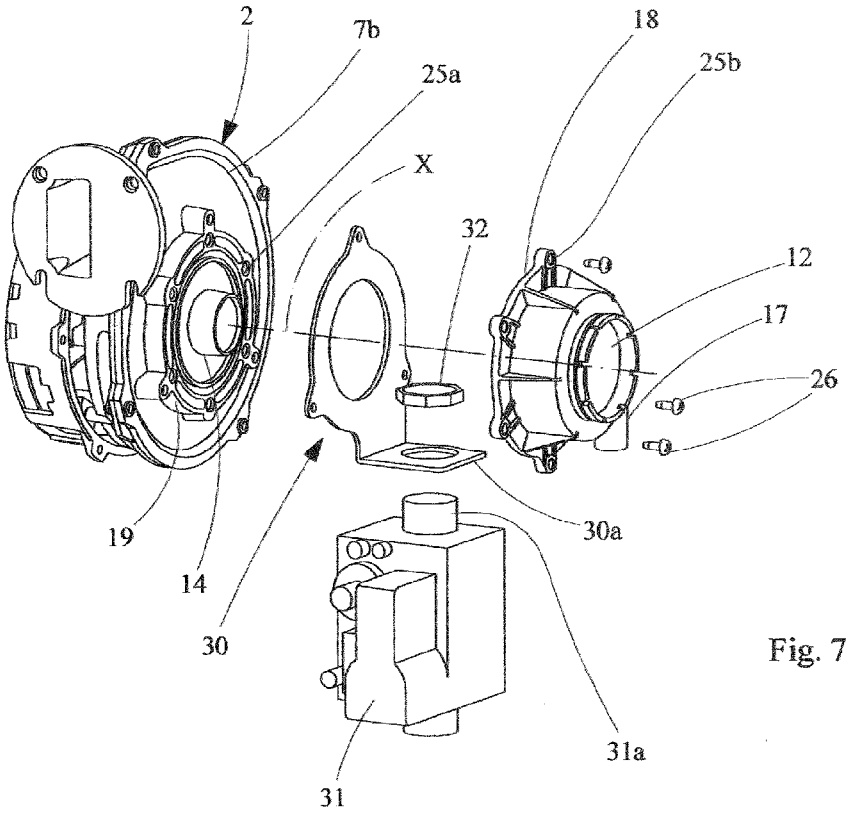

Fig. 7

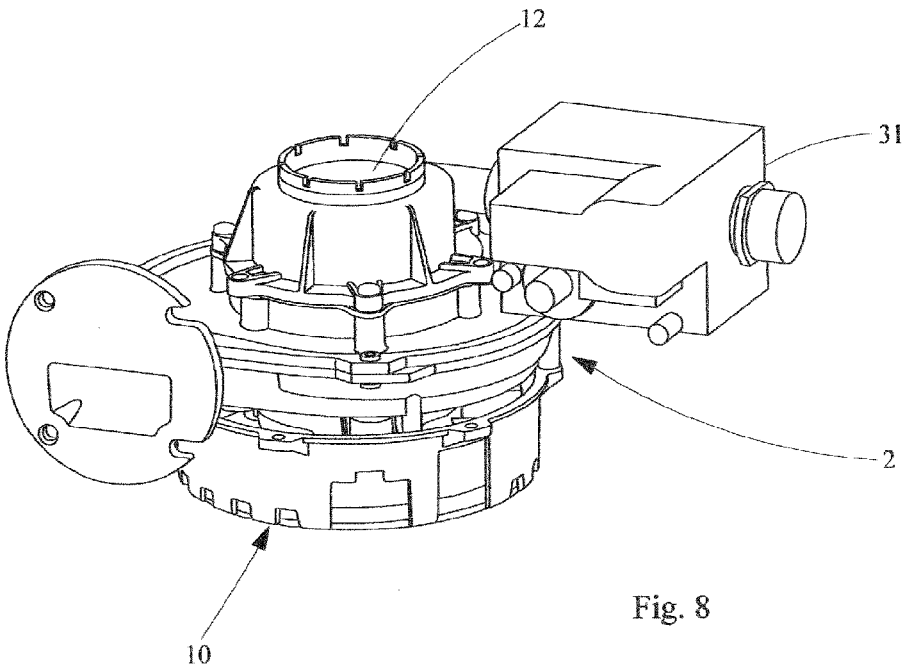

Fig. 8

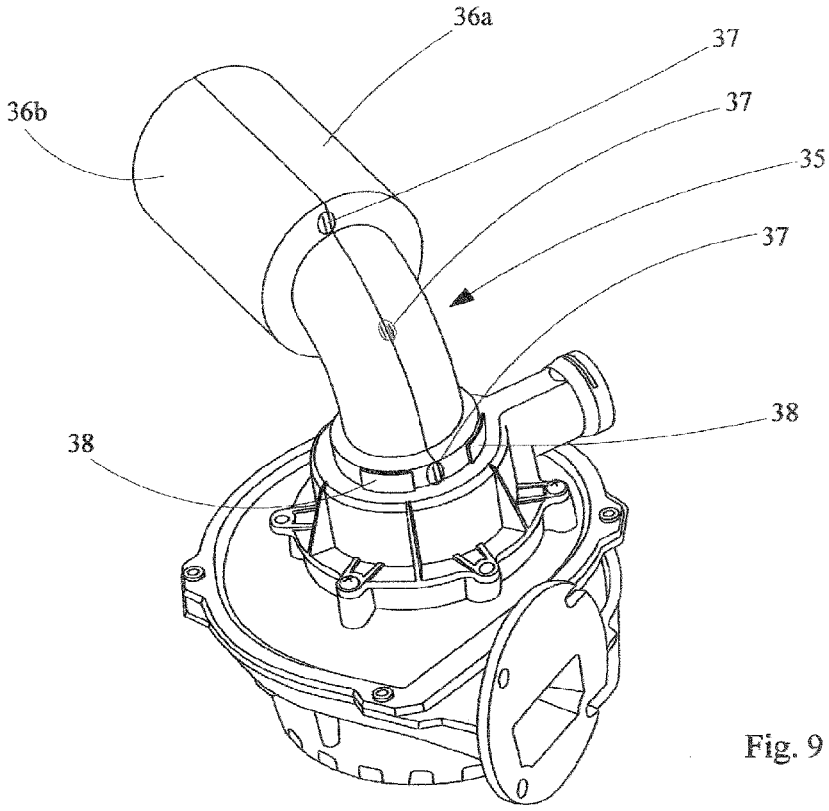

Fig. 9

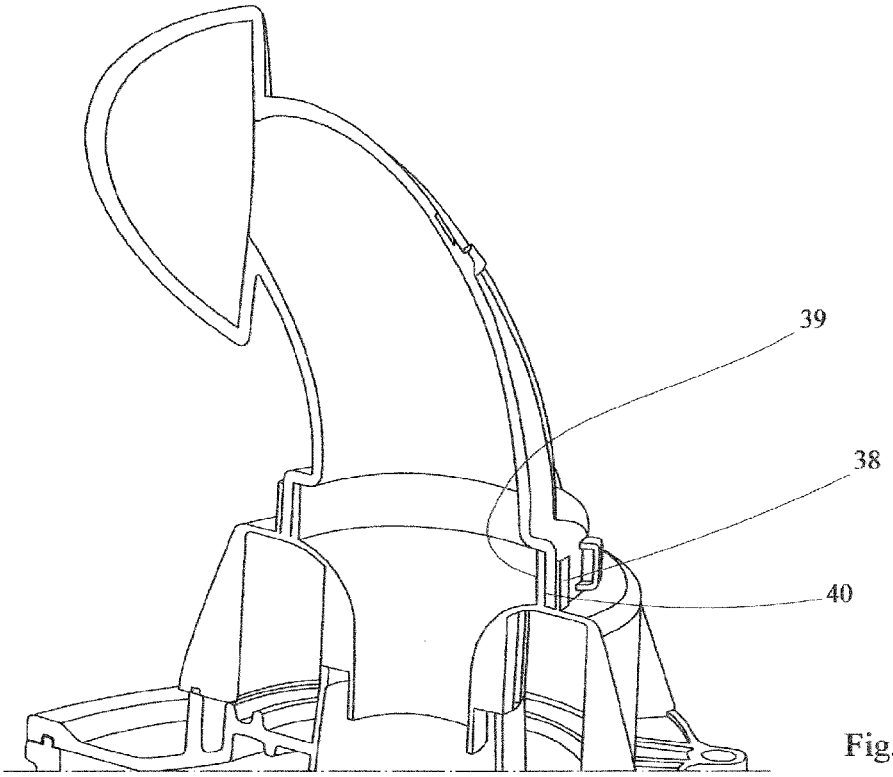

Fig. 10

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 12 19 3596

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 197 29 047 C1 (HONEYWELL BV [NL]) 24 September 1998 (1998-09-24) * the whole document *	1-7	INV. F23D14/64 F23L5/02 F23D14/46
X	DE 103 49 344 B3 (EBM PAPST LANDSHUT GMBH [DE]) 30 June 2005 (2005-06-30) * paragraphs [0024], [0035]; figures 1, 6 *	1,5,6	
X	EP 1 482 245 A1 (HOVALWERK AG [LI]) 1 December 2004 (2004-12-01) * paragraphs [0029], [0030]; figure 2 *	1	
X	US 5 527 367 A (HARADA SHINICHI [JP]) 18 June 1996 (1996-06-18) * column 3, line 20 - column 5, line 13; figure 1 *	1,8	
A	EP 2 278 224 A2 (LN 2 S R L A SOCIO UNICO [IT]) 26 January 2011 (2011-01-26) * paragraphs [0015], [0018], [00190022]; figures 1-5 *	2	

TECHNICAL FIELDS SEARCHED (IPC)
F23D
F23L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 February 2013	Harder, Sebastian

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 19 3596

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-02-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19729047 C1	24-09-1998	DE 19729047 C1	24-09-1998
		EP 0890787 A2	13-01-1999
DE 10349344 B3	30-06-2005	AT 378516 T	15-11-2007
		CA 2542466 A1	02-06-2005
		DE 10349344 B3	30-06-2005
		EP 1694967 A1	30-08-2006
		ES 2295934 T3	16-04-2008
		JP 4588712 B2	01-12-2010
		JP 2007509273 A	12-04-2007
		KR 20060108684 A	18-10-2006
		PT 1694967 E	11-02-2008
		US 2007066209 A1	22-03-2007
		WO 2005050025 A1	02-06-2005
EP 1482245 A1	01-12-2004	AT 318393 T	15-03-2006
		CA 2464993 A1	30-11-2004
		DE 10324706 B3	02-12-2004
		EP 1482245 A1	01-12-2004
		ES 2258691 T3	01-09-2006
		PL 367655 A1	13-12-2004
		US 2004237947 A1	02-12-2004
US 5527367 A	18-06-1996	JP 3343632 B2	11-11-2002
		JP 7158513 A	20-06-1995
		US 5527367 A	18-06-1996
EP 2278224 A2	26-01-2011	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82