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(54) HEAT GENERATOR WITH EFFICIENT THERMAL EXCHANGE

(57) The present invention relates to a heat generator for heating environments comprising a main frame (2) delimiting a combustion chamber (CC), the generator further including a door for opening/closing (3) an opening for accessing to the combustion chamber (CC).

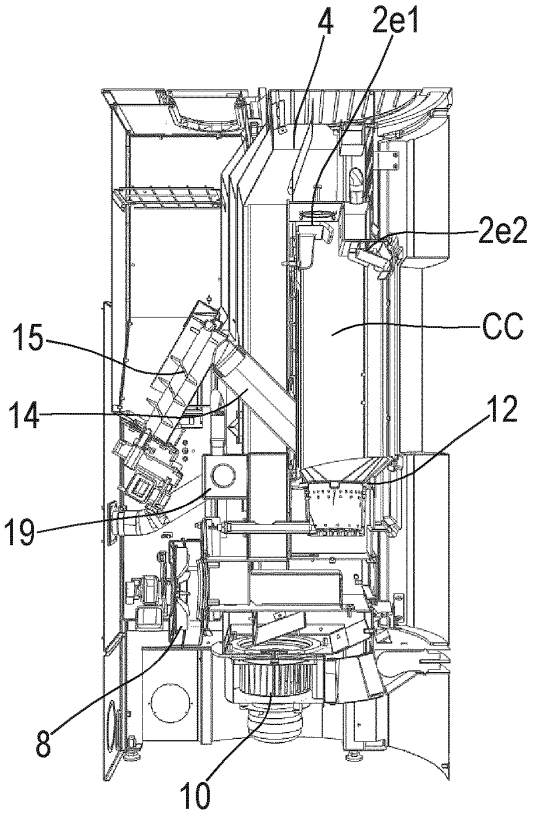

FIG.22

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to a heat generator, in particular powered with biomass, such as pellets, which has a new structure of heat exchange, which is particular effective, in particular among air to be heated and combustion fumes.

STATE OF THE PRIOR ART

[0002] Many heat generators have been proposed, each with respective heat exchange circuits.

[0003] The European patent EP1327825B1 describes for example a pellet stove comprising a flue gas discharge circuit including a section extending from the top of the respective combustion chamber as well as a suction circuit for air to be heated extending downwards and in heat exchange with part of the discharge circuit.

[0004] Although this solution ensures efficient operation, it does not allow the heat generated to be optimally exploited.

OBJECTS OF THE INVENTION

[0005] An object of the present invention is thus to provide a new heat generator, in particular powered with biomass.

[0006] Another object of the present invention is to provide a heat generator capable of ensuring an effective heat exchange, in particular between the air to be heated and the combustion fumes.

[0007] Another object of the present invention is to provide a heat generator suitable for ensuring low nitrogen emissions.

[0008] Another object of the present invention is to provide a heat generator capable of ensuring a completion of the combustion with an increase in the CO_2 content and a reduction of pollutants, such as particulate matter.

[0009] According to an aspect of the invention, a heat generator is provided according to claim 1.

[0010] The dependent claims refer to preferred and advantageous embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Other features and advantages of the invention will be more evident from the description of an embodiment of a heat generator, illustrated by way of example in the accompanying drawings in which:

- figures 1 and 2 are perspective views from respective sides of a heat generator according to the present invention;
- figures 3 to 10 are views of the heat generator of figure 1 with parts removed,
- figure 3a illustrates a variant of fitting of the recirculation duct,
- figures 11 to 22 are cross-section views of the heat generator of figure 1.

[0012] In the accompanying drawings, identical parts or components are indicated by the same reference numbers.

EMBODIMENTS OF THE INVENTION

[0013] With reference to the attached figures, a heat generator 1 has been illustrated, such as a stove for heating environments according to the present invention.

[0014] Such heat generator comprises, in addition to optional outer protection walls 1a, a main frame 2 delimiting a combustion chamber CC, the generator further including a door or wing for opening/closing 3 an opening for accessing to the combustion chamber CC, which door is constrained, for example pivoted to the main frame, so that it is movable between an open position and a closed position of the combustion chamber CC. Of course, the combustion chamber CC is delimited by respective walls of the frame 2.

[0015] The door or wing 3 defines the front F of the generator, whereas the opposed surface of the generator 1 defines the rear R thereof. Therefore, the indications in this text to the front, rear, front portion or rear portion should be considered according to this approach.

[0016] More specifically, the frame 2 delimits a first circuit 4 for the passage of ambient air to be heated in the generator 1 and conveyed hot to the environment to be heated around the generator 1 and/or (by means of respective ducts) away from it, a second circuit 5 for transmitting comburent air from the external environment to the generator 1 in the combustion chamber CC and a third circuit 6 for the intake or discharge of the combustion fumes or gases from the combustion chamber CC to the outside.

[0017] It will be understood that the expression "ambient air to be heated" indicates the air taken from the environment outside the generator, heated in the generator itself and then returned to the environment to heat it (forced convective air). Therefore, this ambient air is not involved in the combustion that occurs in the stove due to the reaction between fuel and comburent air.

[0018] The first circuit 4 has a section in heat exchange relationship with a respective section of the third circuit 6, so that the ambient air to be heated is heated by the heat emanating from the combustion fumes flowing in the third circuit 6.

[0019] Advantageously, according to the embodiment illustrated in the figures, the second circuit 5 has a section in heat exchange relationship with a respective section of the third circuit 6, so that the comburent air is heated by the heat emanating from the combustion fumes flowing in the third circuit 6.

[0020] Preferably, the generator 1 then comprises at least one duct or pipe for recirculating 7 the combustion

fumes from the third intake or discharge circuit 6 or from suction or thrust means provided in the same or for the same in the combustion chamber CC and/or in the second circuit 5 for transmitting comburent air and/or in a brazier of the generator provided or opening in the combustion chamber CC. The recirculation duct or pipe 7 is then arranged to send part of the combustion fumes from an initial, intermediate or terminal section of the third circuit 6 into the combustion chamber CC or into the second transmission circuit 5, so that the combustion fumes, instead of being expelled directly from the generator, are involved in the combustion of new comburent and fuel.

[0021] If desired, the recirculation duct 7, if provided is a pipe with a circular section with a suitable diameter, such as between 10 and 200 mm, if desired about 30-50 mm, for example 40 mm or even not with circular section and having a suitable section, for example between 80 mm^2 and 30000 mm^2, for example about 1200-1300 mm^2.

[0022] Therefore, this duct, if provided, can have a circular, rectangular section or a section with another configuration.

[0023] With reference to this aspect, in accordance with this feature, the at least one recirculation duct can include at least one pipe 7 extending between a portion of the third circuit 6 and a section of the second section 5, for example a plenum where the comburent air conveyed is conveyed from outside the generator 1.

[0024] In addition or as an alternative, a recirculation pipe or duct 7 could be provided extending from a section of the third circuit 6 directly into a brazier of the generator 1 and/or into the combustion chamber CC.

[0025] Therefore, the recirculation duct 7 can have a terminal intake section 7a fitted in a hole delimited by a portion or duct 23 or 24 of the third circuit 6. Clearly, this connection is ensured by means of a suitable dimensioning of the terminal intake section 7a and/or by means of suitable fastening means, but in any case in such a way that there is a fluid seal between the terminal intake section 7a and a respective hole in a duct of the third circuit 6, so that there is no leak of the exhaust gases at this fitting.

[0026] Advantageously, the terminal intake section 7a is open in the direction of the flow of the combustion fumes (see figure 3a). More in particular, the terminal intake section 7a or rather a respective end portion 7a1 can be arranged so as to be substantially parallel or slightly inclined with respect to the direction of the combustion fumes CF in the respective section (if desired 23 or 24) of the third circuit 6 where the end portion 7a1 is arranged and in such a way as to define an inflow or inlet opening IO which is open or facing the direction of arrival of the combustion fumes CF in the respective section (if desired 23 or 24) of the third circuit 6.

[0027] With regard to this aspect, according to the non-limiting embodiment illustrated in the figures, the end portion 7a1 delimiting the inflow or inlet opening IO in the recirculation duct 7 is substantially parallel to the main extension dimension of the section 23 or 24 of the third circuit 6 where this end portion 7a1 is arranged, and the inflow opening IO is open in the direction opposite to the direction of flow of the fumes in this section 23, 24.

[0028] The above described expedient, which is advantageous but not necessary, clearly facilitates the entry of the combustion fumes CF into the recirculation duct 7 or better in the respective terminal intake section 7a.

[0029] Moreover, the terminal intake section 7a of the recirculation duct 7 fitted in the third circuit could have, approaching the respective inflow opening, a second portion 7a2 and then the end portion 7a1, and these portions 7a1, 7a2 are preferably orthogonal or inclined with respect to each other.

[0030] Clearly, a manifold, a valve or the like could also be envisaged where the third circuit 6 opens, which has at least two outlets, another section of the third circuit 6 being mounted in one of these outlets, while the recirculation duct 7 is mounted in the other outlet.

[0031] The optional intake of combustion fumes from the third circuit 6 through the recirculation duct 7 can clearly be obtained by means of any other suitable solution.

[0032] Moreover, valves or baffles can or cannot be provided, even in the recirculation duct 7, for example which are automatic electronically controlled by a respective control unit of the generator 1 and arranged to open/close respective compartments or openings, so as to allow or not the passage of the fumes between the third circuit 6 and the combustion chamber CC and/or the second transmission circuit 5. These valves would therefore be arranged to allow or prevent the communication of fluid between an intermediate section of the third circuit 6 and the combustion chamber CC or between the third circuit 6 and the second circuit 5.

[0033] Advantageously, at least one first fan 8 is then provided in the generator 1, as a means of suction or thrust provided in the third circuit 6, which first fan 8 is provided with or served by a first suction motor or gearmotor 9, a respective duct or section of the third intake or exhaust circuit 6 opening into the fan 8, so that the first fan 8 is arranged to suck the combustion fumes from the combustion chamber CC. Of course, the first fan 8 could be provided in an initial, intermediate or terminal position of the third circuit 6.

[0034] According to a variant, the recirculation duct 7, if provided, could extend directly from the first fan 8.

[0035] The suction of the fumes from the combustion chamber CC by the first fan 8 can cause a vacuum in the combustion chamber which determines an intake of comburent air through the second circuit 5. Thanks to this expedient, the suction of the fumes from the combustion chamber CC determines, in fact, a vacuum in the latter and thus, if a recirculation duct is provided, causes also the suck of the combustion fumes in the at least one recirculation duct 7 and therefore in the second circuit 5 and/or in the brazier and/or in the combustion chamber.

[0036] If desired, the generator 1 is also provided with

a second fan 10 with a second motor or gearmotor 11 for the intake or delivery of ambient air to be heated in the first circuit 4.

[0037] In this regard, the first circuit 4 for air passage extends from the top of the generator towards the bottom thereof, so that the air to be heated passes through the generator 1 from top to bottom for all or part of its path. Moreover, the first circuit 4 can open on the front of the generator, for example in an area below the door or leaf 3.

[0038] Clearly, a thrust fan and not a suction fan for combustion fumes could also be provided, as well as alternatively or in addition to what is indicated above, a thrust or suction fan for the comburent air. Similarly, the ambient air in the first circuit 4 could also be conveyed upwards starting from the bottom, sides and/or rear of the generator.

[0039] Advantageously, the generator 1 is then also provided with at least one brazier 12 in the combustion chamber CC for the combustion of a first fuel.

[0040] The generator 1 can also be equipped with a tank 13 for a fuel, such as a biomass, for example pellets, as well as with at least one duct or line 14 for feeding this fuel from the tank 13 to the combustion chamber CC and, if provided, to the brazier 12.

[0041] In this regard, the generator 1 can also include means for conveying, for example automatic, such as an auger 15 or the like means, suitably driven, of the fuel along the supply line 14 up to the combustion chamber CC and from there to the brazier 12 or on the fire bed of the combustion chamber CC. The supply line 14 can open into the combustion chamber CC in a position slightly higher than the brazier 12 or even inside the brazier 12.

[0042] With regard to this aspect, the tank 13 can be mounted on the rear of the generator 1, for example in a position raised from the ground and supported by respective uprights or components of the frame 2, while the supply line 14 extends from the tank 13 downwards and towards the front F of generator 1.

[0043] The brazier 12, as it is known, is provided for the positioning and combustion of the fuel or fuels supplied by means of the supply duct 14 from a fuel tank or container kept by a user or also positioned manually by an operator in the combustion chamber CC.

[0044] The generator 1 can then comprise at least one burner or tubular casing 16 adapted to receive the igniter resistance. In this case, advantageously, the flame generation end or tip of the at least one burner or tubular casing 16 is provided in the brazier 12 or better at a lower portion thereof, clearly suitably operated or operable, preferably electronically.

[0045] The brazier 12, if provided, can comprise at least one base 12a and a tubular wall 12b, for example cylindrical, extending from the base 12a and connected to the bottom of the combustion chamber CC. In this case the duct or supply line 14 can be mounted or open into the brazier 12 or above it.

[0046] Moreover, the brazier 12 can delimit at least one hole 12c for the passage of comburent air and any combustion fumes, for example at the base 12a or at the tubular wall 12b. The second circuit 5 is in fluid communication with the passage hole/s 12c, so that the comburent air possibly with the recirculated combustion fumes is/are fed through the at least one passage hole 12c.

[0047] In this case, respective components of the frame 2 could delimit an accumulation area CA around the brazier 12, and the second circuit 5, as will be described later, could flow into this accumulation area CA around the brazier 12 and from this within it through the passage holes 12c for supplying comburent air and any combustion fumes in the brazier 12.

[0048] In this regard, a plurality of holes 12c along the whole base 12a and two or more plurality of holes 12c in the tubular wall 12b can be provided, each plurality being for example aligned along a respective circumference or linear extension, for example concentric or coaxial to the longitudinal axis of the tubular wall 12b.

[0049] The comburent air fed through the holes 12c is mainly used to ignite the flame as soon as possible and once the combustion has started to limit as much as possible the emissions of undesired substances.

[0050] If desired, the brazier 12 even includes an upper wall 12d for receiving the fuel from the supply line 14, which upper wall 12d can for example be flared towards the center or intermediate area of the brazier, so as to convey the fuel towards this center/intermediate area.

[0051] With specific reference to the non-limiting embodiment shown in the figures, the frame 2 comprises a front main body FMB where, among other things, the combustion chamber CC is delimited and, if desired, behind the combustion chamber a zone of passage PZ for ducts of the first and/or third circuit.

[0052] As regards the combustion chamber CC, it is delimited by a bottom 2a, two side walls 2b, 2c, a rear 2d and a top 2e of the front main body FMB.

[0053] With reference to the bottom 2a, it can have a lower wall 2a1 with the brazier 12 mounted in an intermediate position or in the center thereof, which brazier may or may not extend upwards starting from the lower wall 2a1.

[0054] On the sides (starting from them or not) of the lower wall 2a1, the walls or sections of the side wall 2b, 2c extend upwards (if desired also partially downwards), while the rear 2d delimiting the combustion chamber CC extends upwards (also partly downwards) from the rear edge of the lower wall 2a1, which rear 2d is connected, for example welded or mechanically connected to the side walls 2b, 2c.

[0055] If an upper receiving wall 12d of the brazier 12 is provided, the fuel will be fed on the latter and will mainly remain on it or will slide towards the center of the brazier 12 during the respective combustion.

[0056] The rear 2d can be made of a suitable material, for example a refractory material, if desired based on aluminum oxides, calcium silica, silico-aluminous compounds, magnesium compounds and in any case with a chemical composition ensuring use in a combustion

chamber subject to the prolonged action of fire, together with characteristics of reduced thermal conductivity.

[0057] The rear can comprise a section of wall with a main vertical extension 2d, although if desired curved in horizontal section, connected at the top or in one piece with a section with a main horizontal extension and, if desired, also partly vertical 2e1 of the top element 2e, extending from the upper edge of the rear 2d towards the front of the generator 1. The section with main horizontal extension 2e1 of the top element 2e can have a width substantially equal to that of the combustion chamber CC and an extension in the direction front-rear between about 1/3 and 1/2 of the latter.

[0058] The top element 2e can also include a second box-like body or front box-like body 2e2 supported by other walls of the frame 2 or better of the respective upper main body.

[0059] Then, a top wall 2m can be provided as an upper closure of the combustion chamber, which top wall 2m is at a distance between the horizontal main section 2e1 and optional front box-like body 2e2.

[0060] Moreover, an area of passage is delimited between the section with main horizontal extension 2e1 and, if provided, the front box-like body 2e2, which extends upwards and from here towards the passage area PZ and therefore within outlet or discharge ducts 6a which will be discussed later.

[0061] If desired, the two side walls 2b, 2c are bridge-connected by means of a rear wall 2f at a distance from the rear 2d so as to define with it the passage area PZ.

[0062] Moreover, a main jacket 2g can also be provided enclosing the combustion chamber CC and also the rear wall 2f on the rear and sides, which main jacket 2g has an upper section 2g1 which ends at the top of the generator 1 at a level higher than the combustion chamber and the rear wall 2f.

[0063] As regards in more detail the structure of the circuits with reference to the non-limiting embodiment shown in the figures, the first circuit 4 can include one or a series of two, three, four or more conveying ducts 4a, if desired with extension substantially vertical or inclined with respect to the vertical, which extend behind the combustion chamber CC and more particularly behind the rear 2d thereof, in contact or not with the latter.

[0064] The overall passage section defined by the conveying ducts 4a can be any suitable, for example between about 25,000 and 35,000 mm^2, if desired about 30,000 mm^2.

[0065] More specifically, the conveying ducts 4a are open upwards, so that they extend from a top zone UZ of the generator 1, if desired closed or hidden by means of a suitable grid 1b, until they open into a bottom area BA defined from the generator 1 and the second fan 10 is mounted and acts on a boundary wall 4b - in particular the lower one - of the bottom area BA.

[0066] The first circuit 4 can then comprise a delivery duct 4d for the air to be heated, which departs from the second fan 10 and opens at the front of the generator, for example in an area below the door or leaf 3, if desired with a grille covering the discharge end of the conveying duct 4a.

[0067] The top zone UZ is defined at the rear by the upper section 2g1 of the main jacket 2g and frontally by another wall of the frame 2, for example a shaped wall 2h extending upwards from the top wall 2m.

[0068] The conveying ducts 4a can be delimited or fitted and therefore extend into the passage zone PZ between the rear 2d and the rear wall 2f.

[0069] If desired, a baffle 17 is also provided, mounted in the bottom area BA under the lower end of the conveying ducts 4a and arranged to deviate the flow of air exiting from the conveying ducts 4a, so that it does not enter directly into the second fan 10, but only after it has passed around the baffle 17. In this case, the baffle 17 can be supported by means of one or more sections of wall extending between the upper wall 4c delimiting the bottom area BA and a respective section, if desired an edge section of the deflector 17.

[0070] The baffle 17 can be made of a plate, if desired, made of metallic material, with horizontal or inclined main extension with respect to the horizontal. According to the non-limiting embodiment shown in the figures, the baffle 17 has a main section 17a with an end front and proximal to the front F of the generator 1 at a level higher than the respective rear or distal end of the front F of the generator. The baffle 17 can also be provided with end sections 17b, 17c each extending from the main section 17a, which end sections 17b, 17c are bent from the main section 17a upwards.

[0071] Basically, according to the non-limiting embodiment illustrated in the figures, the first circuit 4 extends from the top to the bottom of the generator 1, actually passing behind the combustion chamber CC.

[0072] With reference instead to the second circuit 5, it can extend from the rear R of the generator 1 to the combustion chamber CC.

[0073] More specifically, an intake opening SO can be provided open towards the rear R of the generator 1, from which a supply duct 18 starts and flows, directly or not, into the combustion chamber CC.

[0074] The intake opening SO could have any suitable size, for example between about 800 and about 1200 mm^2, if desired about 1000 mm^2.

[0075] Moreover, the generator 1 can provide, for defining or delimiting the intake opening SO, a fitting or sleeve 25, for example flanged, which can be mounted, for example by means of screws, on the frame 2, if desired on the rear R of the latter, which fitting or sleeve 25 would guarantee or facilitate the connection, if necessary, of a pipe for conveying air from the outside towards the intake opening SO.

[0076] The supply duct 18 can have any suitable configuration and position. Thus, for example, the supply duct 18 can extend starting from the suction opening SO, from the bottom upwards with a curved or rectilinear extension or even with other extension. This duct 18 can

have, for example, a cross-section circular or of another shape.

[0077] If desired, a first box-like body or plenum 19 is also provided, where the supply duct 18 opens and, if desired, into which the recirculation pipe or duct 7, if provided, opens.

[0078] In this case, the box-shaped body 19 can define a first area FA where the supply duct 18 and, if desired, the recirculation duct 7 open, as well as a second area SA, in fluid communication by means of a suitable passage opening 20 with the first area FA, which second area SA is open towards the combustion chamber by means of a window 21.

[0079] In this case, the window 21 can open into the accumulation area CA, if provided, and from here into the brazier 12.

[0080] As regards in detail the non-limiting configuration shown in the figures of the box-like body 19, it can be provided with a first portion 19a defining the first area FA and having a configuration for example of a polyhedron, such as a cube or a parallelepiped, and a second portion 19b defining the second area SA and with configuration for example of a polyhedron, such as a cube or a parallelepiped, with a wall or a section of wall in common with the first portion 19a, in which second portion the passage opening 20 is delimited, if desired having circular profile.

[0081] Moreover, the second portion 19b has an extension greater, for example between 2 and 4 times than the first portion 19a.

[0082] The second portion 19b can have a wall or a portion of wall in common with the front main body FMB or with the rear of the same or in any case a wall or a section of the wall of the second portion 19b is leaning against a respective section of a wall (if desired, the rear) of the combustion chamber CC or of the front main body FMB.

[0083] The tubular casing 16 designed to house the igniter resistance can extend through the box-like body 19 or the respective second portion 19b and then through the accumulation area CA where an end or tip for generating the flame is provided.

[0084] The second circuit 5 could also include a branch duct 22 for transmitting the comburent air at the door 3 or better flush the internal surface 3a1 of the respective glass or double glazing 3a.

[0085] The branch duct 22 can comprise, among others, a duct, which if desired extends from the box-like body or plenum 19 and flows into an upper area of the frame 2. Said branch duct 22 can have, for example, a main section 22a which is substantially vertical and, if desired, one, two or more horizontal sections 22b, 22c from the box-like body 19 to the vertical portion 22a and from this in the door 3 or in an intermediate component, which two horizontal sections 22b, 22c could also be at different levels. The main section 22a can extend on a side of the generator 1.

[0086] According to the non-limiting embodiment shown in the figures, the frame 2 has in an zone at the top of the combustion chamber CC, at least one front box-like body 2e2 including a series of wall sections 2e3, 2e4 mutually connected with each other, if desired by means of screws or welding, so as to define a volume HV where the branch duct 22 flows, which volume HV is open at the bottom, for example at a slot SL which runs immediately above the internal surface 3a1 of the glass or double-glazing unit 3a and for an extension equal to all or part of its width.

[0087] This volume HV can have a first upper section HV1, if desired, with a rectangular or polygonal section and a second lower section HV2 with a section decreasing downwards up to if desired a section of a few mm.

[0088] To this end, a first upper series of sections of wall 2 and 3 are provided such as to define the first upper section HV1 and a second lower series of sections of wall 2 and 4 such as to define the second lower section HV2 and opening below into the slot SL.

[0089] With regard then to the third circuit 6, it can extend for example starting from a zone above and behind the combustion chamber CC and more particularly in the passage zone PZ.

[0090] With reference to the non-limiting embodiment shown in the figures, the third circuit 6 includes one or a series of two, three, four or more outlet or exhaust ducts 6a, for example with an extension substantially vertical or slightly inclined with respect to the vertical.

[0091] The end of entrance to the outlet or exhaust duct or ducts 6a can be accessible (from the fumes or combustion gases) from an area above the top of the combustion chamber CC, and more particularly between the top wall 2m and the section with horizontal main extension 2e1.

[0092] In this regard, the combustion chamber CC is defined by an upper section 2e1 with a passage opening, slot or path around or in front of this upper section 2e1 so as to reach the upper ends of the outlet or exhaust ducts 6a. Of course, such a condition can be achieved with any suitable structure.

[0093] These outlet or discharge ducts 6a can be arranged between or alternated with respective conveying ducts 4a, if the latter are provided.

[0094] Basically, the outlet or discharge ducts 6a and the conveying ducts 5a are advantageously in the same zone with reference to the distance with respect to the combustion chamber CC and even more advantageously they are separated from the latter only by a wall constituted by the rear 2d.

[0095] Moreover, the outlet ducts 6a can be delimited or fitted between the rear wall 2f and the rear 2d of the combustion chamber CC.

[0096] These outlet ducts 6a open below into a manifold zone CZ of the third circuit 6, which area is defined below the combustion chamber CC and, if desired, above the bottom area BA, if the latter is provided. The manifold zone CZ can be defined below by the upper wall 4c delimiting the bottom area BA.

[0097] With reference to this aspect, the outlet ducts 6a are open at the front at the manifold zone CZ.

[0098] In the manifold zone CZ, a tubular component 23 can be mounted, if desired above the upper wall 4c, if desired with at least one suitably perforated wall 23a, which tubular component 23 extends from the manifold zone CZ towards the rear of the generator 1 and can open into the first fan 8 or into a duct that opens into the first fan 8.

[0099] With regard to this aspect, a plurality of holes 23b, for example two, three, four, five, six or more, each with a diameter between 10 and 20 mm, for example about 15 mm, can be delimited in a wall 23a, if desired frontally, of the tubular component 23.

[0100] An exhaust duct 24 of the third circuit 6 can then extend from the first fan 8 and open on the rear R of the generator.

[0101] In this case, the recirculation pipe or duct 7 can extend from the tubular component 23 and/or from the exhaust duct 24 or even from the fan 8.

[0102] As regards the heat exchange between circuits 4, 5 and 6, as above indicated, the first 4 and/or second 5 circuits are in a heat exchange ratio for a section thereof with the third circuit 6.

[0103] Thus, for example, heat exchange could be provided between the first 4 and third 6 circuits, this occurring in particular between at least one conveying duct 4a and at least one outlet or exhaust duct 6a. In this regard, according to the non-limiting embodiment shown in the figures, at least one conveying duct 4a is parallel for at least 60%, 70%, 80% or 90% and extends alongside or if desired shares a wall with at least one outlet or discharge duct 6a.

[0104] Preferably, at least two conveying ducts 4a are provided, one opposite to the other with respect to an outlet or discharge duct 6a or viceversa.

[0105] Alternatively or in addition to what has now been indicated, heat exchange between second 5 and third 6 circuit could be provided.

[0106] In this regard, the box-like body or plenum 19, if desired, a respective second portion 19b, could extend alongside, if desired in contact with an outlet or discharge duct 6a or between two outlet or discharge ducts 6a.

[0107] Moreover, the manifold zone CZ, if provided, could be in heat exchange with the bottom area BA, if the latter is provided.

[0108] Of course, the generator also comprises a control unit or unit for electronic control of the respective components, such as for example the motors, any valves, the auger, etc.

[0109] Therefore, it will be possible to ascertain, as thanks to a generator according to the present invention, it is thus possible to recirculate the fumes or exhaust gases from the third circuit 6 into the second circuit 5 and/or directly into the combustion chamber CC and/or into the brazier 12 .

[0110] In this regard, by activating a fan for suctioning or delivering fumes, the latter are also conveyed into the at least one recirculation duct 7 and thus into the second circuit 5 and/or directly into the combustion chamber CC and/or into the brazier 12, this being obtained according to the size of the ducts or even after activating suitable valves.

[0111] The holder of the present patent rights has been able to experience that owing to a generator according to the present invention it is possible to reduce remarkably nitrogen oxide emissions.

[0112] As a further benefit, combustion was further completed with an increase in the CO2 content and a reduction in pollutants such as particulate matter.

[0113] Moreover, as it will be able to ascertain, the increase in the concentration of CO2 benefits the corrective formulas of the pollutants referring to a predetermined value of oxygen and this also determines a significant increase in combustion efficiency.

[0114] Changes and variants of the invention are possible within the scope defined by the claims.

Claims

1. Heat generator for heating environments comprising a main frame (2) delimiting a combustion chamber (CC), said generator further including a door for opening/closing (3) an opening for accessing to the combustion chamber (CC), said frame delimiting a first circuit (4) for the passage of ambient air to be heated in the generator and conveyed into the environment around said generator, a second circuit (5) for transmitting comburent air from the external environment to the generator in the combustion chamber (CC) and a third circuit (6) for the intake or discharge of the combustion fumes from the combustion chamber (CC) to the outside,

   wherein the first circuit (4) is in a heat exchange ratio for a section thereof with said third circuit (6), so that the ambient air to be heated is heated by the heat emanating from the combustion fumes flowing in the third circuit (6),
   where said first circuit (4) extends from the top of the generator towards the bottom thereof, so that the air to be heated passes through the generator from top to bottom for all or part of its path, and
   wherein said third circuit (6) extends from a zone above and behind the combustion chamber (CC) and includes at least one outlet or exhaust duct (6a) with an extension substantially vertical or slightly inclined with respect to the vertical.

2. Heat generator according to claim 1, comprising a second fan (10) with a second motor (11) for the intake or delivery of ambient air to be heated in the first circuit (4).

3. Heat generator according to claim 2, wherein said first circuit (4) includes at least one conveying duct (4a) extending behind the combustion chamber (CC), said at least one conveying duct (4a) being open upwards, so that it extends from a top zone (UZ) of the generator, until it opens into a bottom area (BA) defined from the generator itself and the second fan (10) acts in the bottom area (BA).

4. Heat generator according to claim 3, comprising a baffle 17 mounted in the bottom area (BA) under the lower end of said at least one conveying duct (4a) and arranged to deviate the flow of air exiting from said at least one conveying duct (4a), so that it does not enter directly into the second fan (10), but only after it has passed around the baffle (17).

5. Heat generator according to claim 2, 3 or 4, wherein said first circuit (4) comprises a delivery duct (4d) for the air to be heated, which departs from the second fan (10) and opens at the front of the generator.

6. Heat generator according to any one of the preceding claims, comprising at least one first fan (8) provided or served by a first suction motor (9), a respective duct or section of the third circuit (6) opening into such fan (8), so that the first fan (8) is designed to suck the combustion fumes from the combustion chamber (CC).

7. Generator according to claim 6, wherein the suction of the fumes from the combustion chamber (CC) by the first fan (8) determines an intake of comburent air by means of the second circuit (5) into the combustion chamber (CC), so that the suction of the fumes from the combustion chamber (CC) determines a vacuum in the latter and therefore also determines the suction of comburent air by means of the second circuit (5).

8. Generator according to claim 6 or 7, wherein said at least one outlet duct (6a) opens below into a manifold zone (CZ) defined below the combustion chamber (CC), in the manifold zone (CZ), a tubular component (23) is mounted having at least one perforated wall (23a), said tubular component (23) opening into said first fan (8).

9. Generator according to claim 6 or 7 or 8, wherein an exhaust duct (24) of the third circuit (6) extends from the first fan (8) and open on the rear (R) of the generator.

10. Generator according to any one of the preceding claims, comprising a plurality of outlet or discharge ducts (6a) and a plurality of conveying ducts (4a), wherein said outlet or discharge ducts (6a) are arranged between or alternated with respective conveying ducts (4a).

11. Generator according to claim 10, wherein said outlet or discharge ducts (6a) and said conveying ducts (5a) are in the same zone with reference to the distance with respect to the combustion chamber CC.

12. Generator according to any one of the preceding claims, comprising at least one brazier (12) in the combustion chamber (CC) provided for positioning and the combustion of fuel, said second circuit (5) opening at said at least one brazier (12).

13. Generator according to any one of the preceding claims, wherein said second circuit (5) extends from the rear (R) up to the combustion chamber (CC).

14. Generator according to claim 13, delimiting an intake opening (SO) open towards the rear (R) of the generator from which a supply duct (18) of the second circuit (5) branches off and flows into a box-shaped body (19) of the second circuit (4), said box-shaped body (19) being open towards the combustion chamber (CC) through a window (21).

15. Generator according to any one of the preceding claims, comprising at least one duct for recirculating (7) the combustion fumes from the third circuit (6) or from suction or thrust means provided in the same or for the same in the combustion chamber (CC) and/or in the second circuit (5) and/or in a brazier (12) of the generator in the combustion chamber (CC).

16. Generator according to any one of the preceding claims, wherein the second circuit (5) is in a heat exchange ratio for a section thereof with the third circuit (6), so that the comburent air is heated by the heat emanating from the combustion fumes flowing in the third circuit (6).

17. Generator according to any one of the preceding claims, wherein said frame (2) comprises a front main body (FMB) where the combustion chamber (CC) is delimited and behind the combustion chamber a zone of passage (PZ) for ducts of the first and/or third circuit.

18. Generator according to claim 17, wherein the combustion chamber (CC) is delimited by a bottom (2a), two side walls (2b, 2c), a rear (2d) and a top (2e) of the front main body (FMB).

19. Generator according to claim 18, wherein the rear comprises a section of wall with a main vertical extension (2d), connected at the top or in one piece with a section with a main horizontal extension and, if desired, also partly vertical (2e1) of the top element

(2e), said main horizontal extension section (2e1) extending from the upper edge of the rear (2d) towards the front of the generator.

20. Generator according to claim 19, comprising a top wall (2m) provided as an upper closure of the combustion chamber (CC), which top wall (2m) is at a distance between the horizontal main section (2e1) and a front box-like body (2e2) of the top element (2e).

21. Generator according to claim 20, wherein an area of passage is delimited between the section with main horizontal extension (2e1) and the front box-like body (2e2), which extends upwards and from here towards the passage area (PZ) and therefore within said at least one outlet or discharge duct (6a).

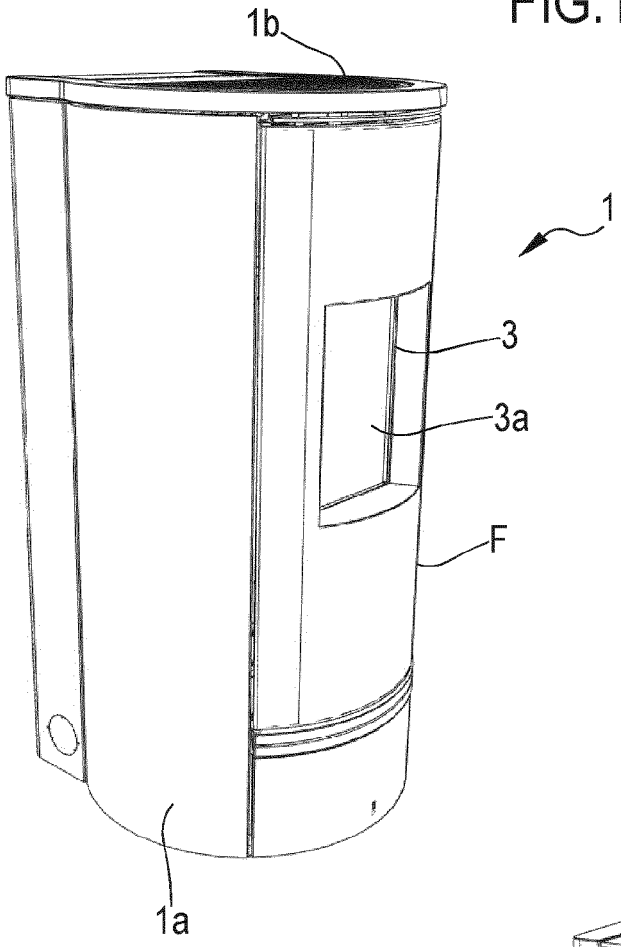
22. Generator according to any one of the preceding claims from 17 to 21, wherein the two side walls (2b, 2c) are bridge-connected by means of a rear wall (2f) at a distance from the rear (2d) so as to define with it the passage area (PZ).

23. Generator according to claim 22, comprising a main jacket 2g enclosing the combustion chamber (CC) and also the rear wall 2f on the rear and sides, which main jacket (2g) has an upper section (2g1) which ends at the top of the generator at a level higher than the combustion chamber and the rear wall (2f).

24. Generator according to claim 22 or 23, wherein said at least one conveying duct (4a) is delimited or fitted and therefore extends into the passage zone (PZ) between the rear (2d) and the rear wall (2f).

25. Generator according to claim 22 or 23, wherein said at least one conveying duct (4a) is delimited or fitted between the rear wall (2d) and the rear (2f) of the combustion chamber (CC).

FIG.1



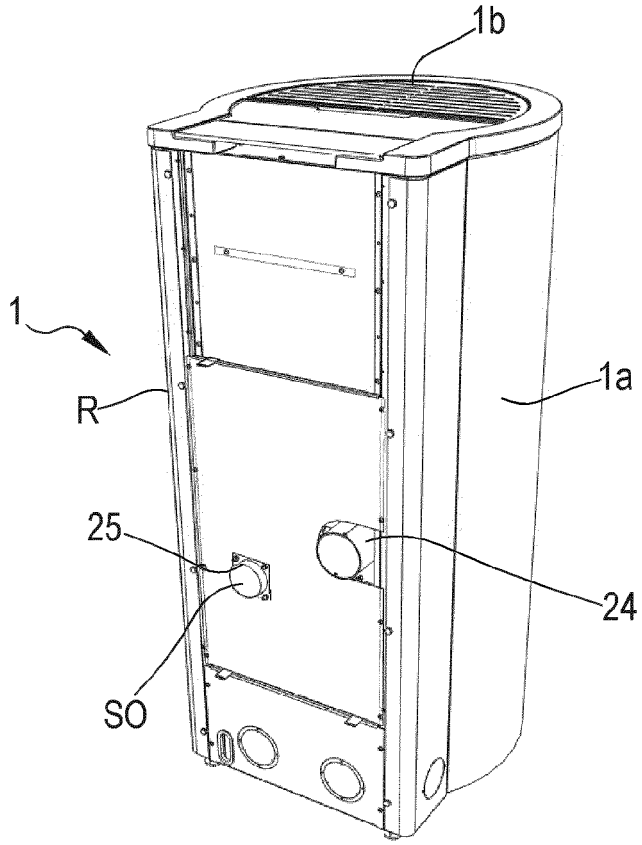


FIG.2

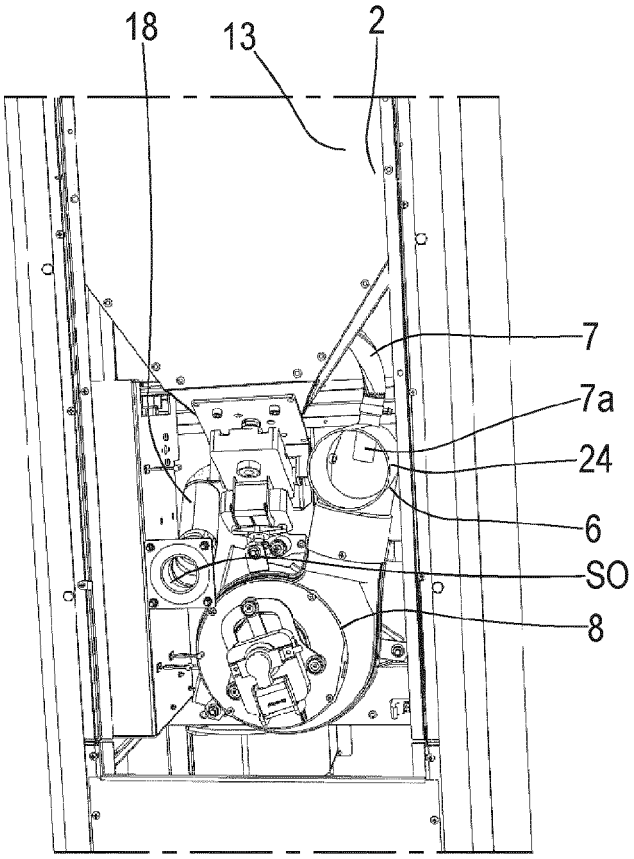


FIG.3

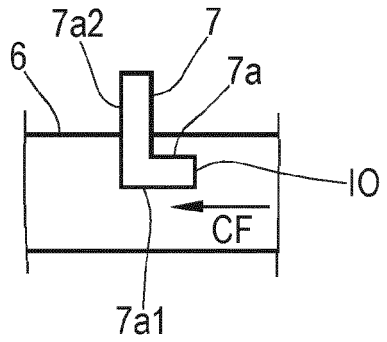


FIG.3a

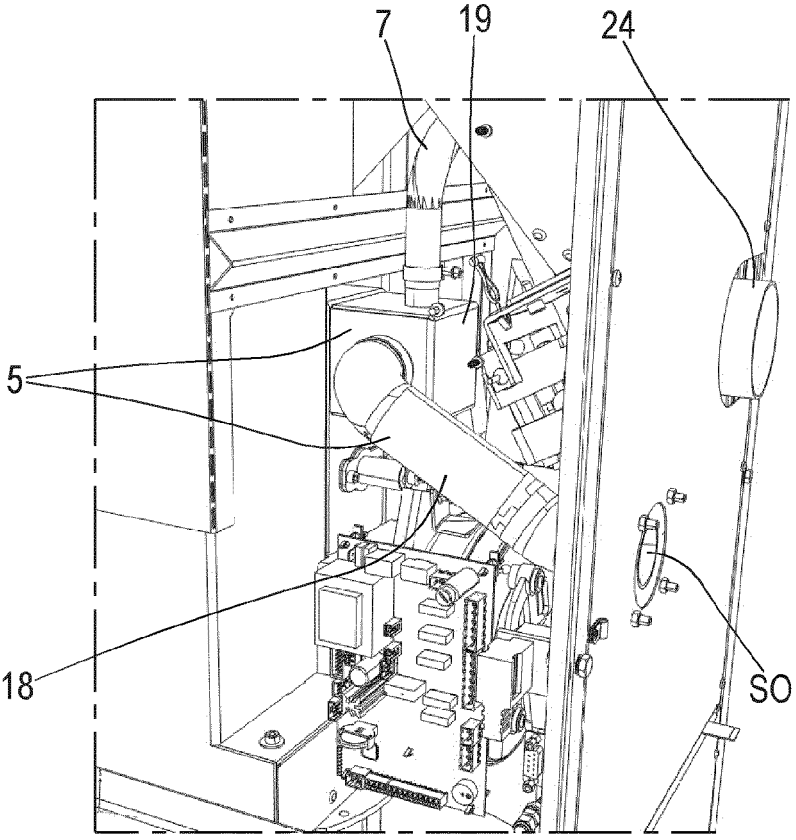
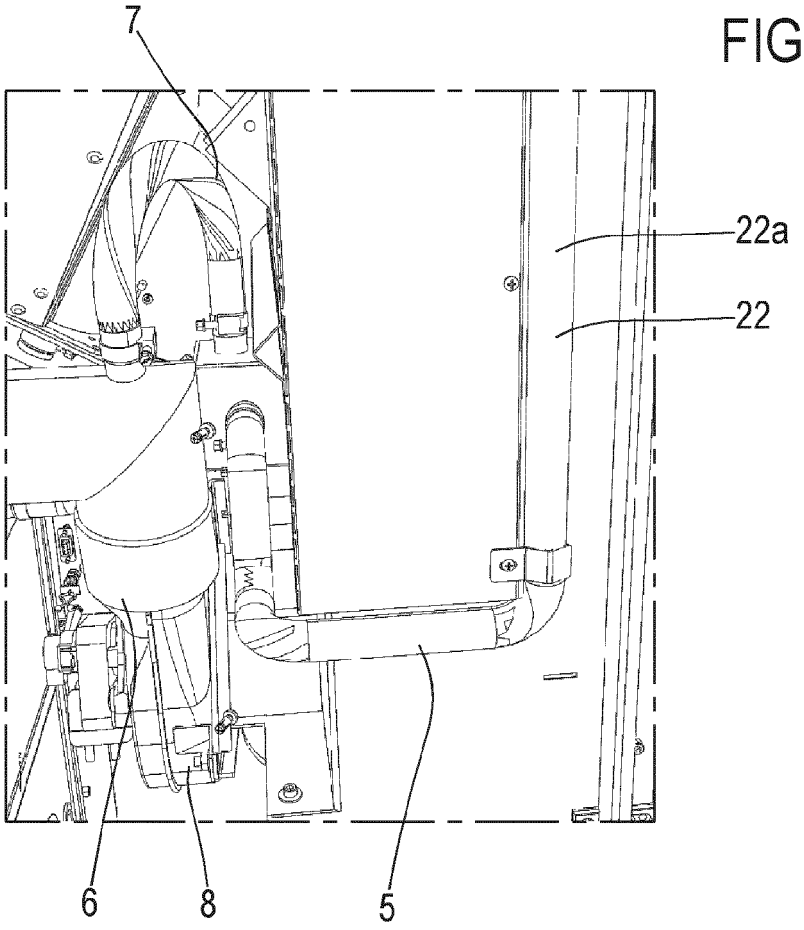


FIG.4

FIG.5



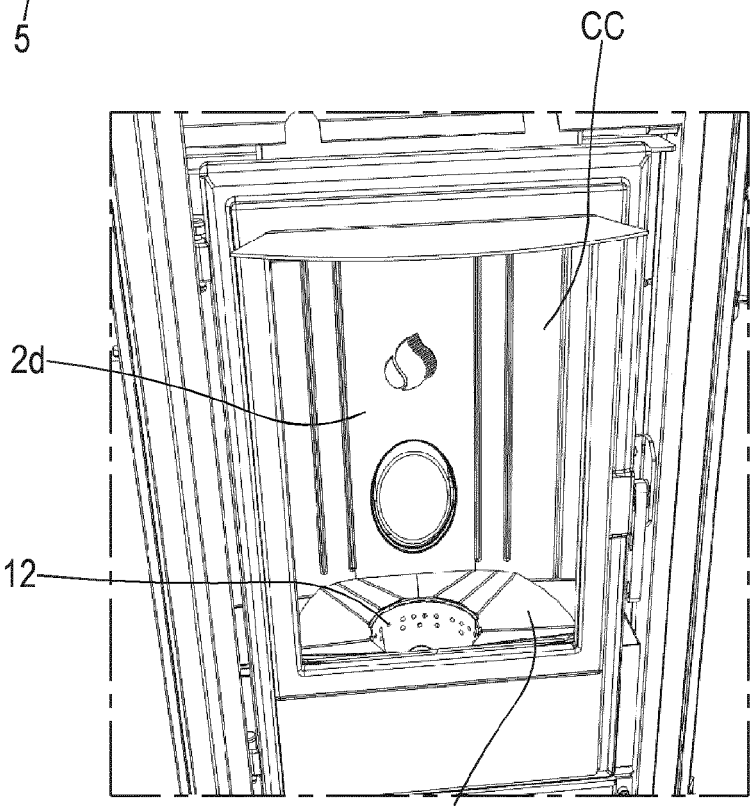
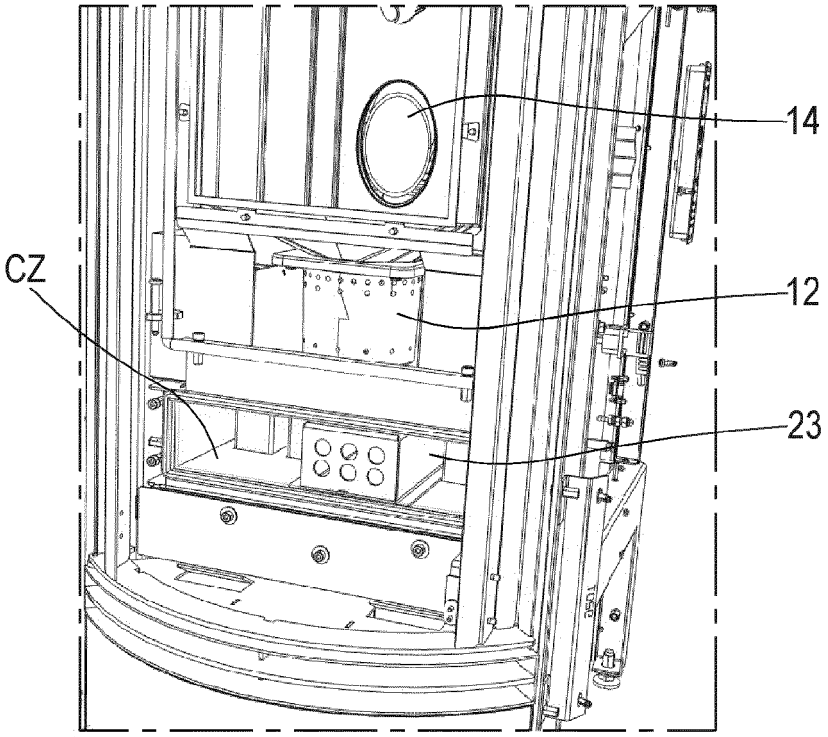


FIG.6

FIG.7



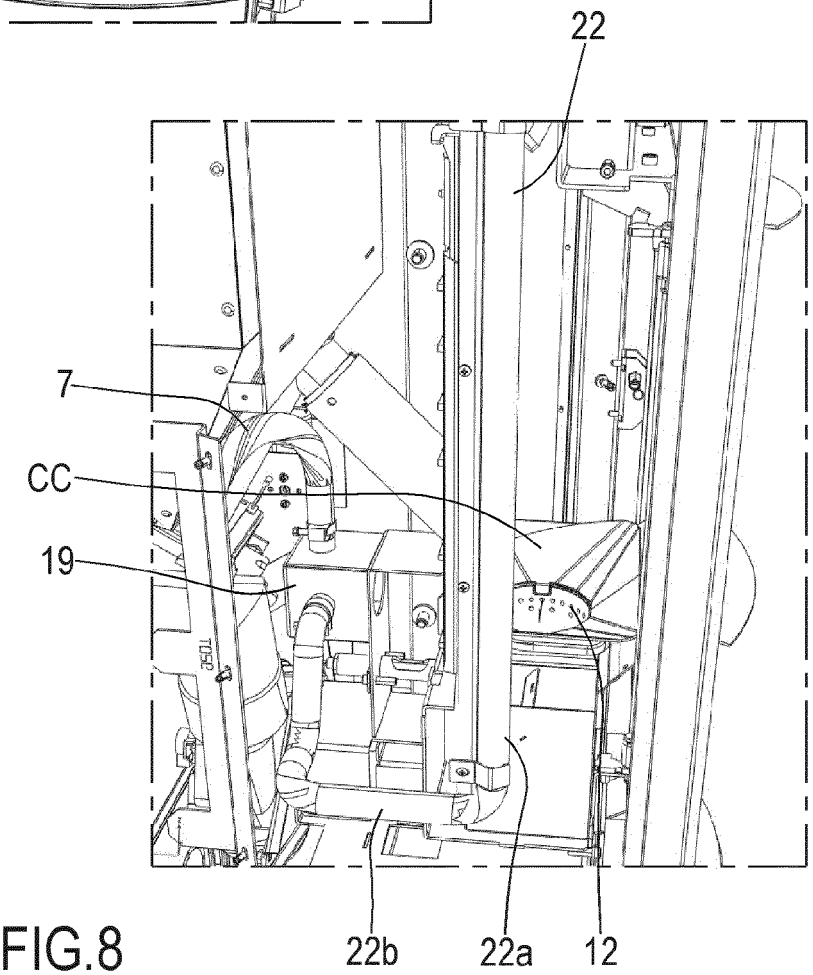
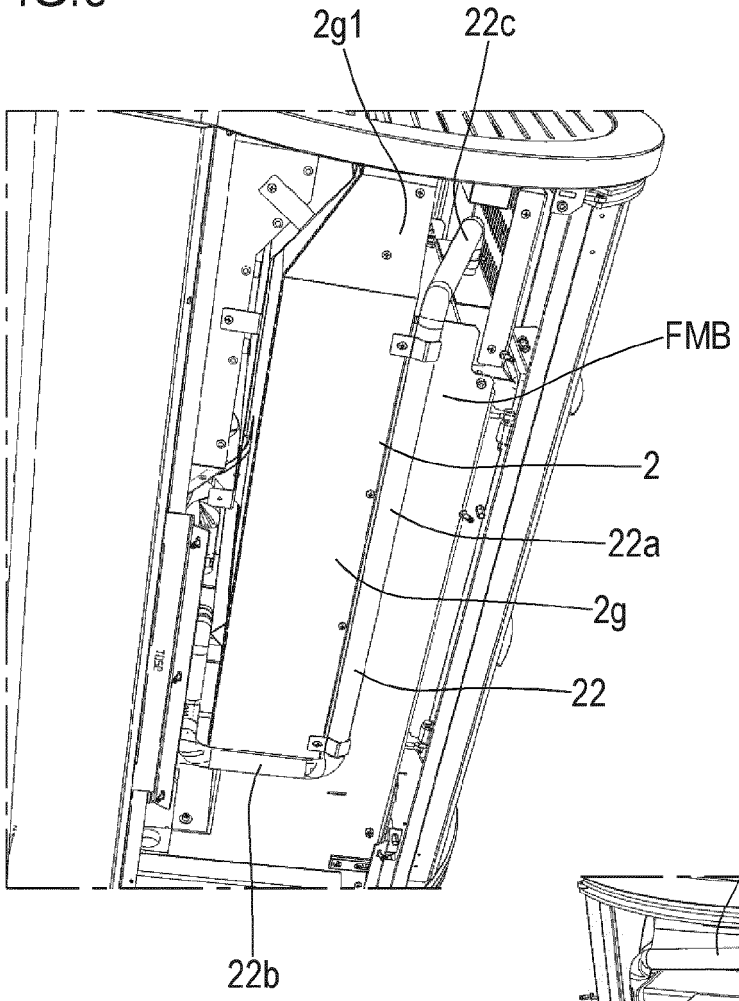


FIG.8

FIG.9



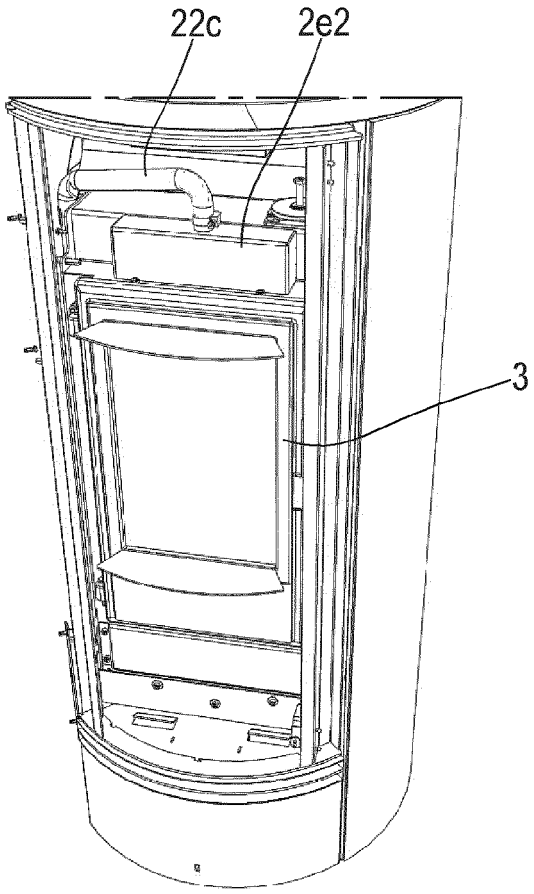


FIG.10

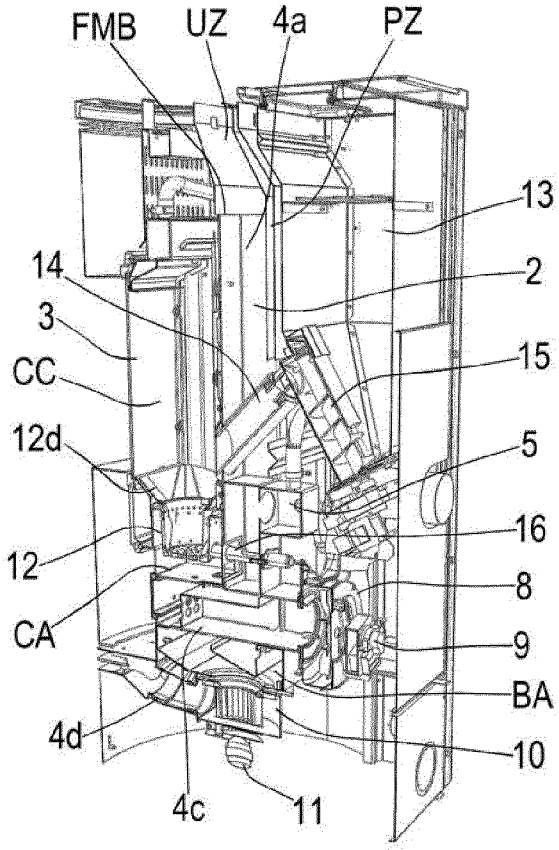

FMB
UZ
4a
PZ
13
14
2
3
15
CC
5
12d
16
12
8
CA
9
BA
4d
10
4c
11

FIG.11

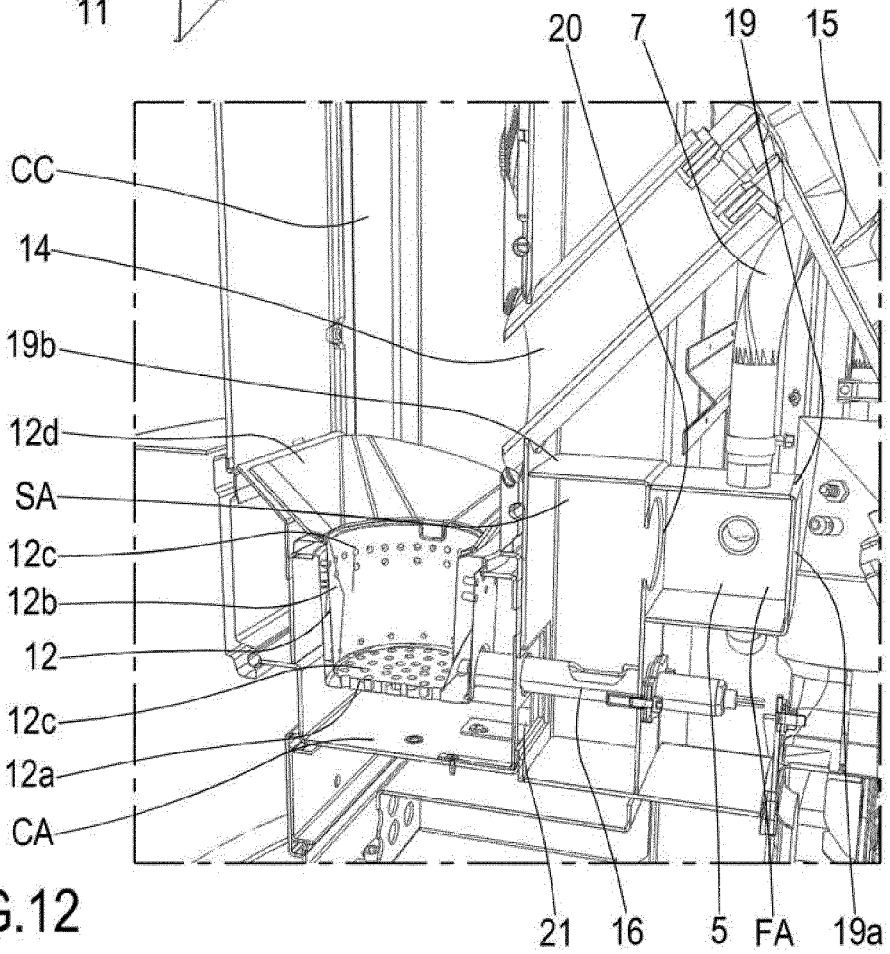
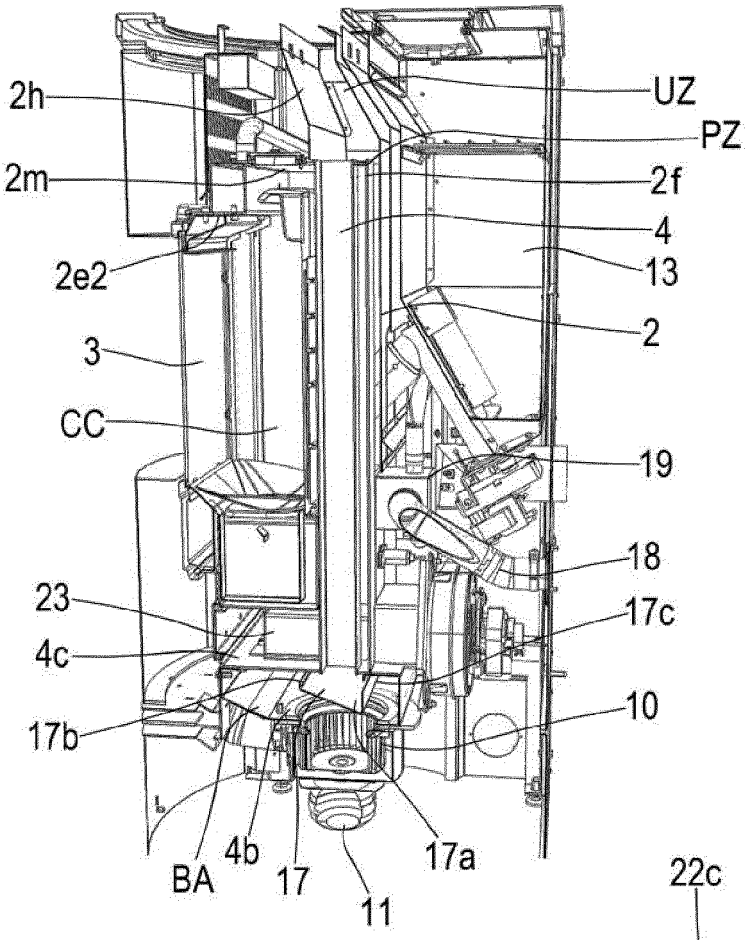

20
7
19
15
CC
14
19b
12d
SA
12c
12b
12
12c
12a
CA
21
16
5
FA
19a

FIG.12

FIG.13


2h
2m
2e2
3
CC
23
4c
17b
BA
4b
17
11
17a
UZ
PZ
2f
4
13
2
19
18
17c
10

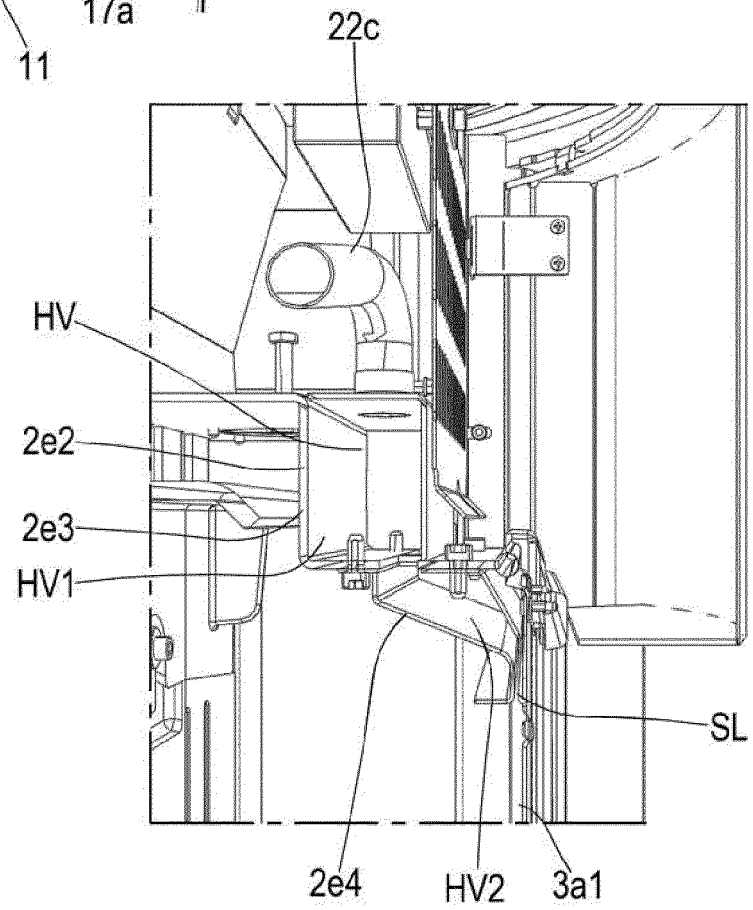

22c
HV
2e2
2e3
HV1
SL
2e4
HV2
3a1

FIG.14

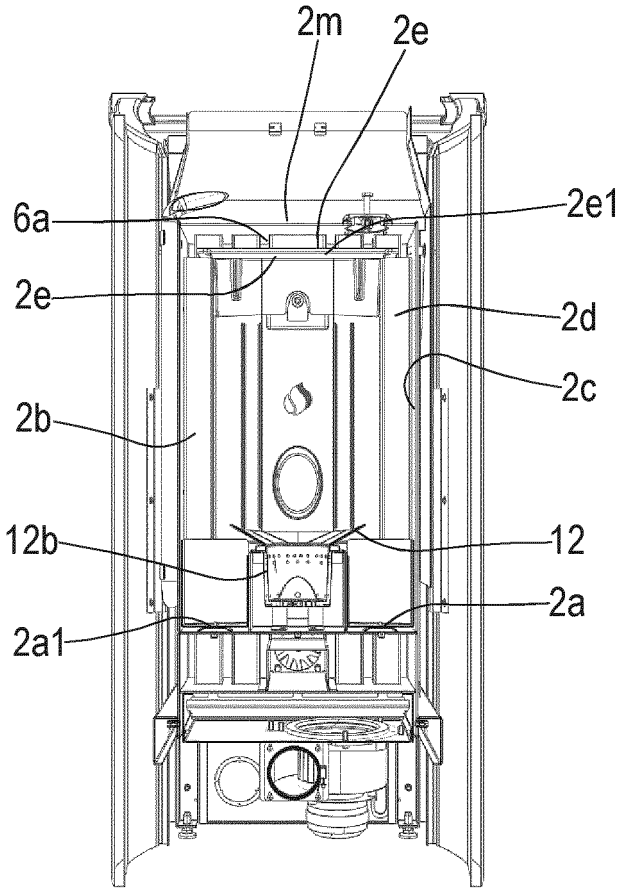


FIG.15

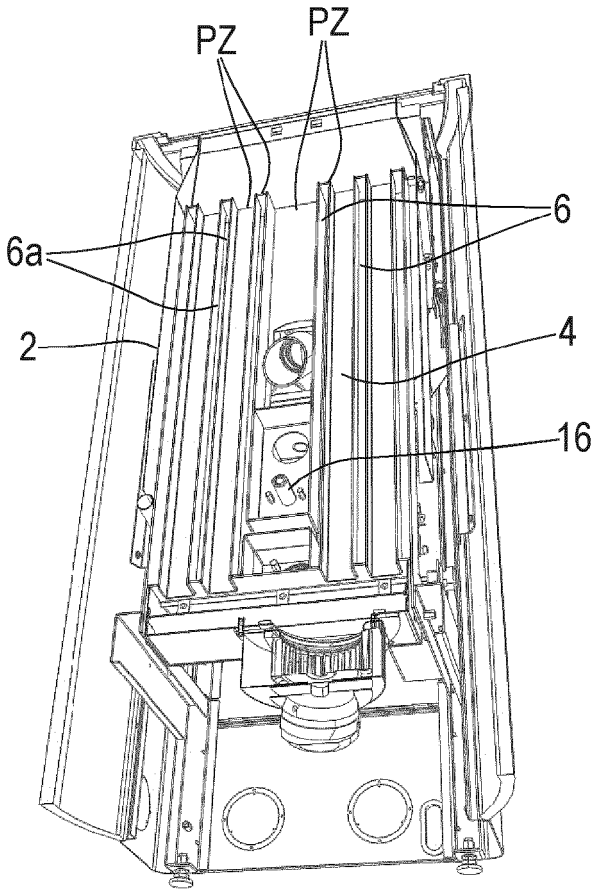


FIG.16

FIG.17

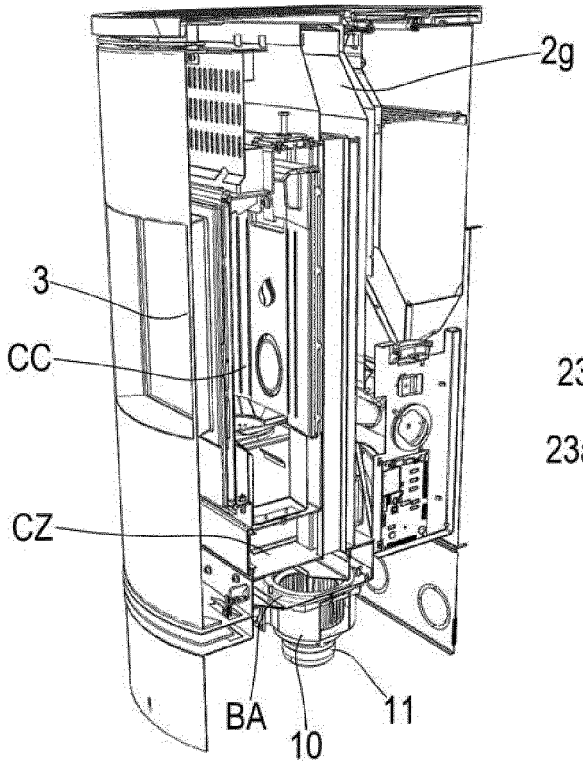
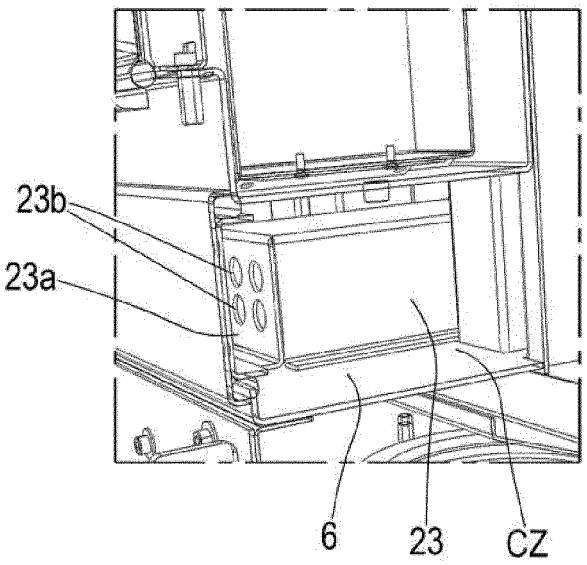


FIG.18



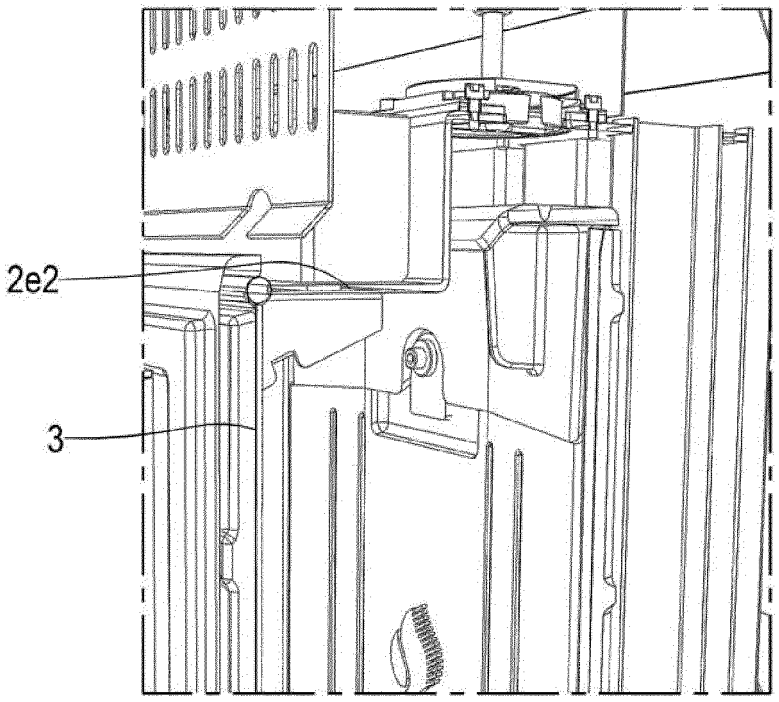
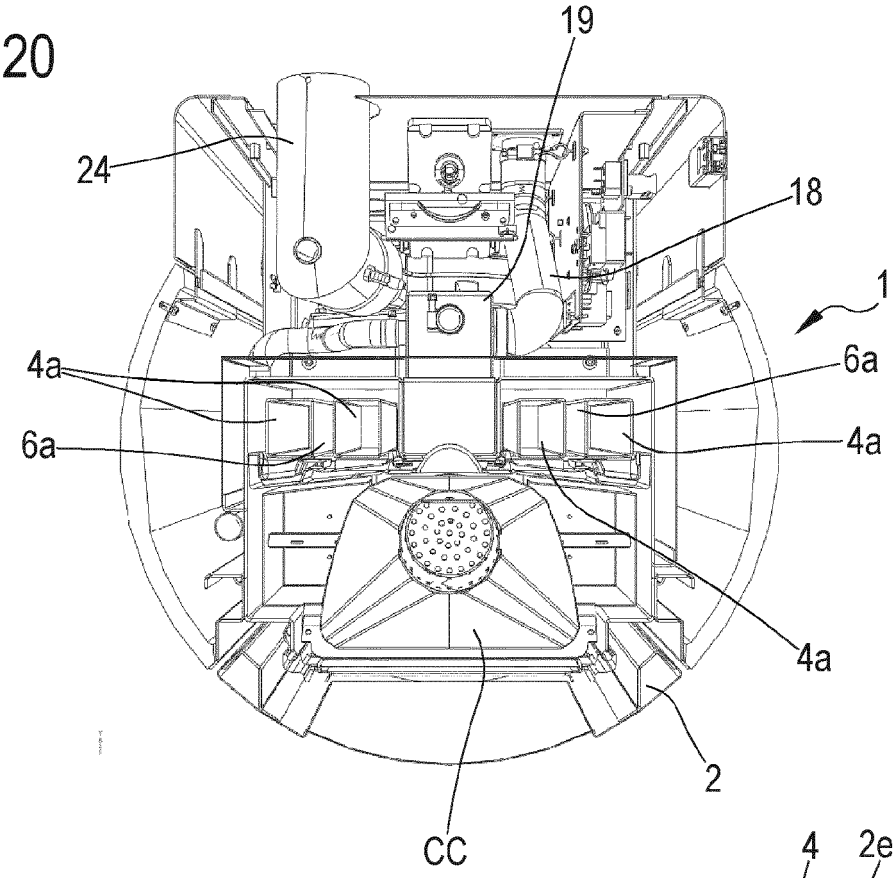


FIG.19

FIG.20



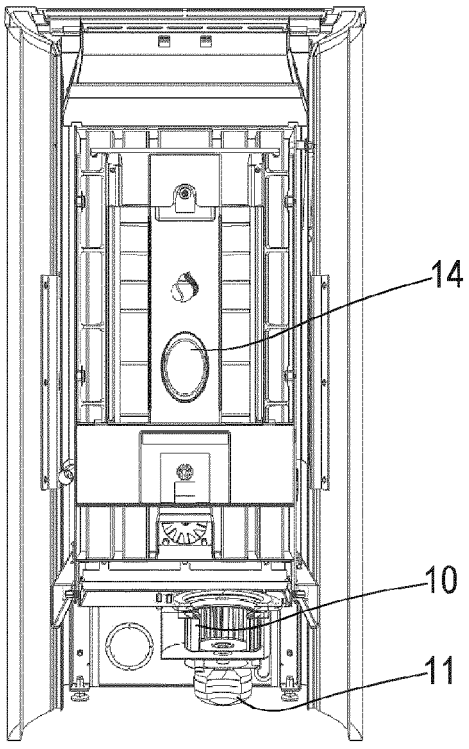


FIG.21

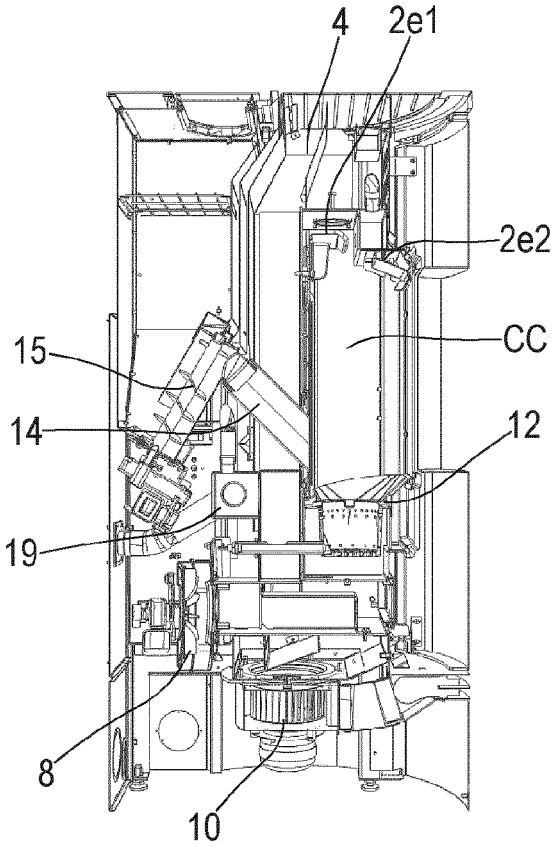


FIG.22

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EUROPEAN SEARCH REPORT

Application Number
EP 22 16 4690

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	WO 2006/008762 A1 (DI CECILIA FILIPPO ANTONIO [IT]) 26 January 2006 (2006-01-26)	1-3,6,7, 9,12-14, 16-18	INV. F23B30/00 F23B50/12 F23B60/02 F23B80/00 F24B1/185 F24B1/189 F24B5/02
Y	* page 1, line 5 - line 9; figures	15	
A	1,2,4-11 * * page 4, line 2 - page 6, line 11 * * page 6, line 19 - line 23 * * page 7, line 4 - line 8 *	4,5,8, 10,11, 19-25	
X,D	EP 1 327 825 B1 (GRUPPO PIAZZETTA SPA [IT]) 5 April 2006 (2006-04-05)	1-3,6,7, 9,12,13, 16	
	* paragraph [0001]; figures 1-3 * * paragraphs [0009] - [0013] * * paragraph [0015] *		
Y	WO 2019/145854 A1 (BELLINTANI CLAUDIO [IT]; SORRENTINO GIUSEPPE [IT]) 1 August 2019 (2019-08-01)	15	
A	* page 1, line 3 - line 7; figure 1 * * page 3, line 28 - page 5, line 17 * * page 6, line 4 - line 8 *	1	

TECHNICAL FIELDS SEARCHED (IPC)

F23B
F24C
F24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 August 2022	Hauck, Gunther

CATEGORY OF CITED DOCUMENTS

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03-08-2022

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

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