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(54) HEATING APPARATUS

(57) Heating apparatus, particularly of the stove, fireplace and similar type, fed with fuels such as wood, pellets and the like, comprising a combustion chamber (2), forced expulsion means (3) of the combustion fumes from the combustion chamber (2), a fume outlet path (4) from the combustion chamber (2) along which the forced expulsion means (3) are arranged, and at least one cyclone separator (5) of the combustion fumes, positioned at the end of the path (4), a support structure (7) in which the separator (5) is integrated, the outlet path (4) being integrated in the support structure (7) and comprising one first discending section (11) communicating with the combustion chamber (2), and one second ascending section (13) communicating with the separator (5). The forced expulsion means (3) comprise one fan (3) at the top of the second ascending section (13) and at the inlet for the fumes into the separator (5).

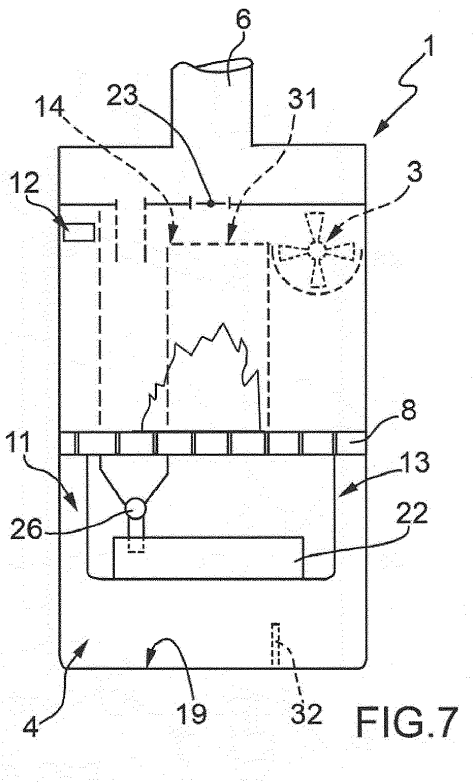

FIG.7

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention concerns a heating apparatus.

[0002] More in particular, the present invention concerns a heating apparatus such as a stove, a fireplace or the like.

STATE OF THE ART

[0003] Apparatuses, such as stoves, fireplaces and the like, for heating environments fed with solid fuels such as wood, pellets, wooden chips and the like, are known and widespread. These apparatuses, although allowing renewable energy sources and not fossil fuels, to be used, are responsible of the emission in the atmosphere of considerable amounts of particulate.

[0004] As known, such a particulate is made up of an array of solid particles with different chemical composition and granulometry, and some studies deem that its concentration in the atmosphere is responsible for various problems related to the pollution of the environment.

[0005] Moreover, such a particulate tends, over time, to dirty and clog up the fume exhaust of the heating plant, thus requiring frequent and wasteful maintenance operations.

[0006] Nowadays, the majority of the heating apparatuses installed in the civil field are completely without means for the abatement of the particulate transported by the combustion fumes, therefore the combustion fumes are discharged directly into the atmosphere without being treated.

[0007] Some apparatuses are equipped with catalytic filtering systems, or other systems, for example operating electrostatically, installed in the chimney, which are extremely expensive and require frequent maintenance and replacement of the clogged parts.

[0008] On the other hand, there are known means for the abatement of the particulate mainly used in the industrial field, operating according to various principles, which cannot obviously be applied to small heating apparatuses used in the civil field.

PURPOSES OF THE INVENTION

[0009] The technical field of the present invention is thus that of improving the state of the art, by devising a heating apparatus which makes it possible to abate or considerably minimise the emission of particulate, present in the combustion fumes, into the atmosphere.

[0010] In the field of such a technical task, one purpose of the present invention is to make a heating apparatus with limited emission of particulate which is structurally and functionally simple.

[0011] Yet another purpose of the present invention is that of devising a heating apparatus with limited emission of particulate which can be made at low costs and with means known in the field.

[0012] A further purpose of the present invention is that of making a heating apparatus with limited emission of particulate which is distinguished by technical characteristics of use and by installation bulks which are comparable with those of know types of apparatuses.

[0013] This task and these purposes are achieved by the heating apparatus according to the attached claim 1.

[0014] According to one aspect of the present invention, the heating apparatus comprises a fume outlet path from the combustion chamber, along which there are forced expulsion means, and which leads to a cyclone separator. While passing said path the fumes are progressively cooled down, and also the coarsest part of the particulate transported by the fumes themselves is held.

[0015] Then, inside the cyclone separator, the finer particles of the particulate are deposited, so that the residual concentration in the fumes, which leave the apparatus and are directed towards the fumes exhaust, is minimised.

[0016] According to another aspect of the present invention, the path of the fumes in outlet and the cyclone separator are both completely integrated inside the support structure, so as to minimise the bulk and to eliminate any cost or any additional installation and/or maintenance activity.

[0017] According to a further aspect of the present invention, the forced expulsion means of the fumes are foreseen near to the inlet of the cyclone separator, so as to increase the inlet speed of the fumes into the separator itself and so as to increase the efficiency of the separator.

[0018] According to yet another aspect of the present invention, some sections of the fume outlet path are arranged at the sides of the support structure of the apparatus, so as to improve the heat exchange with the exchange fluid, be it liquid or aeriform.

[0019] According to a further aspect of the present invention, the heating apparatus comprises a support structure in which the cyclone separator is integrated; the fume outlet path is integrated in the support structure and it comprises at least one first discending section communicating with the combustion chamber, and at least one second ascending section communicating with said cyclone separator.

[0020] According to yet another aspect of the invention, the forced expulsion means of the fumes comprise at least one fan positioned at the top of said second ascending section and at the inlet for the fumes into said cyclone separator.

[0021] Further advantageous characteristics are described in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The characteristics of the invention shall become clearer to a man skilled in the art from the following description and from the attached drawing tables, given

as an example and not for limiting purposes, in which:

figure 1 is a schematic and sectioned front view of an apparatus according to the present invention;
figure 2 is a schematic and sectioned side view of the apparatus of figure 1;
figure 3 is a schematic and sectioned plan view of the apparatus of figures 1, 2;
figure 4 is a schematic and sectioned front view of another embodiment of the apparatus according to the present invention;
figure 5 is a schematic and sectioned side view of the apparatus of figure 4;
figure 6 is a schematic and sectioned plan view of the apparatus of figures 4, 5;
figure 7 is a schematic and sectioned front view of another embodiment of the apparatus according to the present invention;
figure 8 is a schematic and sectioned side view of the apparatus of figure 7;
figure 9 is a schematic and sectioned plan view of the apparatus of figures 7, 8;
figure 10 is a schematic and sectioned front view of yet another embodiment according to the present invention;
figure 11 is a schematic and sectioned side view of the apparatus of figure 10;
figure 12 is a schematic and sectioned plan view of the apparatus of figures 10, 11;
figure 13 is a schematic and sectioned detailed side view of another embodiment of the apparatus according to the present invention;
figure 14 is a schematic and sectioned detailed side view of a further embodiment of the apparatus according to the present invention;
figure 15 is a plan view of a detail of the cyclone separator of the apparatus according to the invention;
figure 16 is a sectioned side view of the detail of figure 15;
figure 17 is a sectioned side view of the detail of another embodiment of the cyclone separator of the apparatus according to the invention;
figure 18 is a sectioned and detailed side view of yet another embodiment of the cyclone separator of the apparatus according to the invention.

EMBODIMENTS OF THE INVENTION

[0023] With reference to the attached figure 1, a heating apparatus according to the present invention is wholly indicated with reference numeral 1.

[0024] The heating apparatus according to the invention can consist, for example, of a stove, of a fireplace, or of any other similar apparatus that is fed with fuel such as wood, pellets and the like, without any limitation as far as dimensions, uses, thermal power delivered and other possible characteristics are concerned.

[0025] The heating apparatus according to the invention comprises a combustion chamber 2. The apparatus also comprises forced expulsion means of the fumes from the combustion chamber 2, wholly indicated with reference numeral 3.

[0026] The apparatus 1 moreover comprises a fume outlet path from the combustion chamber 2, wholly indicated with reference numeral 4.

[0027] Along the fume outlet path 4 of the fumes it is foreseen for there to be the aforementioned forced expulsion means 3 of the fumes themselves from the combustion chamber 2, as shall become clearer in the rest of the description.

[0028] The apparatus 1 also comprises a cyclone separator 5 of the combustion fumes.

[0029] The cyclone separator 5 is suitable for holding inside it the finer particles of the particulate transported by the combustion fumes, so as to abate the emission in the atmosphere in a substantial manner.

[0030] The cyclone separator 5 is positioned at the end of the fume outlet path 4 of the fumes coming from the combustion chamber 2, and communicates with the fumes exhaust 6 of the apparatus 1 through a further section of duct T, which can have a variable length. More in detail, the heating apparatus 1 comprises a support structure, wholly indicated with reference numeral 7.

[0031] The support structure 7 has specific characteristics which can vary in relation to the application of the heating apparatus.

[0032] For example the materials used, the dimensions, the installation modalities, and yet more can be varied.

[0033] The materials used for making the support structure 7, its dimensions, etc. are essentially known in the field, and are not therefore object of the present invention and do not require further detailed description.

[0034] The combustion chamber 2 of the heating apparatus 1 is of the type *per se* known in the field.

[0035] The combustion chamber 2 comprises a conventional brazier 8 on which a solid fuel such as wood, pellets, wooden chips or the like is loaded, and from which the ashes fall. The combustion chamber 2 is provided at the top with a fumes deflector 9, that is suitable for holding a first part of particulate and ashes.

[0036] At the front of the combustion chamber 2 a protection 10, for example made of glass, of the type known in the field, is also foreseen.

[0037] As illustrated in particular in figures 2, 3, the cyclone separator 5 is completely integrated in the support structure 7, and for example, it can be contained inside it. Also the fume outlet path 4 from the combustion chamber 2 is completely integrated in the support structure 7.

[0038] With reference therefore to figures 1-3, the path 4 comprises at least one first descending section 11 communicating with the combustion chamber 2.

[0039] More in detail, the path 4 comprises two first descending sections 11 communicating with the com-

bustion chamber 2.

[0040] The first two descending sections 11 communicate with the combustion chamber 2 through two respective first openings 12.

[0041] The path 4 moreover comprises a second ascending section 13.

[0042] The second ascending section 13 is placed in communication with the cyclone separator 5, through a second opening 14.

[0043] More in particular, as can be seen in figure 3, the aforementioned first two descending sections 11 are arranged, inside the support structure 7, laterally and on opposite sides with respect to the cyclone separator 5.

[0044] The second ascending section 13, on the other hand, is positioned between the first descending sections 11, directly adjacent to the outer wall of the cyclone separator 5. The forced expulsion means of the fumes 3, more in detail, comprise a fan.

[0045] The fan 3 is of the type essentially known in the field.

[0046] The fan 3 is positioned between the first descending sections 11 and the second ascending section 13.

[0047] The fan 3, more in detail, is positioned at the base 15 of the support structure 7.

[0048] As visible in figures 1, 2, at the base 15 of the support structure 7 a lower chamber 16 is foreseen.

[0049] Inside the lower chamber 16 the impeller 17 of the fan 3 is housed.

[0050] The lower chamber 16 comprises a first port 18, which communicates with a horizontal section 19 which joins the first two descending sections 11 of the path 4.

[0051] The lower chamber 16 moreover comprises a second port 20, which communicates with an upper chamber 21.

[0052] The upper chamber 21 is, also, placed directly in communication with the second ascending section 13 of the path 4.

[0053] At the horizontal section 19 and/or at the lower chamber 16 an inspection and cleaning opening can be foreseen, possibly equipped with a collection tank, that is not represented in the figures, for the deposited particulate.

[0054] The apparatus according to the invention also comprises a main collection tank 22. Advantageously both the combustion ashes, which fall from the brazier 8, and the particulate, which is deposited inside the cyclone separator 5, are discharged into the main tank 22.

[0055] The main tank 22 can be periodically removed so as to be emptied out and cleaned. The heating apparatus 1 comprises a safety valve 23 of the combustion chamber 2.

[0056] The safety valve 23 is positioned at the top of the combustion chamber 2, substantially near to the fumes exhaust outlet 6.

[0057] The selective opening of the safety valve 23 makes it possible to exclude, from the escape route of the combustion fumes, the path 4: the fumes coming from the chamber 2, therefore, flow directly towards the fumes exhaust outlet 6.

[0058] The opening of the safety valve 23 can be manual or automatic, in the case in which the heating apparatus 1 is provided with an electronic unit for controlling and managing its operation, of the known type.

[0059] The opening of the safety valve 23 can occur in particular situations during the normal operation of the apparatus, or it can occur in the case in which there is failure of the expulsion means 3 of the fumes, or again in the case in which there is a lack of electric energy.

[0060] In such a way, the combustion fumes are directed directly towards the fumes exhaust outlet 6, and do not flow towards the path 4 which leads to the cyclone separator 5.

[0061] The cyclone separator 5, of the *per se* known type in its general and size characteristics, comprises an outlet tube 24 equipped with at least an inner deflector 25, suitable for interrupting the swirling motion of the gases so as to limit the drawing of the dust already deposited at the bottom of the separator 5 itself, as illustrated in figures 15 and 16.

[0062] The inner deflector 25 of the outlet tube 24 has a substantially rectangular shape, substantially having the same length as the tube 24 itself.

[0063] The cyclone separator 5 also comprises a lower closure valve 26.

[0064] The lower closure valve 26, from which an extension projects allowing the particulate to be discharged, can be actuated manually, or automatically in the case in which the heating apparatus 1 is provided with an electronic unit for controlling and managing its operation, of the type *per se* known.

[0065] The operation of the heating apparatus according to the invention is as follows.

[0066] The fumes produced in the combustion chamber 2 flow through the first openings 12, and thus travel along the first descending sections 11.

[0067] From these, the fumes pass through the horizontal section 19 and the first port 18, and flow through the lower chamber 16, in which the impeller 17 is housed.

[0068] From the lower chamber 16 the fumes move on, through the second port 20, towards the upper chamber 21, and from here they flow towards the second ascending section 13, to then reach the second opening 14 which feeds to the cyclone separator 5.

[0069] In their flow through the path 4, the fumes are progressively cooled down.

[0070] Moreover, the various load losses associated to each change of direction inside the path 4 make it possible to separate, from the fumes, the heaviest parts of the particulate transported by the fumes themselves.

[0071] In particular, at the horizontal section 19 and/or at the lower chamber 16 a considerable amount of particulate is deposited, which can be removed through a special inspection opening equipped with a possible collection tank.

[0072] Inside the cyclone separator 5, according to

ways of operating that are known for this type of device, the finer particles of the particulate transported by the fumes are deposited. These particles deposit at the bottom, and can be discharged into the main tank 22 through the lower closure valve 26.

[0073] Finally, the fumes, flow through the outlet tube 24 of the cyclone separator 5 and are directed towards the fumes exhaust 6.

[0074] The invention, thus conceived, makes it possible to obtain important technical advantages.

[0075] Firstly, when passing through the path 4, due to the various load losses that the fumes undergo, a substantial part of the particulate is subtracted, consisting of the coarsest particles.

[0076] The remaining part, i.e. the finer particles, are advantageously deposited inside the cyclone separator 5, according to modalities known for this type of device so that at the outlet from the separator the fumes contain a minimum, if not even negligible, concentration of particulate, also of the finest type.

[0077] The heating apparatus has a compact structure, having a limited bulk, and does not require special installation activity to make the fumes abatement efficient. Indeed, both the path 4 and the cyclone separator 5 are efficiently and completely integrated inside the support structure 7.

[0078] The apparatus has a limited cost, it is constructively and operationally simple and it can be made with technologies and means that are known in the field.

[0079] The energy consumption and the operation costs can be compared to those of known apparatuses without fume abatement means.

[0080] Another embodiment of the heating apparatus according to the present invention is illustrated in figures 4, 5, 6.

[0081] In the description of this embodiment the same reference numerals as the previous embodiment have been used to distinguish same parts or components.

[0082] In this embodiment, the fume outlet path 4 comprises a single first descending section 11 and a single second ascending section 13.

[0083] More in detail, as illustrated in particular in figure 6, both the first descending section 11 and the second ascending section 13 are positioned at the sides of the support structure 7.

[0084] Moreover, heat exchange fins 27 are also foreseen at both the first section 11 and at the second section 13.

[0085] In such a way, there is an increase in the heat exchange between the hot fumes inside the path 4 and the exchange fluid.

[0086] In detail, the first descending section 11 flows into the upper chamber 21 through a first side opening 28.

[0087] The upper chamber 21 is separated in two parts by a central divider 29, as illustrated in figure 4.

[0088] The upper chamber 21 is placed in communication with the lower chamber 16, where the impeller 17 is housed, through the first port 18 and the second port 20.

[0089] The upper chamber 21 also communicates with the second ascending section 13 through a second side opening 30.

[0090] The second ascending section 13, finally, communicates with the cyclone separator 5 through an upper section 31.

[0091] In this embodiment, therefore, the fumes from the combustion chamber 2 flow into the first descending section 11 through the first opening 12.

[0092] From here, the fumes go down towards the first side opening 28, and penetrate inside the upper chamber 21.

[0093] From the upper chamber 21 the fumes flow into the lower chamber 16 through the first port 18; through the second port 20, then, the fumes pushed by the fan 3 move on again towards the upper chamber 21 and then, through the second side opening 30, towards the second ascending section 13.

[0094] Once they have reached the top of the apparatus 1, the fumes finally flow through the upper section 31 and then enter into the second opening 14 which feeds to the cyclone separator 5. Inside the latter the phenomena already described for the previous embodiment occur.

[0095] In this embodiment, therefore, there is a substantial increase in the heat exchange with the exchange fluid, since the first descending section 11 and the second ascending section 13 have a greater exchange surface with the vector fluid, for example water or air.

[0096] Another embodiment of the heating apparatus according to the present invention is illustrated in figures 7, 8, 9.

[0097] In the description of this embodiment the same reference numerals as the previous embodiment are used to distinguish the same parts or components.

[0098] In this embodiment, the forced expulsion means of the fumes 3 comprise a fan positioned at the top of the second ascending section 13, and in particular at the second fume inlet opening 14 in the cyclone separator 5.

[0099] Also the fume outlet path 4 is, consequently modified.

[0100] Indeed, the path comprises a first descending section 11, a horizontal section 19, and a second ascending section 13 reciprocally communicating and positioned behind with respect to the combustion chamber 2; there is also an upper section 31 which leads towards the cyclone separator 5.

[0101] Along the path 4 there is at least one dividing wall 32 suitable for holding part of the ashes and of the particulate present inside the combustion fumes.

[0102] The dividing wall 32, in particular, is foreseen between the first descending section 11 and the second ascending section 13, i.e. along the horizontal section 19.

[0103] In this embodiment of the apparatus, therefore, the fumes of the combustion chamber 2 pass through the first opening 12, flow along the first descending section 11, and from here the move on directly along the horizontal section 19 and then along the second ascend-

ing section 13, progressively cooling down.

[0104] While passing the horizontal section 19, the presence of the dividing wall 32 makes it possible to hold a part of the particulate transported by the fumes, especially the heavier particles.

[0105] In this area, therefore, it can be foreseen for there to be an extractable collection, inspection and cleaning tank.

[0106] The fumes then pass through the fan 3 and move on through the upper section 31 towards the cyclone separator 5, in which the phenomena already described occur.

[0107] In this embodiment the fumes, thanks to the positioning of the fan 3, are introduced inside the cyclone separator 5 with a speed that is greater than that which occurs in the solutions with the fan 3 placed at the bottom: thanks to this, there is a considerable increase in the efficiency of the cyclone separator 5.

[0108] Another embodiment of the heating apparatus according to the present invention is illustrated in figures 10, 11, 12.

[0109] In the description of this embodiment the same reference numerals as the previous embodiment have been used to distinguish same parts or components.

[0110] This embodiment is similar to that of figures 4, 5, 6, with the difference that the forced expulsion means 3 of the fumes are positioned at the top of the support structure 7 of the apparatus 1.

[0111] The fume outlet path 4 thus comprises a single first descending section 11 and a single second ascending section 13.

[0112] Both the first descending section 11 and the second ascending section 13 are positioned at the sides of the support structure 7.

[0113] Heat exchange fins 27 are also foreseen at both the first section 11 and second section 13.

[0114] In such a way, the heat exchange between the hot fumes inside the path 4 and the exchange fluid is increased.

[0115] In detail, the first descending section 11 flows out into the upper chamber 21 through a first side opening 28.

[0116] The upper chamber 21 is equipped with a pair of dividing walls 32 suitable for holding a part of the particulates transported by the fumes.

[0117] The upper chamber 21 moreover communicates with the second ascending section 13 through a second side opening 30.

[0118] The second ascending section 13 communicates with the upper section 31, along which the fan 3 is inserted. The upper section 31 finally leads to the cyclone separator 5.

[0119] In this embodiment, therefore, the fumes from the combustion chamber 2 flow into the first descending section 11 through the first opening 12.

[0120] From here, the fumes go down towards the first side opening 28, and penetrate inside the upper chamber 21.

[0121] From the upper chamber 21 the fumes flow, through the second side opening 30, towards the second ascending section 13.

[0122] Part of the particulate transported by the fumes is held by the dividing walls 32.

[0123] In this area, therefore, it can be foreseen for there to be an extractable collection, inspection and cleaning tank.

[0124] Once they have reached the top of the apparatus 1, the fumes finally flow through the upper section 31 and, by passing through the fan 3, they then enter into the second opening 14 which feeds to the cyclone separator 5. Inside the latter the phenomena already described for the previous embodiment occur.

[0125] In this embodiment, therefore, the heat exchange with the exchange fluid is substantially increased, since the first descending section 11 and the second ascending section 13 have a greater exchange surface with the vector fluid, for example water or air.

[0126] Moreover, also the efficiency of the cyclone separator 5 is considerably increased, since the inlet speed of the fumes is relatively high.

[0127] Figure 13 illustrates a schematic detail of another embodiment of the heating apparatus according to the invention.

[0128] In this embodiment, the apparatus 1 comprises an additional collection tank 33, in which the particulate deposited inside the cyclone separator 5 is discharged.

[0129] Such an additional tank 33 can advantageously be removed and cleaned independently from the main tank 22, which collects the ashes produced in the combustion chamber 2.

[0130] Figure 14 illustrates a schematic detail of another embodiment of the heating apparatus according to the invention.

[0131] In this embodiment, the dividing walls 32 suitable for holding the particulate have a different arrangement with respect to the previous embodiments; such dividing walls 32 can also be made orientable or adjustable in relation to the actual through port which is desired to be obtained.

[0132] Figures 17, 18 illustrate other embodiments of the apparatus, with particular reference to the outlet tube 24 of the fumes from the cyclone separator 5.

[0133] In particular, in the embodiment of figure 17, the inner deflector 25 of the outlet tube 24 has a rectangular shape with a length that is shorter than that of the outlet tube 24 itself. In the embodiment of figure 18, on the other hand, the inner deflector 25 of the outlet tube 24 has a curvilinear profile, substantially tapered downwards.

[0134] In the embodiments of figures 17 and 18, the interruption of the swirling motion of the gas inside the outlet tube 24 occurs in a less abrupt manner, and therefore more gradual. In other embodiments of the apparatus according to the invention, not represented in the figures, the cyclone separator 5 can be provided with a plurality of parallel outlet tubes 24, each equipped with a respective inner deflector 25.

[0135] In such a way the flow rate of fumes coming from the separator 5 and flowing towards the fumes exhaust outlet 6 is increased.

[0136] It has thus been seen how the invention reaches the proposed purposes.

[0137] The present invention has been described according to preferred embodiments, but equivalent variants can be conceived without for this reason departing from the scope of protection offered by the following claims.

[0138] For example the cyclone separator 5 and/or the fume path 4 can be integrated in the apparatus 1 positioned outside the support structure 7.

Claims

1. Heating apparatus, particularly of the stove, fireplace and similar type, fed with fuels such as wood, pellets and the like, **characterised in that** it comprises a combustion chamber (2), forced expulsion means (3) of the combustion fumes from said combustion chamber (2), a fume outlet path (4) from said combustion chamber (2) along which said forced expulsion means (3) are arranged, at least one cyclone separator (5) of the combustion fumes, positioned at the end of said path (4) and communicating with the fumes exhaust (6) through a further section of duct (T), a support structure (7) in which said cyclone separator (5) is integrated, said fume outlet path (4) being integrated in said support structure (7) and comprising at least one first discending section (11) communicating with said combustion chamber (2), and at least one second ascending section (13) communicating with said cyclone separator (5), **characterized in that** said forced expulsion means of the fumes (3) comprise at least one fan (3) positioned at the top of said second ascending section (13) and at the inlet for the fumes into said cyclone separator (5).

2. Apparatus according to claim 1, comprising a main collection tank (22) into which both the combustion ashes and the particulate deposited inside said cyclone separator (5) are discharged.

3. Apparatus according to any one of the previous claims, comprising at least one additional collection tank (33) into which the particulate deposited inside said cyclone separator (5) is discharged.

4. Apparatus according to one of the previous claims, comprising at least one safety valve (23), arranged at the top of said combustion chamber (2), the selective opening of which is suitable for excluding said fume outlet path (4).

5. Apparatus according to one of the previous claims, wherein said cyclone separator (5) comprises an outlet tube (24) equipped with at least one inner deflector (25) suitable for interrupting the swirling motion of the gases to limit the drawing of the dusts.

6. Apparatus according to one of the previous claims, wherein said cyclone separator (5) comprises at least one lower closure valve (26), actuated manually or automatically.

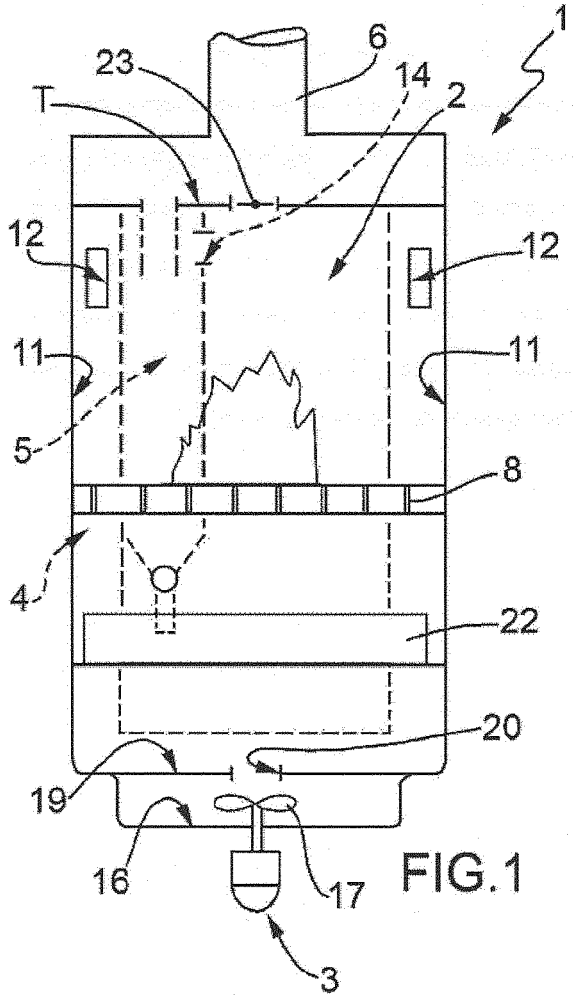

FIG.1

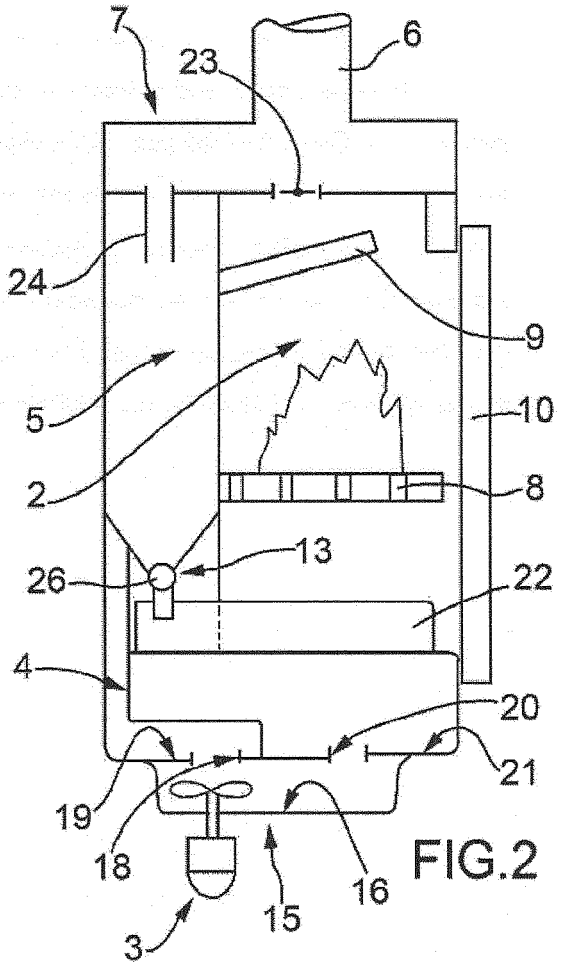

FIG.2

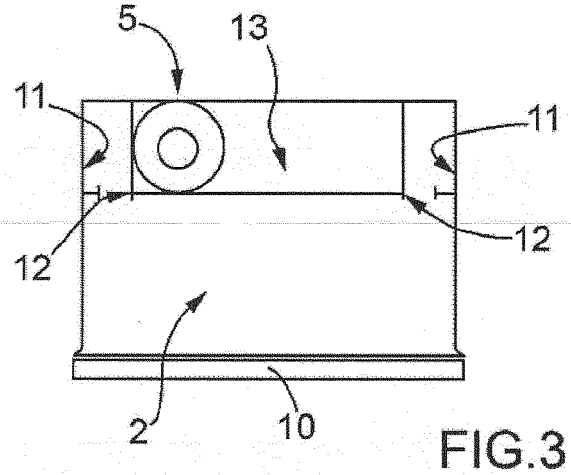

FIG.3

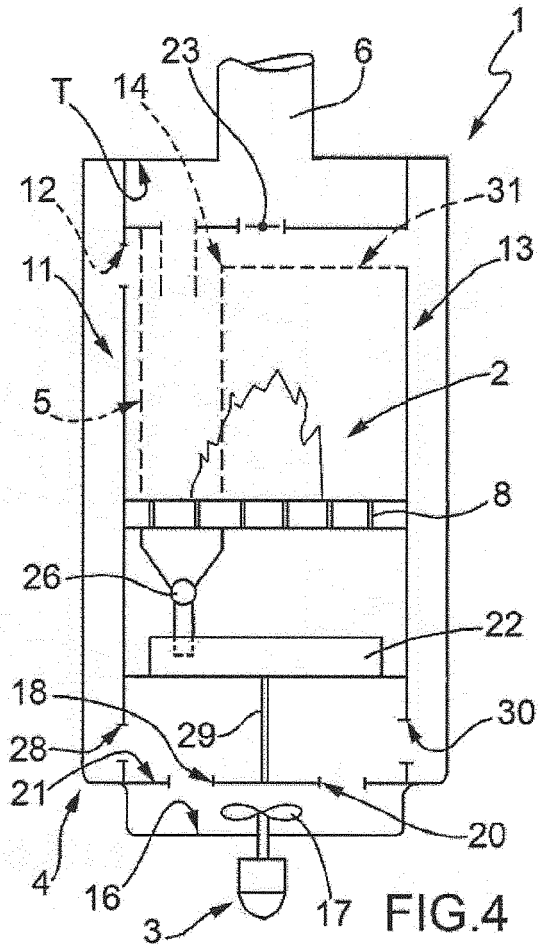

FIG.4

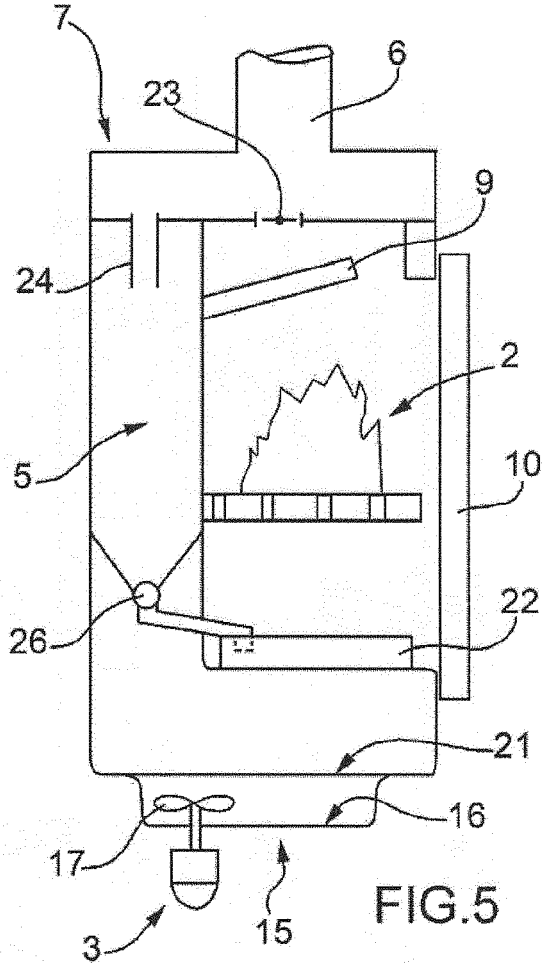

FIG.5

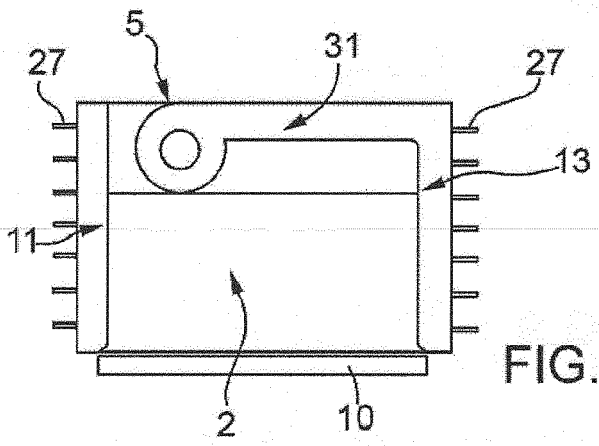

FIG.6

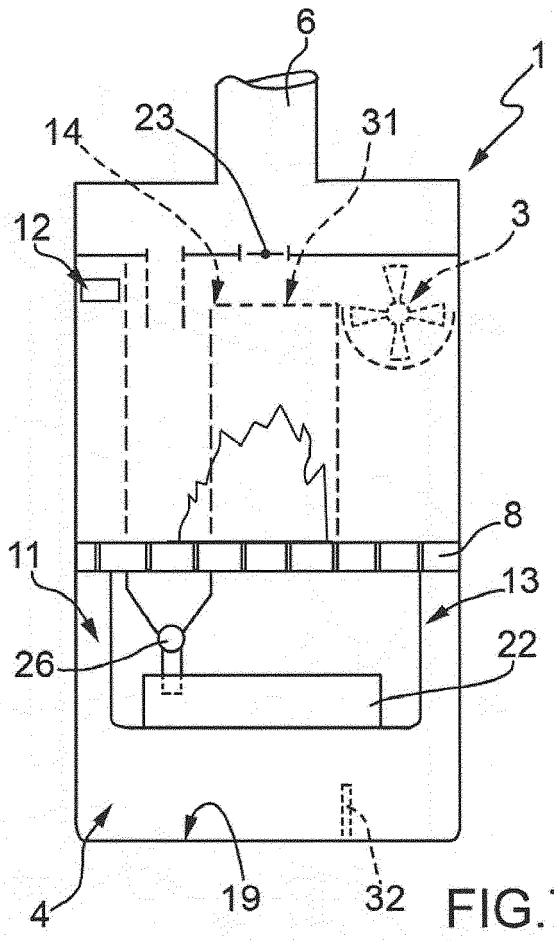

FIG.7

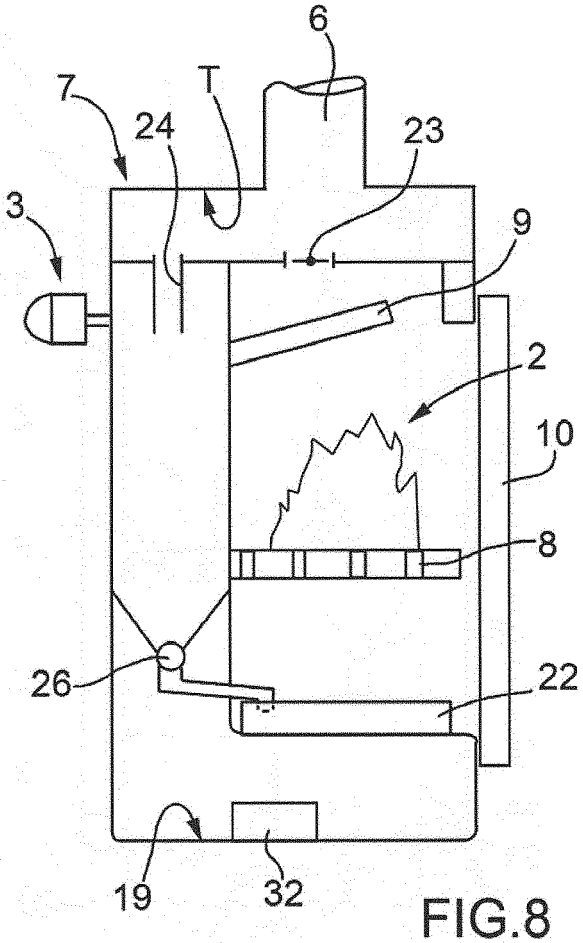

FIG.8

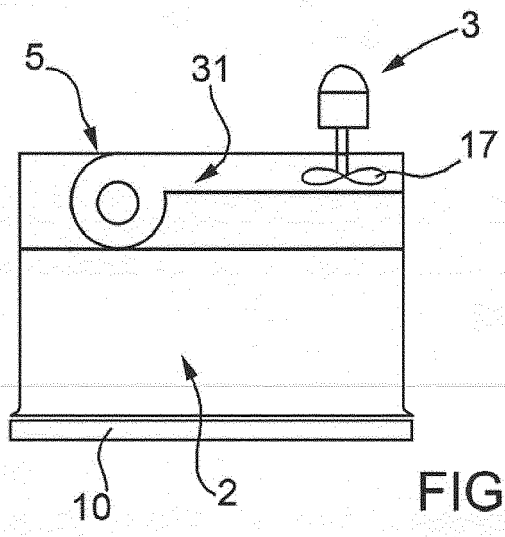

FIG.9

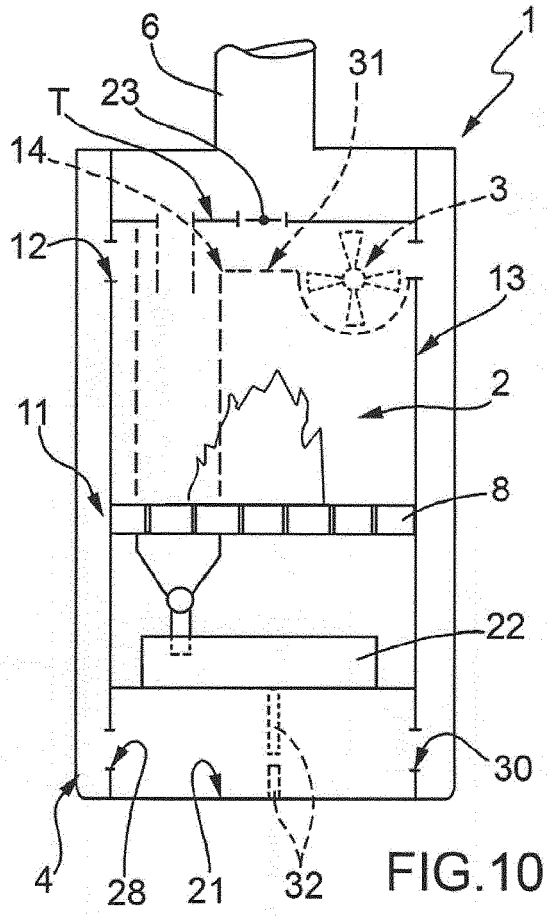

FIG.10

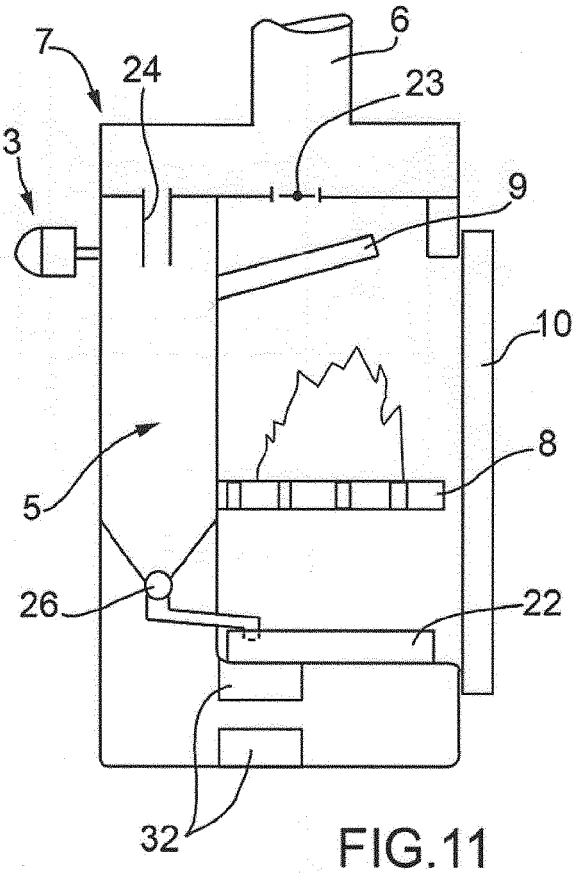

FIG.11

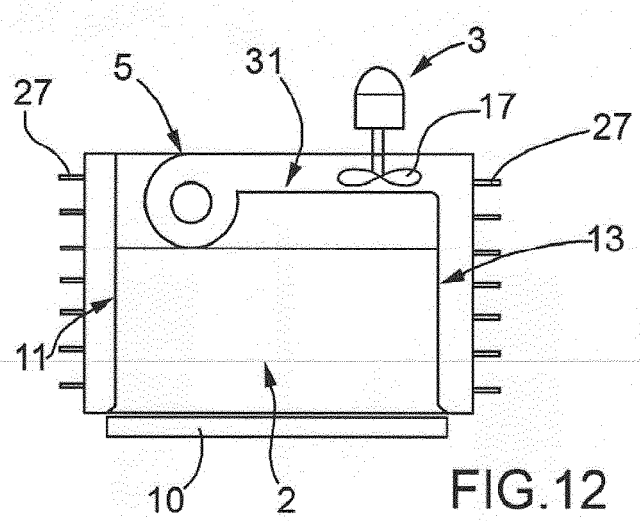

FIG.12

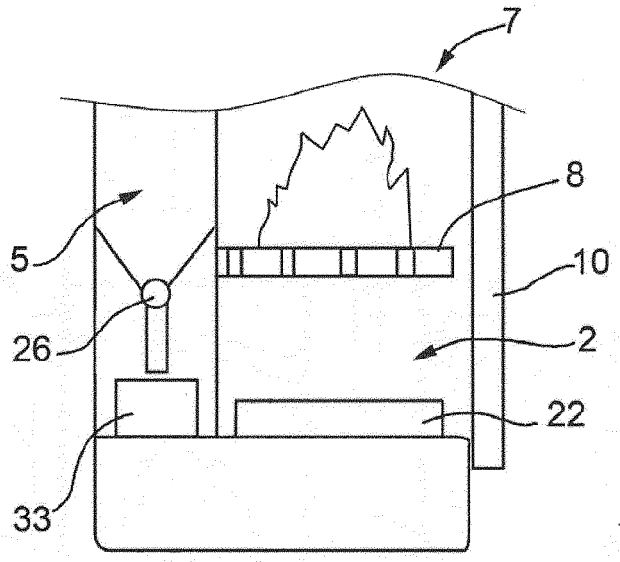

FIG.13

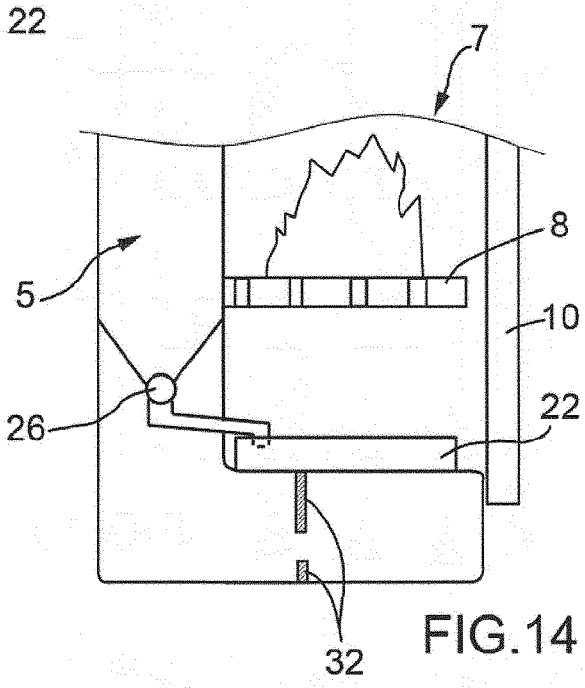

FIG.14

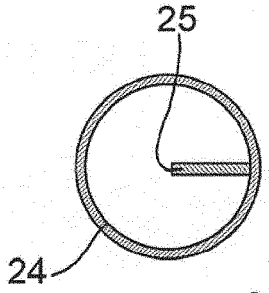

FIG.15

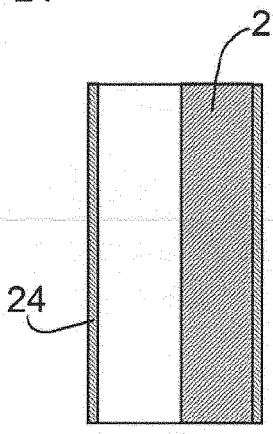

FIG.16

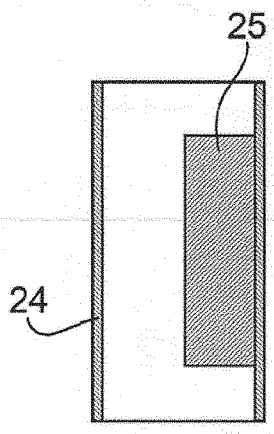

FIG.17

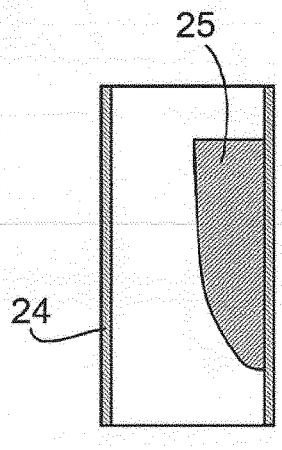

FIG.18

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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 8248

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 October 2015	Mougey, Maurice

CATEGORY OF CITED DOCUMENTS

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