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(54) GENERATOR STOVE

(57) A combustion apparatus such as a stove 10 with a combustion chamber 12. A thermoelectric generator 24 is provided to convert heat energy to electricity. A passage 16 extends upwardly on the rear of the combustion chamber 12 for cool air to pass thereup and be warmed, with the generator 24 located between the passage 16 and the combustion chamber 12.

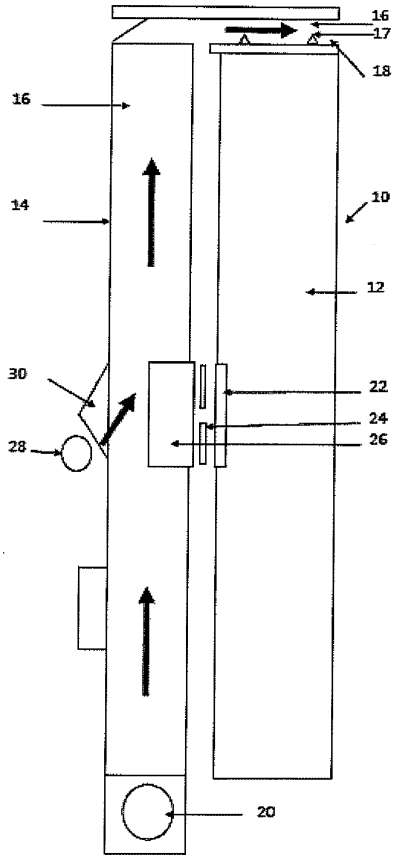

FIG. 2

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Description

[0001] This invention concerns combustion apparatus.

[0002] A wide range of combustion apparatus is currently available. Such apparatus includes stoves using any type of fuel, which may for instance be in the form of solid fuel stoves which can provide an aesthetically pleasing heating appliance in a room. Such stoves and other combustion apparatus are often however quite inefficient, and particularly in fully using the heat energy produced by combustion.

[0003] According to a first aspect of the invention there is provided combustion apparatus, the apparatus including a combustion chamber where fuel can be burnt, an energy converter device for converting heat energy to electricity, a passage extending upwardly on the rear of the combustion apparatus outside of the combustion chamber for cool air to pass thereup and be warmed by the combustion chamber, with the energy converter device located between the passage and the combustion chamber.

[0004] An internal heat sink may be provided in or adjacent to the combustion chamber for transferring heat to the energy converter device.

[0005] The energy converter device may be provided on an opposite side of the internal heat sink to the combustion chamber.

[0006] The internal heat sink may be mounted on or adjacent an external wall of the combustion chamber.

[0007] An external heat sink may be provided on an opposite side of the energy converter device to the combustion chamber.

[0008] A first fan may be provided for directing air onto the external heat sink. The first fan may be located in the passage, and may be located in a lower part of the passage for directing air upwardly therethrough.

[0009] A second fan may be provided for blowing air at least generally laterally onto the external heat sink. The second fan may blow air onto the external heat sink laterally or at an upwards inclination.

[0010] The second fan may be provided on or adjacent the rear of the passage.

[0011] Further fans may be provided towards an upper part of the passage.

[0012] A battery may be provided to power the or each fan if required.

[0013] The battery may be rechargeable and may be a Ni-Cad battery.

[0014] The battery may be recharged by electricity produced by the energy converter device.

[0015] The passage may extend upwardly to the top of the combustion apparatus, and may extend thereacross to provide a source of warmed air at the front of the combustion apparatus.

[0016] One or more baffles may be provided in the combustion chamber to direct flue gases.

[0017] The baffle or baffles may direct flue gases rearwardly and downwardly.

[0018] In one embodiment the internal heat sink may be located below the lowermost baffle.

[0019] Two internal heat sinks may be provided, potentially with each extending through a respective opening in the lowermost baffle.

[0020] In a still further embodiment the internal heat sink is located above the lowermost baffle.

[0021] In one arrangement the passage on the rear of the combustion chamber extends for substantially the full height of the combustion chamber and/or is of uniform width.

[0022] Alternatively the passage on the rear of the combustion chamber may diverge upwardly.

[0023] In a further arrangement the passage on the rear of the combustion chamber only extends over an upper part of the combustion chamber.

[0024] Projections may be provided extending upwardly into the housing as it extends across the top of the combustion apparatus, to act as a heat sink.

[0025] A voltage increaser may be provided for the energy converter device, and the voltage increaser may increase the output voltage to 12V.

[0026] A remote controller may be provided for the first fan.

[0027] The second fan may be powered by electricity produced by the energy converter device.

[0028] The further fans may be powered by electricity produced by the energy converter device.

[0029] The internal and/or external heat sinks may comprise a plurality of parallel plates.

[0030] The combustion apparatus may comprise a stove, which stove may burn any of oil, gas, wood, coal or bio fuel.

[0031] The energy converter device may be a thermo electric generator.

[0032] Embodiments of the present invention will now be described by way of example only and with reference to the accompanying drawings, in which:-

Fig. 1 is a first diagrammatic rear view of a combustion apparatus according to the invention;

Fig. 2 is a diagrammatic cross sectional side view through the apparatus of Fig. 1;

Fig. 3 is a diagrammatic perspective rear view from below of the apparatus of Fig. 1;

Fig. 4 is a similar view to Fig. 2 but of a second combustion apparatus according to the invention;

Fig. 5 is a plan view of part of the apparatus of Fig. 4;

Fig. 6 is a plan view of further parts of the apparatus of Fig. 4;

Fig. 7 is a diagrammatic side view part of the apparatus of Fig. 4;

Fig. 8 is a similar view to Fig. 5 but of a modified arrangement;

Fig. 9 is a similar view to Fig. 6 but of the modified arrangement;

Fig. 10 is a similar view to Fig. 2 but of a third combustion apparatus according to the invention;

Fig. 11 if the similar view to Fig. 2 but of a fourth combustion apparatus according to the invention;

Fig. 12 is a diagrammatic rear view of a first arrangement of a combustion apparatus according to the invention;

Fig. 13 is a similar view to Fig. 12 but of a second arrangement; and

Fig.14 is a similar view to Fig.2 but of a fifth combustion apparatus according to the invention.

[0033] Figs 1 to 3 of the drawings show a first combustion apparatus in the form of a stove 10 suitable for burning any type of fuel, for instance wood. The stove 10 comprises a combustion chamber 12. A housing 14 is provided centrally at the rear of the stove 10 spaced a short distance from the rear of the chamber 12. The housing 14 defines a rectangular cross-section passage 16 extending vertically to the top of the combustion chamber 12.

[0034] The passage 16 then extends vertically above the top of the combustion chamber 12 to an outlet 18 at the front of the stove 10. In the passage 16 on the top of the combustion chamber 12 upwardly extending projections 17 are provided to act as heat sinks.

[0035] A first fan 20 is provided at a lower end of the passage 16 for blowing cool air upwardly therethrough. An internal heat sink 22 in the form of a block of relatively high thermal conductivity is provided on a rear face of the chamber 12, internally thereof.

[0036] Adjacent the internal heat sink 22, but externally of the chamber 12, and spaced a short distance rearwardly therefrom is a thermo electric generator 24. An external heat sink 26 in the form of a plurality of parallel metal plates is provided inside the passage 16, adjacent the thermo electric generator 24.

[0037] A second fan 28 is provided just behind the housing 14 level with a lower part of the external heat sink 26. An inclined opening 30 into the housing 14 is provided adjacent the second fan 28, such that air blown by the second fan 28 is directed laterally at an upwards inclination onto the external heat sink 26. The second fan 28 is powered by the thermo electric generator 24, such that if no electricity is being generated the second fan 28 will not operate.

[0038] Located on the outside of the housing 14 below the height of the second fan 28, is a 12V increaser 32 to act as a transformer in converting any electricity received from the thermo electric generator 24, to 12V. Below the 12V increaser 32 is a controller 34 for the first fan 20, which controller 34 can be remotely operated for instance by infra red.

[0039] In use air will be driven up by the first fan 20 through the passage 16 in the housing 14 onto the external heat sink 26, thereby providing cooling for the external heat sink 26. As the air passes through the passage 16 it will become warmed by heat from the combustion chamber 12 and also the external heat sink 26. The warmed air passes to the top of the combustion chamber 12 and then passes through the passage 16 across the top of the combustion chamber 12, being further warmed and providing heated air passing through the outlet 18 for instance for a room.

[0040] As the amount of electricity produced by the thermo electric generator 24 increases, the second fan 28 will be operated providing further cooling to the external heat sink 26 and thus cooling to the thermo electric generator 24.

[0041] Figs, 4 to 7 show a second stove 40 which is similar in many aspects to the stove 10 and similar reference numerals will be used for similar components. A combustion chamber 12 is provided, in this instance with a door 42 indicated and also a flue 44. A pair of baffles 46 are located within the combustion chamber 12. The lowermost baffle 46A extends rearwardly and downwardly from a location spaced a short distance behind the top of the door 42 to define a downwards and rearwards passage for flue gas. The uppermost baffle 46B is provided parallel to an upper and forward half only of the first baffle 46A.

[0042] A central opening 48 is provided in the rear edge of the lowermost baffle 46A which opening 48 locates an internal heat sink 50 which is triangular in section when viewed from the side.

[0043] Figs. 8 and 9 show a modified arrangement where two openings 52 are provided in the lowermost baffle 46A with two separate internal heat sinks 50 located respectively therein. As can be seen from the arrows flue gas will pass upwardly to the front top of the combustion chamber and then pass downwardly between the baffles 46 onto the internal heat sink 50 and then upwardly out through the flue. The arrangement of the housing 14 to provide a passage 16, is similar except that the second fan 28 is directed laterally onto the external heat sink 26.

[0044] Fig. 10 shows a third stove 60 which is similar in most respects except as indicated below, to the second stove 40. Again a pair of baffles 46 are provided, but in this instance the lowermost baffle 46a is a little lower, and an internal heat sink 62 is located extending above the lowermost baffle 46A, and through an opening in the uppermost baffle 46B, through which opening flue gases can pass.

[0045] In this instance the housing 14 does not extend fully down to the bottom of the combustion chamber 12

at the rear of the stove 60. A further fan 64 is provided at the top of the housing 14 at the rear of the stove 60 to direct warmed air to the front of the stove 60.

[0046] Fig. 11 shows a fourth stove 70 which is similar in many respects to the second and third stoves 40,60. In this instance two baffles 46 are provided which are similar to those in the third stove 60. The internal heat sink 72 is though located immediately below the lowermost baffle 46A at the rear of the combustion chamber 12. The housing 14 extends lower at the rear of the combustion chamber 12 than the third stove 60, but does not extend fully to the bottom of the combustion chamber 12. Again a further fan 74 is provided at the top of the housing 14 at the rear of the combustion chamber 12 to direct air across the top of the combustion chamber 12.

[0047] Fig. 12 shows the rear of a stove 80 which the housing 14 extends for the full height of the stove, with a first fan 20 and a second fan 28.

[0048] Fig. 13 is a similar view to Fig. 12 but which shows a different arrangement where the housing 14 on the rear of a stove 90 only extends for approximately an upper half thereof and the housing 14 diverges upwards outwardly. A second fan 28 is again provided, along with two further fans 64, one located adjacent each upper corner of the stove 80.

[0049] Fig.14 show a fifth stove 92 which is similar to the second stove 40 except as follows. In this instance a Ni-Cad rechargeable battery with a trickle charger controlled by a circuit board controller 96 with a overheat temperature controller 98. This means that if required the battery 94 can be used to boost the start up of the stove 92. The power to recharge the battery 94 is provided by the thermoelectric generator 24.

[0050] There are thus described combustion apparatus which produce electricity from the heat energy. The apparatus also provides heating, along with a source of warmed air passing out laterally above the combustion chamber.

[0051] The housing may be made of various materials such as mild steel or potentially a plastics material such as polyurethane. The first fan cools the heat sink thereby producing greater electricity by virtue of the greater temperature differential across the thermo electric generator. The first fan also transfers air through the housing to be warmed to be used for heating.

[0052] The second fan further cools the heat sink to produce more electricity. The air from the second fan being angled upwardly urges the air flow from the first fan through the heat sink. The second fan also protects the thermo electric generator from overheating. The 12V controller increases low voltage to 12V, thereby stabilising the electrical output.

[0053] There are thus described a combustion apparatus which provide for heat output, including the warmed air passing through the outlet, but also provide electricity generated by the combustion process. As the combustion increases the second fan will be operated to cause greater cooling of the heat sink and hence the thermo electric generator, and also a greater flow of air to be warmed as it passes through the passage. The further fans may also be powered by electricity produced by the energy converter device.

[0054] It is to be realised that a wide range of other modifications may be made without departing from the scope of the invention. For example, the passage may take a different form, and different fans may be provided. A different arrangement of hot plate, heat sinks and/or thermo electric generator may be provided.

[0055] Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

Claims

1. Combustion apparatus, the apparatus including a combustion chamber where fuel can be burnt, an energy converter device for converting heat energy to electricity, a passage extending upwardly on the rear of the combustion apparatus outside of the combustion chamber for cool air to pass thereup and be warmed by the combustion chamber, with the energy converter device located between the passage and the combustion chamber.

2. Combustion apparatus according to claim 1, in which an internal heat sink is provided in or adjacent to the combustion chamber for transferring heat to the energy converter device, and the internal heat sink may comprise a plurality of parallel plates.

3. Combustion apparatus according to claim 2, in which the energy converter device is provided on an opposite side of the internal heat sink to the combustion chamber, and may be mounted on or adjacent an external wall of the combustion chamber.

4. Combustion apparatus according to any of the preceding claims, in which an external heat sink is provided on an opposite side of the energy converter device to the combustion chamber, and the external heat sink may comprise a plurality of parallel plates.

5. Combustion apparatus according to claim 4, in which a first fan is provided for directing air onto the external heat sink, the first fan may be located in the passage, and may be located in a lower part of the passage for directing air upwardly therethrough.

6. Combustion apparatus according to claims 4 or 5, in which a second fan is provided for blowing air at laterally or at an upwards inclination, onto the external

heat sink, the second fan may be provided on or adjacent the rear of the passage, and further fans may be provided towards an upper part of the passage.

7. Combustion apparatus according to claims 5 or 6, in which a battery is provided to power the or each fan if required, the battery may be rechargeable, may be a Ni-Cad battery, and the battery may be recharged by electricity produced by the energy converter device.

8. Combustion apparatus according to any of the preceding claims, in which the passage extends upwardly to the top of the combustion apparatus, the passage may extend across the top of the combustion apparatus to provide a source of warmed air at the front of the combustion apparatus, and may be provided extending upwardly into the housing as it extends across the top of the combustion apparatus, to act as a heat sink.

9. Combustion apparatus according to any of the preceding claims, in which one or more baffles is provided in the combustion chamber to direct flue gases, the baffle or baffles may direct flue gases rearwardly and downwardly.

10. Combustion apparatus according to claim 9 when dependent on claim 2, in which the internal heat sink is located below or above the lowermost baffle.

11. Combustion apparatus according to claim 2 or any of claims 3 to 10 when dependent on claim 2, in which two internal heat sinks are provided, and each internal heat sink may extend through a respective opening in the lowermost baffle.

12. Combustion apparatus according to any of the preceding claims, in which the passage on the rear of the combustion chamber extends for substantially the full height of the combustion chamber and/or is of uniform width, and/or diverges upwardly.

13. Combustion apparatus according to claim 6 or any of claims 7 to 12 when dependent on claim 6, in which the second fan and/or the further fans are powered by electricity produced by the energy converter device.

14. Combustion apparatus according to any of the preceding claims, in which the combustion apparatus comprises a stove, which may burn any of oil, gas, wood, coal or bio fuel.

15. Combustion apparatus according to any of the preceding claims, in which the energy converter device is a thermo electric generator.

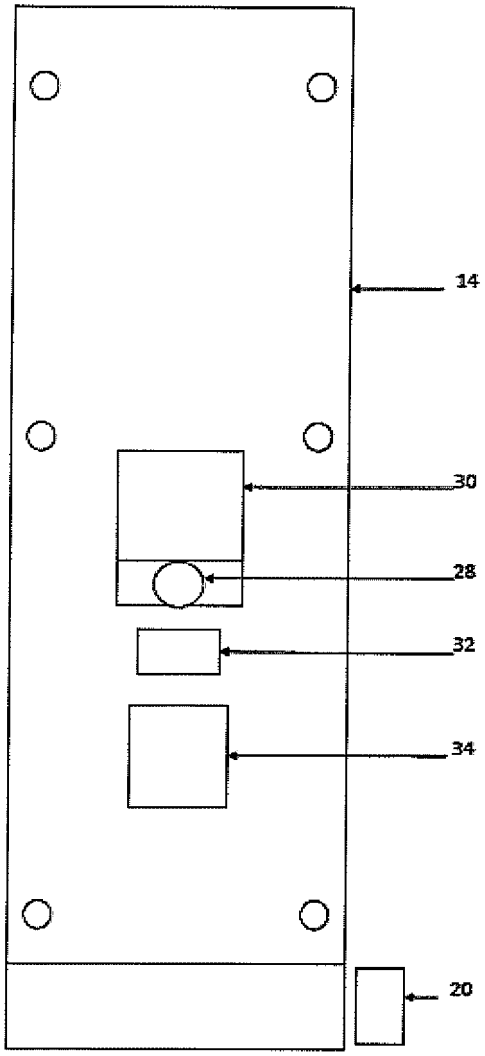

FIG. 1

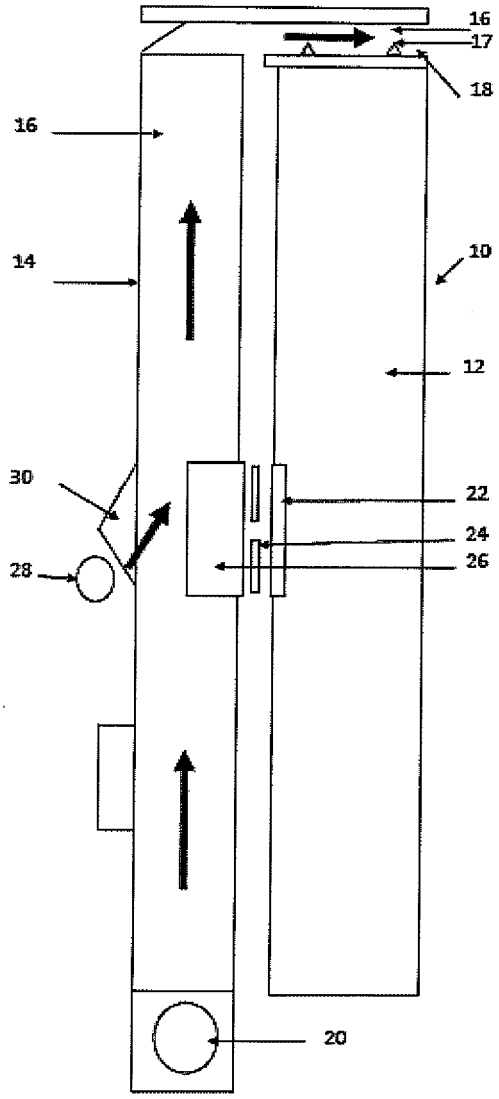

FIG. 2

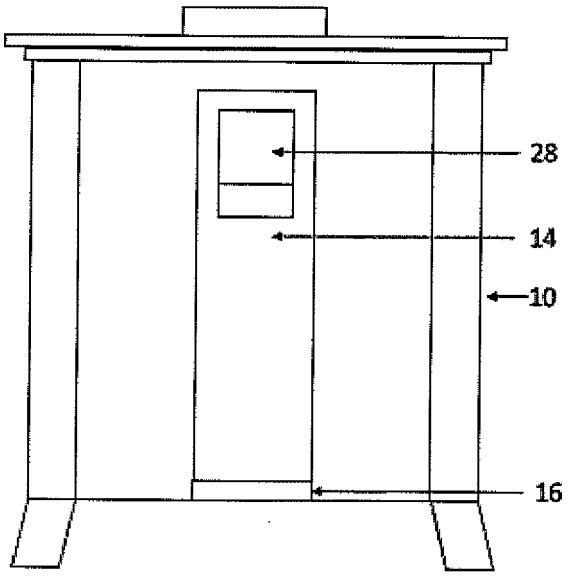

FIG. 3

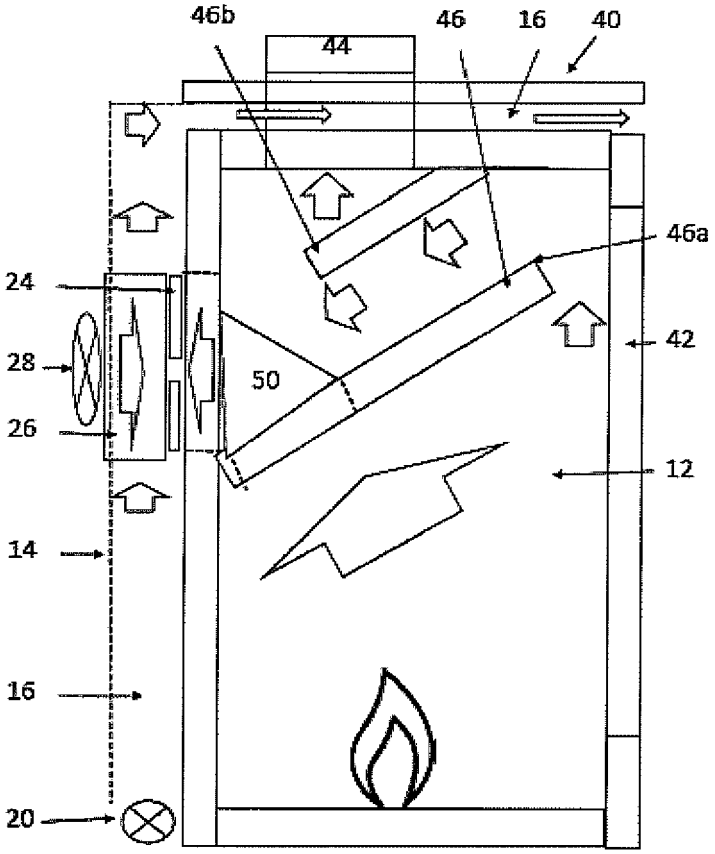

FIG. 4

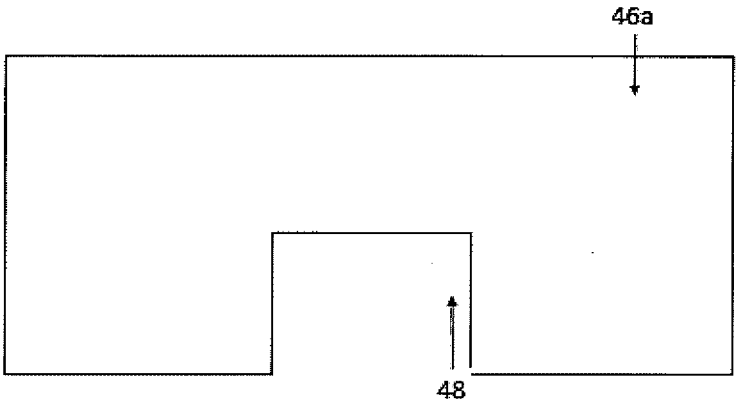

FIG. 5

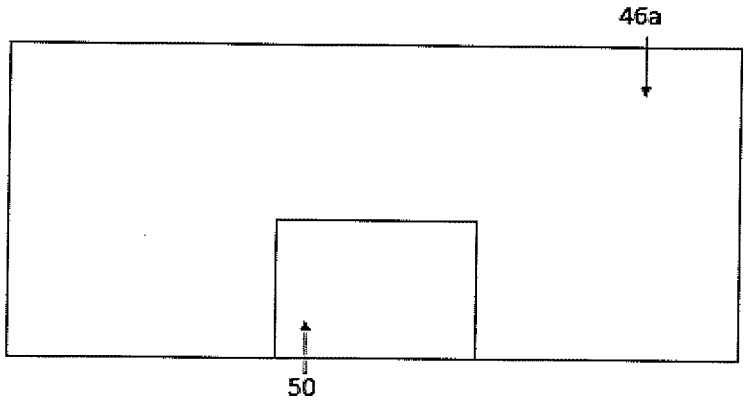

FIG. 6

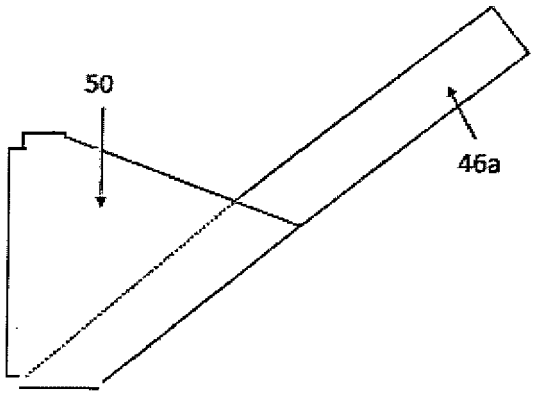

FIG. 7

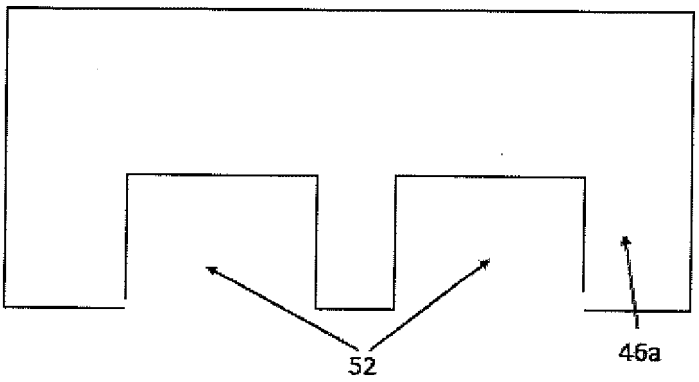

FIG. 8

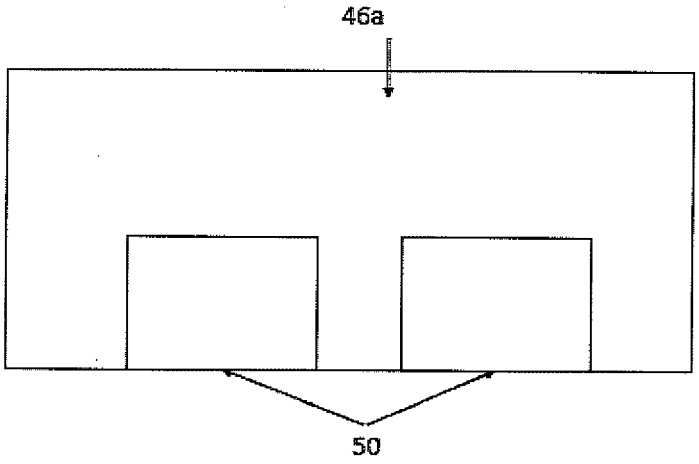

FIG. 9

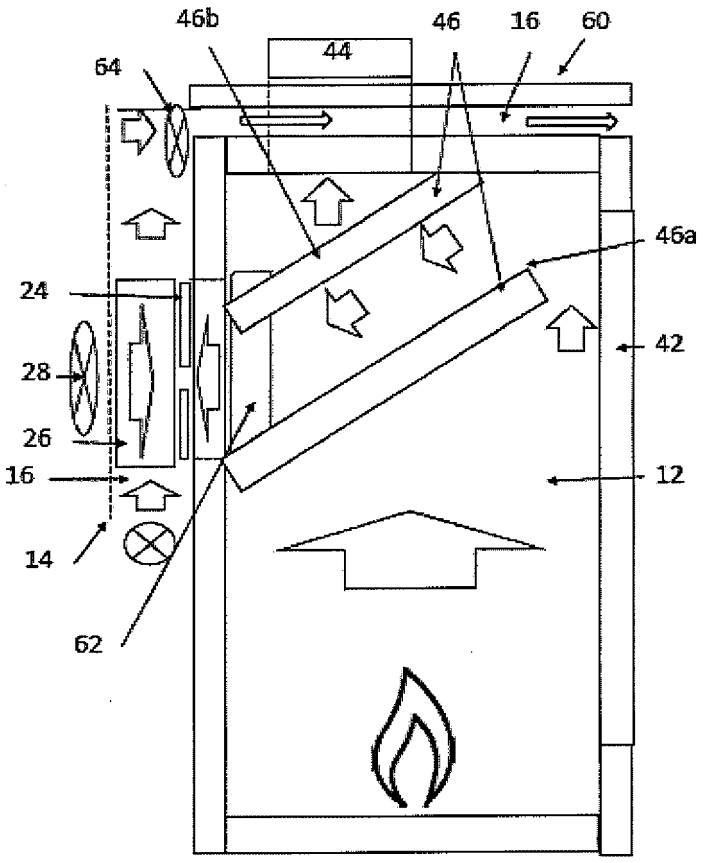

FIG. 10

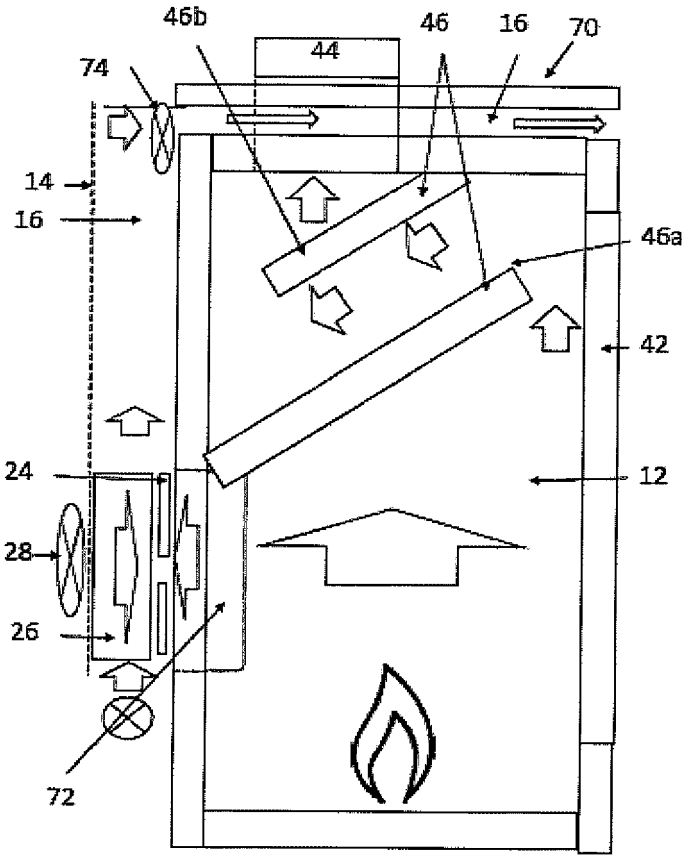

FIG. 11

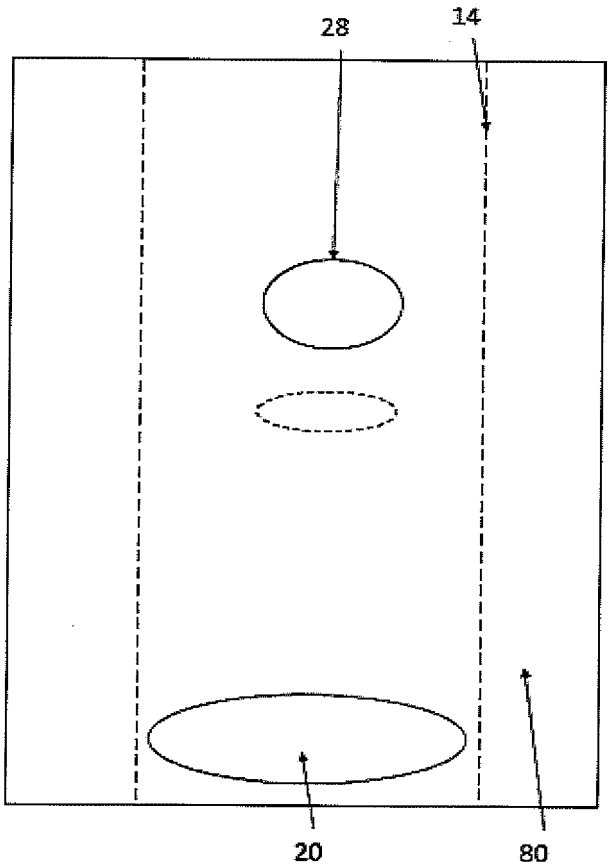

FIG. 12

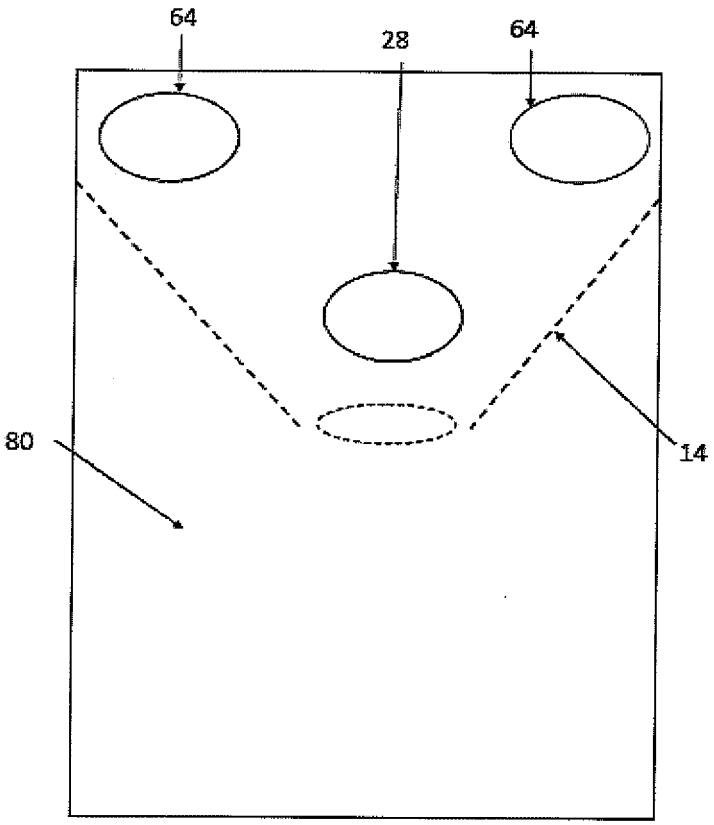

FIG. 13

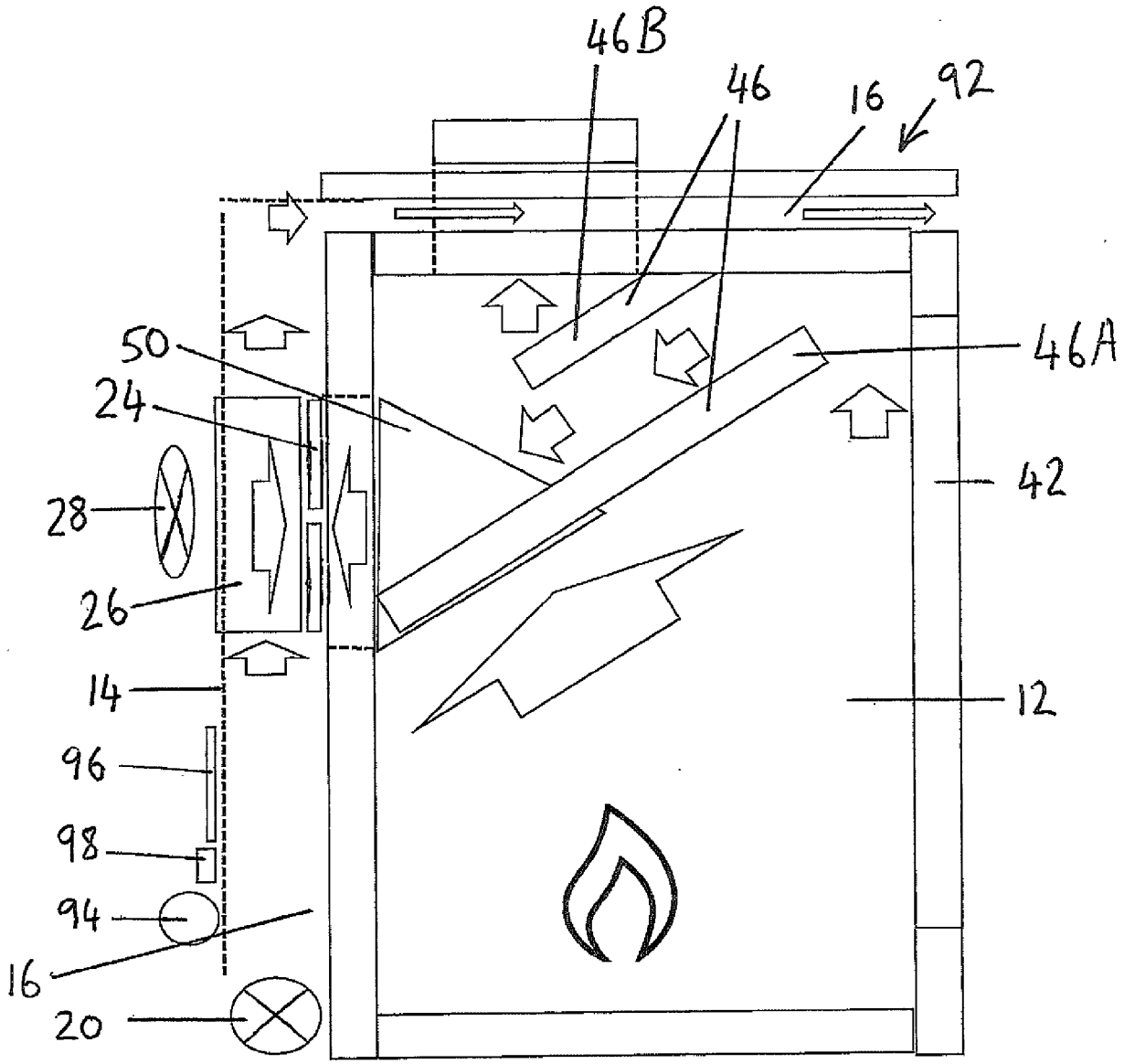

FIG. 14

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EUROPEAN SEARCH REPORT

Application Number
EP 18 15 3756

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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	11 June 2018	Munteh, Louis

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 15 3756

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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