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Improved boiler heat exchanger

(57)

Heat exchanger (1) for a boiler comprising a cylindrical body (2) with a longitudinal axis (W), closed at both of its opposing ends (9, 10) and having a cylindrical lateral surface (8), said body (2) containing a heat exchange tube device, such as a coil, connected to its two free opposing ends and inlet (16) and outlet (15) openings on said body (2) of the exchanger (1), in which said tube device (3) circulates a fluid, typically water. Said body (2) comprises at least two portions (20, 21) each defining a part of the cylindrical lateral surface (8) of said body (2), said two portions (20, 21) being connected at their free ends (20A, 21A) lying in an oblique plane (P) in relation to the longitudinal axis (W) of the cylindrical body.

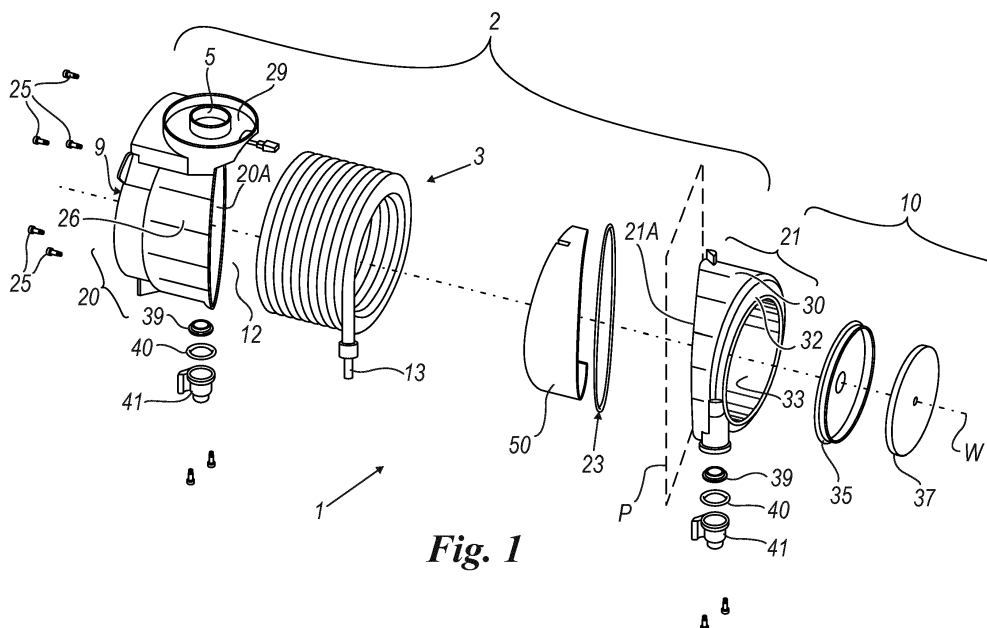


Fig. 1

Description

[0001] This invention relates to a heat exchanger for a boiler according to the pre-characterising clause of the main claim.

[0002] As is known, a conventional heat exchanger for a boiler of the type operating on gaseous or liquid fuel is designed to exchange heat between the combustion products, generated by a conventional burner of the boiler, and a heat transfer fluid (usually water) contained in the exchanger.

[0003] The latter generally comprises a casing or cylindrical body, having end portions that enclose a cylindrical lateral surface. Within the above-mentioned body is housed a tube device, for example in coil form, in which the heat transfer fluid circulates, said tube unit opening in an inlet and an outlet on the cylindrical body. The coil can be single or concentric. In the first case, the fluid circulating therein is water from the heating circuit, in the second case domestic water circulates in the tube inside the coil and water from the heating circuit runs in the gap between the two tubes.

[0004] In the cylindrical body or casing of the exchanger, combustion products (gas or fumes) capable of transferring their heat to the above-mentioned fluid before leaving said body are also present (produced from a burner inside the casing, for example).

[0005] Usually, the cylindrical body or casing is composed of three or more components that are difficult to separate in order to gain access to the coil (and any other components) inside the above-mentioned casing or body; in other solutions, the latter is a single-piece or multi-piece structure and cannot be dismantled, which completely prevents any access to its internal components (coil, temperature-control devices, if any, insulation elements or other parts).

[0006] DE 20 2011 001615 describes a heat exchanger comprising a cylindrical body of the type composed of several portions connected together and closed at both of its opposing ends. In the cylindrical body is a coil tube device, having inlet and outlet openings, in which a fluid, typically water, circulates. The various portions of the body are connected together on planes orthogonal to the longitudinal axis of each portion (coinciding with the longitudinal axis of the cylindrical body) and have no hydraulic manifolds or connections to connect to pipes for the inlet or outlet of water from the exchanger nor an exhaust opening for the fumes. These connection elements or manifolds are added to the cylindrical body later.

[0007] This latter operation takes time and requires sealing elements to be placed at the connection between the various portions of the exchanger. Furthermore, the hydraulic manifolds and fume exhaust, which are elements separate from said portions and autonomous in relation to them, must also be connected thereto.

[0008] In addition, the tube device is not easy to fit between the above-mentioned portions due to their perfectly cylindrical conformation, which requires the tube de-

vice to be fitted into them by inserting it perfectly coaxially to the longitudinal axis of each portion.

[0009] The aim of the present invention is to offer a heat exchanger that is improved in comparison to those known.

[0010] In particular, the aim of the present invention is to offer an exchanger of the type mentioned that is easier to fit than known exchangers and allows its simple removal if an intervention is required on the coil or other components inside its casing.

[0011] Another aim is to offer an exchanger of the type mentioned that ensures an optimum heat exchange between the heat transfer fluid and the combustion products circulating therein, as well as its safe use even in a closed environment.

[0012] A further aim is to offer a heat exchanger of the above-mentioned type that is low cost.

[0013] Yet another aim is to offer a heat exchanger comprising a reduced number of parts whose assembly involves the use of just one sealing element between said parts, which ensures an optimum seal against the combustion products present therein.

[0014] A further aim is to offer a heat exchanger of the type that is already prepared for connection with an exhaust pipe for the fumes capable of conveying them away from the exchanger (towards a point in which the fumes are released into the environment outside the place, for example an apartment, where the heat exchanger is used); in addition, another aim is to offer such an exchanger that is already prepared for connection to pipes in which the heat transfer fluid, entering and exiting the tube device or coil, circulates. These characteristics reduce the time required to insert the exchanger into a heating and domestic water system of an environment where the exchanger is fitted and also facilitate the operations of such insertion.

[0015] These and other aims, which will be clear to a person skilled in the art, will be achieved by a heat exchanger according to the accompanying claims.

[0016] A better understanding of the present invention will emerge from the following drawings, given purely by way of a non-limiting example, in which:

Figure 1 is an exploded view of an exchanger according to the invention;

Figure 2 is a front view of the exchanger (assembled) shown in Figure 1;

Figure 3 is a rear view of the exchanger shown in Figure 1; and

Figure 4 is view of the exchanger shown in Figure 1 seen from below.

[0017] With reference to the figures, an exchanger is indicated generally by 1 and has a body or casing 2 containing a heat exchanging coil or tube device 3 (generally in any form, not necessarily a coil) in which can flow a heat transfer fluid capable of receiving heat from the exhaust products of combustion generated by a burner and

operating on gaseous or liquid fuel (not shown) appropriately connected to the exchanger 1. These exhaust products (or fumes) exit the body 2 through an exhaust opening or hole 5 with which the body 2 is already provided forming one piece with it. This facilitates the connection of the exchanger to at least one conventional pipe to exhaust the fumes outside the environment where the exchanger is located, reduces the time required to fit it in said environment and also reduces the costs of this operation.

[0018] The coil may be single or concentric. In the first case, the fluid circulating therein is water from the heating circuit, in the second case domestic water circulates in the tube inside the coil and water from the heating circuit runs in the gap between the two tubes.

[0019] The casing or body 2 has a cylindrical lateral surface 8 and end parts 9 and 10 that enclose, with said surface 8, an inner compartment 12 of the exchanger. Inside the latter is the tube device 3 connected at its free ends (only one of which, indicated by 13, is visible in Figure 1) to inlet 15 and outlet 16 openings or manifolds of the heat transfer fluid, provided in the body 2. These openings or manifolds are already prepared for simplified connection to pipes, external to the exchanger 1, in which circulates the heat transfer fluid entering and exiting respectively the tube device or coil 3.

[0020] The casing 2 comprises two portions or covers 20 and 21 each defining at least part of the lateral surface 8, said portions having corresponding free ends 20A and 21A connected together along an oblique plane P in relation to a longitudinal axis W of the body or casing 2. At these ends 20A and 21A is located an annular sealing element 23. The latter is preferably and advantageously the only sealing element present between portions 20 and 21.

[0021] The portions or covers 20 and 21 are connected together by means of screws 25. Alternatively, these portions 20 and 21 can be connected together by snap fitting or tie-rods or other removable mechanical securing means.

[0022] The first portion or cover 20, having the fume outlet or exhaust hole 5 forming one piece therewith, comprises an irregular cylindrical part 26, with the open end 20A lying in the above-mentioned oblique plane P. This portion 20 is closed at one of its ends by a substantially flat cover 27 (forming one piece with the remaining part of portion 20), defining the end part 9 of the exchanger, with stiffening ribs 28 and having an external plate 29 near the hole 5, of a known type (for example, as described in Patent Application MI2005U000456 in the name of the present Applicant) to collect condensate or rainwater from the conventional combustion air intake pipe connected to the boiler (not shown). Associated with this hole is the fume exhaust pipe (not shown).

[0023] This plate 29 also forms one piece with the portion 20.

[0024] The condensate or rainwater collected in the external plate 29 can be conveyed directly, through the

exchanger, to a drain for the condensate of the exchanger 60 (also forming one piece with the body or casing 2) or, as in the case of the above-mentioned prior patent filed by the applicant, can be evacuated by means of an external tube connected to a siphon of the boiler.

[0025] The second portion or cover 21 comprises a cylindrical part capable of connecting with the irregular cylindrical part 26 of the first portion or cover 20 and having its free end 21A located on the above-mentioned plane P. This second cover 21 has a partially enclosed end 32 having a through-hole 33 capable of enabling the introduction into the exchanger (and in particular into the tube device 3) of the burner (not shown). Inside the casing 2 and precisely in the tube device 3, a separator plate 35 is screwed, to which is fixed an insulating plate 37 and which partialises the intermediate compartment 12 of the exchanger 1.

[0026] The position of the plate is determined on the basis of the exchanger efficiency tests. At either opposing end, the plate has two teeth (not shown) that enable it to be screwed onto the threads of the coil while at the same time guaranteeing the seal between the plate and the coil.

[0027] Associated with the second cover 21, in any known way, is a conveyor of the air/gas mixture for the burner and a conventional fan, both not shown.

[0028] The coil 3 is centred on the first and in the second covers 20, 21 by means of corresponding bushes 39, each of which also serves to contain a sealing ring 40 or another similar gasket. These bushes are located at the openings or manifolds 15 and 16. Furthermore, the covers 20 and 21 are shaped so that, on inserting the two ends of the coil into the above-mentioned openings or manifolds 15 and 16, these covers can house the coil in a simple and precise way. Thanks to the particular conformation of the covers 20 and 21, with their free ends 20A and 21 which are oblique, that is lying in the plane P oblique in relation to axis W, the fitting of the tube device 3 into said covers is facilitated: in fact, the conformation of the above-mentioned ends 20A and 21A allows an operator easy access into a first cover, for example cover 20, in order to position a first end of the coil or device 3 correctly into the opening 15. The conformation of the end 20A of this cover 20 therefore "guides" its connection with the end 21A of the other cover 21 (connection is obligated precisely because of the oblique conformation of the above-mentioned ends), which also leads to a correct connection of the second end 13 of the coil with the opening 16.

[0029] Therefore, the fact that the covers 20 and 21 have one oblique free end facilitates the fitting both of the device 3 into the exchanger and the fitting of the body or casing 2 thereof.

[0030] The openings or manifolds 15 and 16 also comprise connection elements 41 cooperating with the corresponding bush 39.

[0031] Note that the longitudinal dimension of the exchanger 1 along the axis W can be extended by inserting between the two covers 20 and 21 an element or exten-

sion (not shown in the drawing). A metal protection element 50 is provided between the coil 3 and the cover 20, which is preferably made from composite material. The element 50 serves to protect the cover 20 from high temperatures. By contrast, the cover 21 is preferably made from aluminium and does not require this protection.

[0032] Thanks to the above-mentioned extension, it is possible to create a modular system (exchanger) so as to be able to have products of different powers; this is also as a result of using a tubular exchange device or coils with a greater number of tubes or loops (in the case of the coil). This element or extension, of an annular or partially annular shape, has opposing edges complementary to the ends 20A, 21A of the portions 20 and 21 (that is, they are also oblique to facilitate the fitting of the coil or device 3 into the body 2 and the final assembly thereof).

[0033] The exchanger thus obtained has an ease of assembly and disassembly that cannot be obtained with known exchangers and allows a simple adaptation to the required potentials of use and also simplifies the methods of intervention on the coil (or other heat exchange device) and on the components inside the exchanger, should this be necessary during the use thereof.

[0034] Furthermore, since its body or casing 2 forms one piece with the hole 5 to exhaust the fumes and has openings 15 and 16 for connection to the pipes for the heat transfer fluid, the assembly of the exchanger is faster, simpler and cheaper.

[0035] Lastly, the presence of a single annular sealing element 23 between portions 20 and 21 optimises not only the fitting and assembly of the body 2, but also its seal.

[0036] A preferred embodiment of the invention has been described. However, other embodiments are possible in the light of the preceding description and shall be deemed to fall within the scope of the following claims.

Claims

1. Heat exchanger (1) for a boiler comprising a cylindrical body (2) with a longitudinal axis (W), closed at both of its opposing ends (9, 10) and having a cylindrical lateral surface (8), said body (2) having an inner compartment (12) containing a heat exchange tube device (3), such as a coil, connected to its two free opposing ends and inlet (16) and outlet (15) openings on said body (2) of the exchanger (1), in which said heat exchange tube device (3) circulates a fluid, typically water, said body (2) comprising at least two portions (20, 21) each defining a part of the cylindrical lateral surface (8) of said body (2), said two portions (20, 21) being connected or secured together by removable mechanical securing means such as screws (25), snap fitting, tie-rods or suchlike, **characterised in that** these portions (20, 21) comprise free ends (20A, 21A) lying in an oblique plane (P) in relation to the longitudinal axis (W) of the cylindrical body, said portions (20, 21) being connected together at said oblique free ends (20A, 21A).
2. Heat exchanger according to claim 1, **characterised in that** between the free ends (20A, 21A) of said first and second portions (20, 21) is a sealing element (23).
3. Heat exchanger according to claim 1, **characterised in that** said first portion (20) comprises, forming one piece with it, an outlet hole (5) for the fumes or combustion products generated inside the exchanger (1) and is closed at one of its ends by a substantially flat cover (27), with stiffening ribs (28).
4. Heat exchanger according to claim 3, **characterised in that** the fume outlet hole (5) is associated with a plate (29) to collect the condensate or rainwater from a conventional combustion air intake pipe connected to the boiler, said plate forming one piece with the body (2) of the exchanger.
5. Heat exchanger according to claim 4, **characterised in that** the body (2) comprises, forming one piece therewith, a condensate drain (6) for the water collected by said plate (29).
6. Heat exchanger according to claim 1, **characterised in that** between said first and second portions (20, 21), each defining a part of the lateral surface (8) of the body of the exchanger, is inserted an element or extension having opposing edges complementary to the ends (20A, 21A) of said portions, said element or extension enabling the dimension along the longitudinal axis (W) of the body (2) of the exchanger to be increased.
7. Heat exchanger according to claim 1, **characterised in that** said second portion (21) has an end (32) opposing end (21A) connecting with the first portion (20), said end comprising a through hole (33) capable of allowing the introduction into the exchanger of a conventional burner operating on gaseous or liquid fuel inserted in the exchanger.
8. Heat exchanger according to claim 7, **characterised in that** it has, internally, a separator plate (35), said plate cooperating with an insulating plate (37), said separator plate (35) partialising the internal compartment (12) of the exchanger and connecting to the heat exchange device (3).
9. Heat exchanger according to claim 1, **characterised in that** the heat exchange device (3) is centred in the first and in the second portion (20, 21) of the exchanger.

10. Heat exchanger according to claim 1, **characterised in that** each portion (20, 21) of its body (2) comprises, forming one piece therewith, openings or manifolds (15, 16) to connect the exchanger to external inlet and outlet pipes for the heat transfer fluid, said openings or manifolds (15, 16) accommodating free ends (13) of said tube or exchange device (3). 5
11. Heat exchanger according to claim 10, **characterised in that** it comprises bushes (39) associated with said openings or manifolds (15, 16) of the exchanger (1) capable of cooperating with said heat exchange device (3) and centring it inside said first and second portion (20, 21) of the exchanger. 10
12. Heat exchanger according to claim 1, **characterised in that** it comprises a metal protective element between the heat exchange device (3) and at least one of the portions (20, 21) defining the body (2) of the exchanger (1). 15 20
13. Heat exchanger according to claim 1, **characterised in that** at least one first (20) of the portions is made from a composite material. 25

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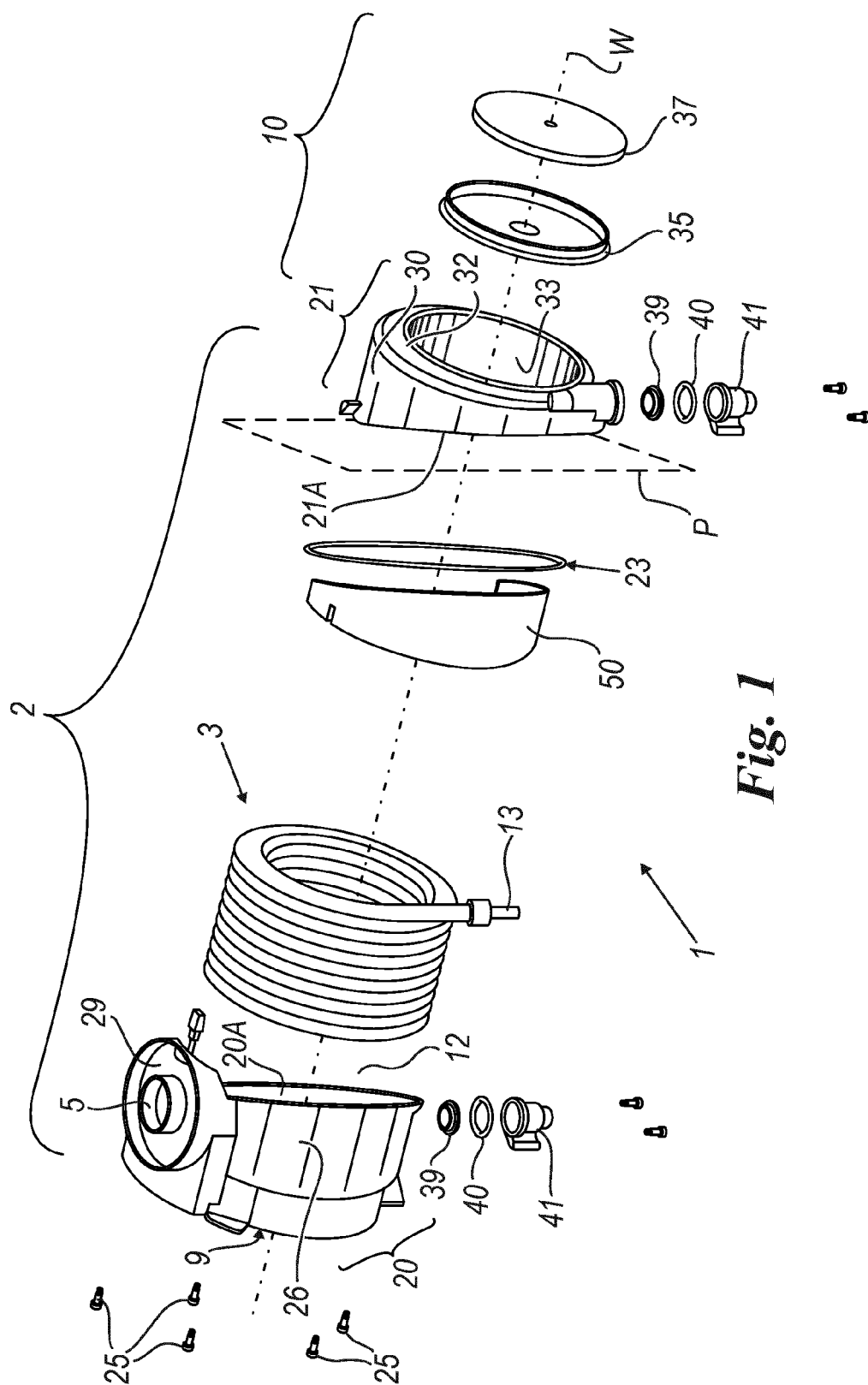


Fig. 1

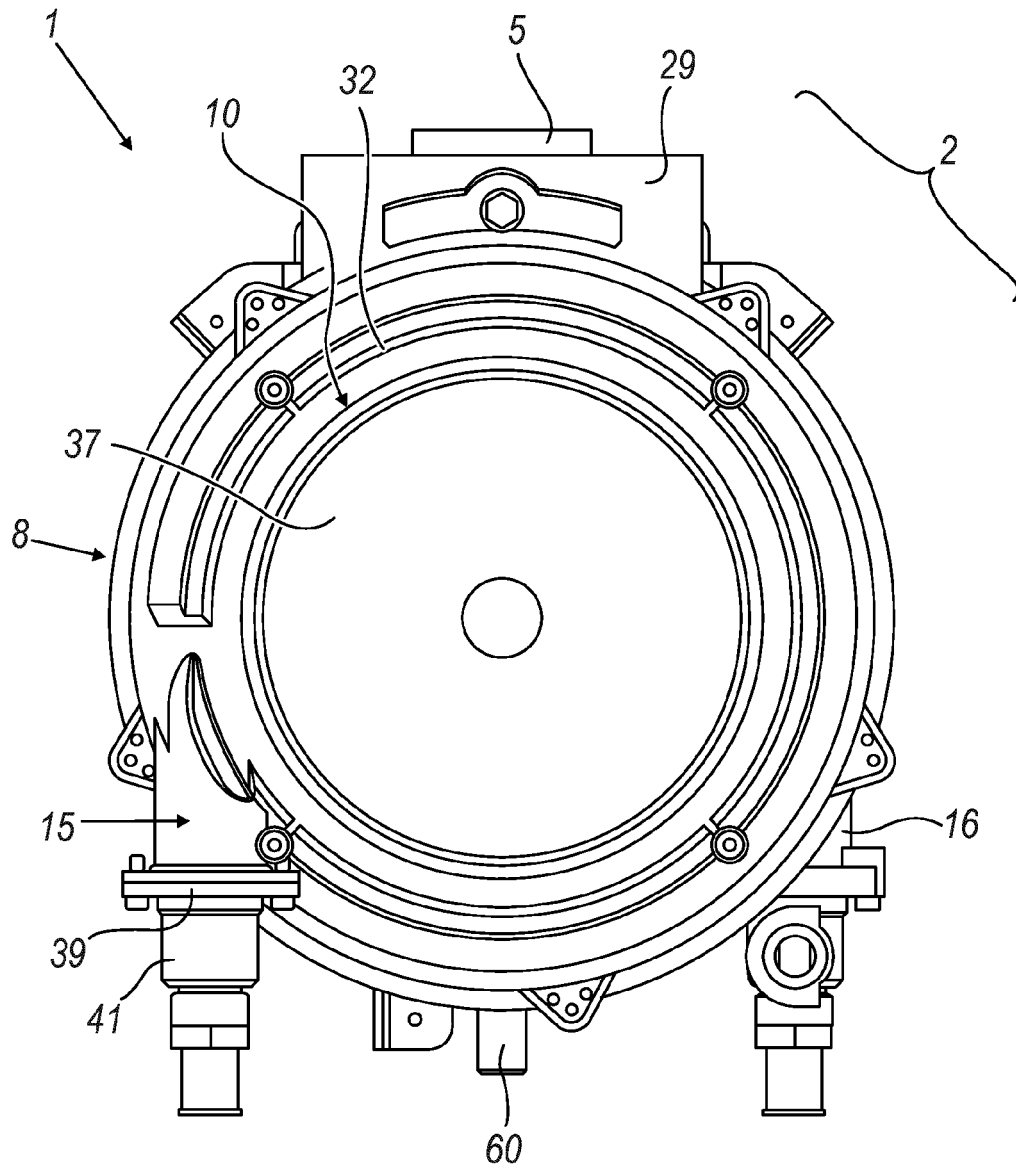


Fig. 2

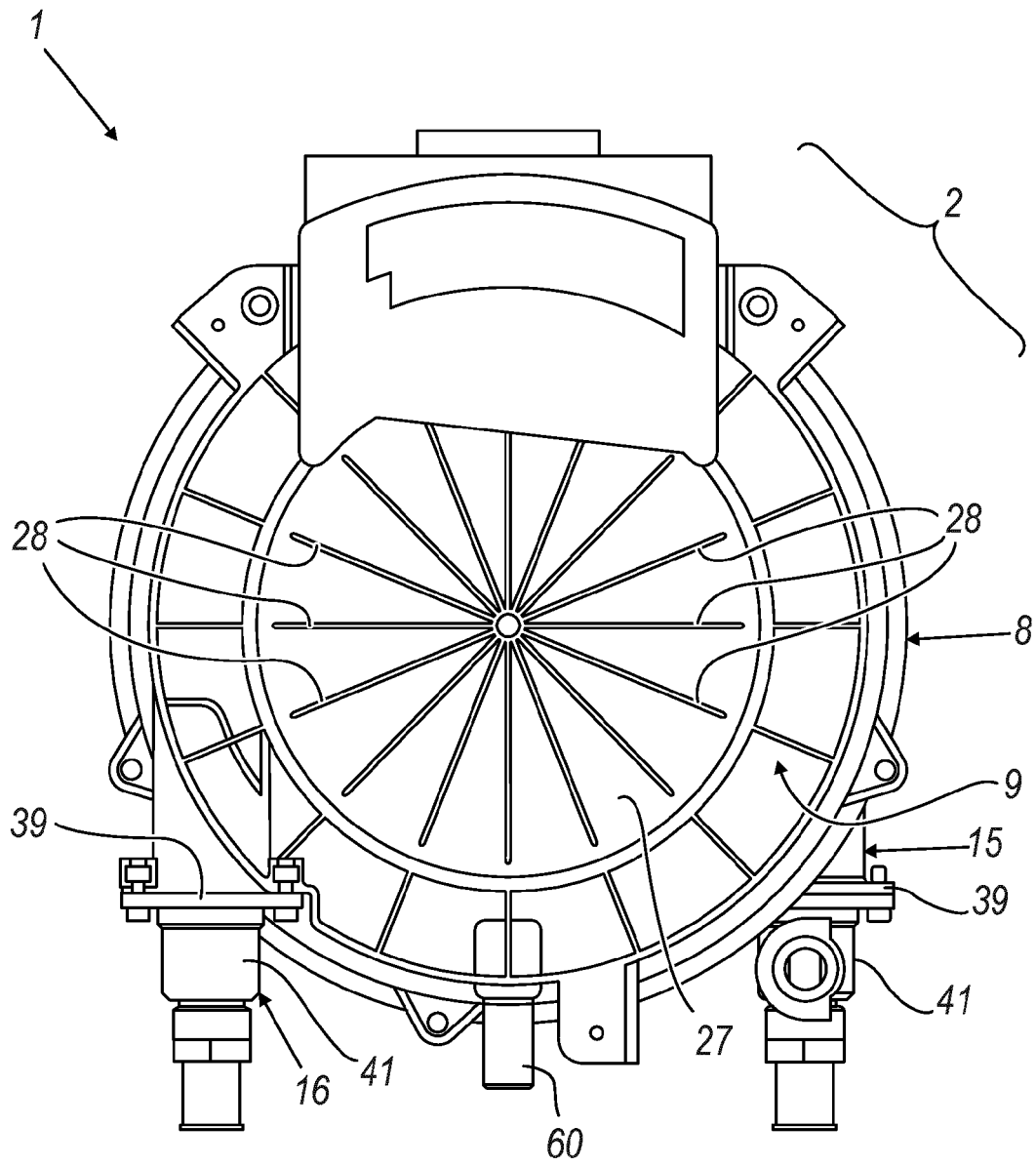


Fig. 3

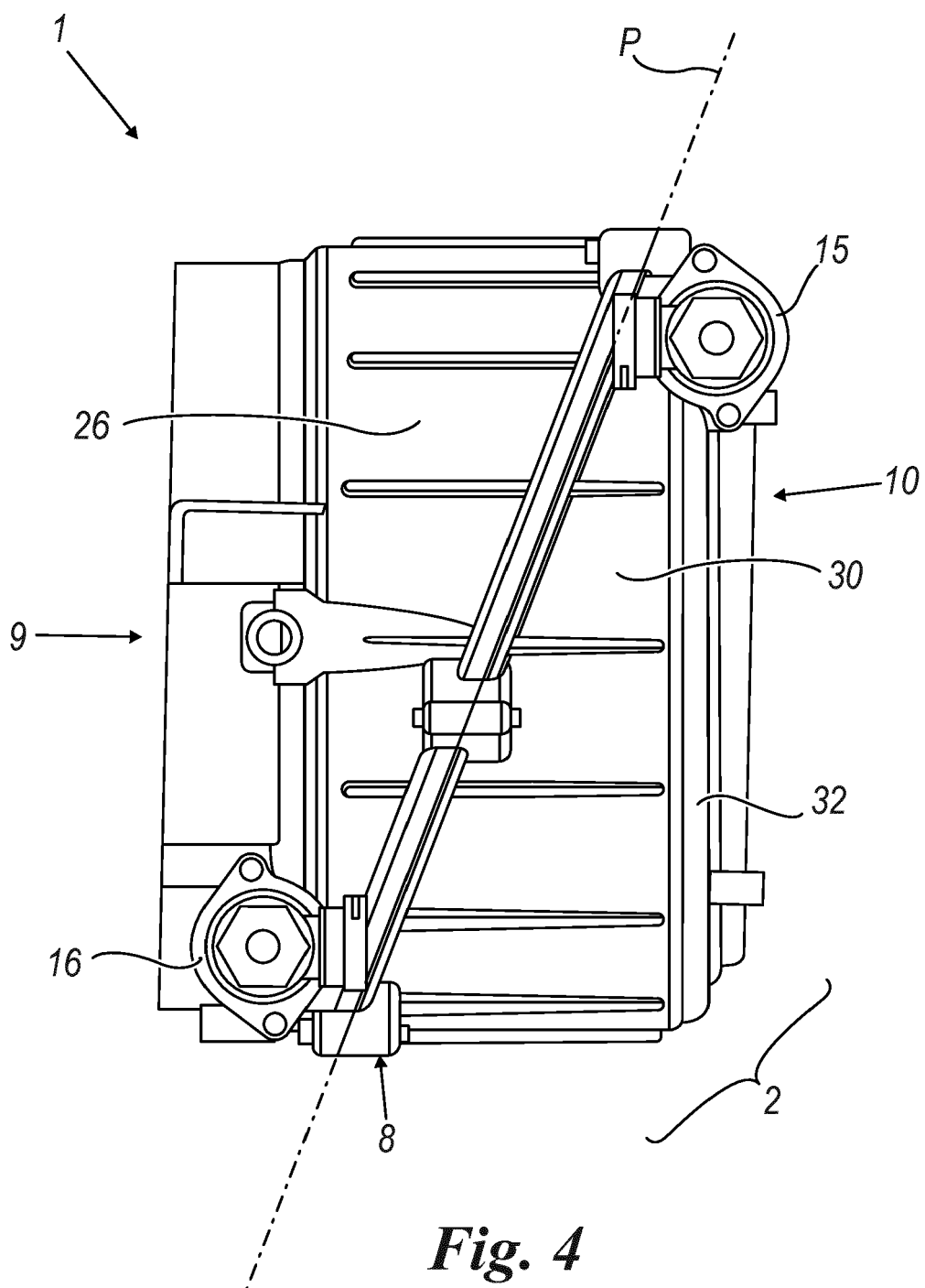


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 14 18 4726

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 20 2011 001615 U1 (VIESSMANN WERKE KG [DE]) 31 March 2011 (2011-03-31) * pages 4-10; figures 1,2 *	1-13	INV. F24H1/43 F24H9/02 F24H9/18
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			TECHNICAL FIELDS SEARCHED (IPC)
			F24H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 16 February 2015	Examiner Blot, Pierre-Edouard
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	

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

REFERENCES CITED IN THE DESCRIPTION

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