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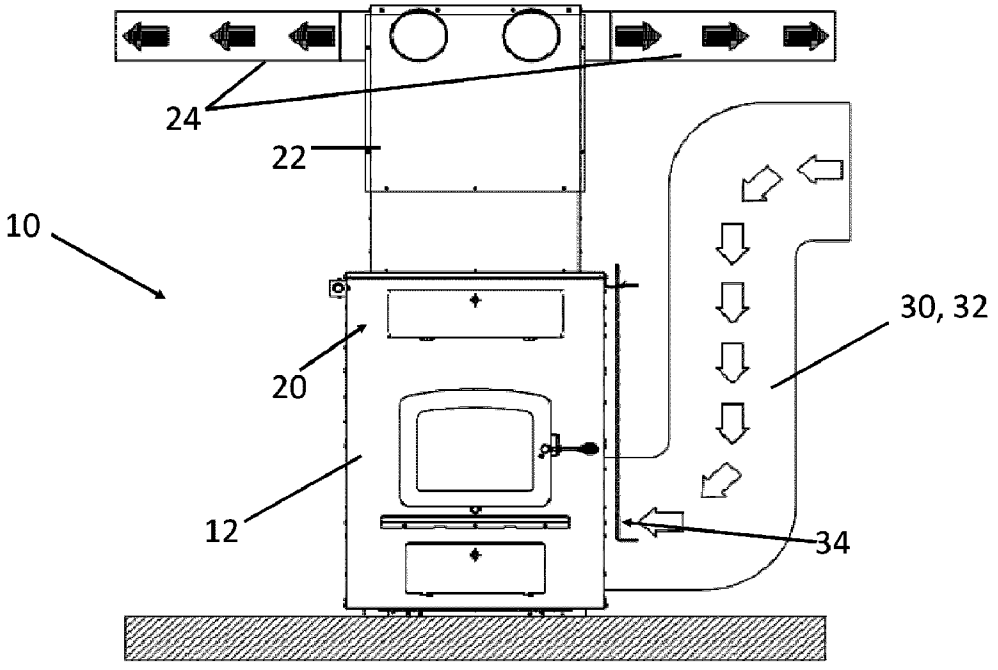
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(54) Titre : APPAREIL UTILISANT DES COMBUSTIBLES SOLIDES ET MODE D'EXPLOITATION
(54) Title: SOLID FUEL BURNING APPLIANCE AND METHOD TO CONTROL SAME



(57) Abrégé/Abstract:
A furnace assembly comprising a furnace housing having a combustion chamber therein for receiving fuel and combustion fluid, a plurality of combustion fluid inlets in fluid communication with the combustion chamber. One or more of the combustion fluid inlets

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(57) Abrégé(suite)/Abstract(continued):
has a closure element operable between an open position and a closed position for blocking the corresponding inlet and controlling the supply of combustion fluid to the combustion chamber. The furnace assembly includes one or more temperature sensors installed in the furnace housing for measuring the temperature at corresponding locations of the sensors; and a control unit for controlling the closure elements, the control unit being operatively coupled to the temperature sensors and configured to adjust the closure elements based on the measured temperatures.

ABSTRACT

A furnace assembly comprising a furnace housing having a combustion chamber therein for receiving fuel and combustion fluid, a plurality of combustion fluid inlets in fluid communication with the combustion chamber. One or more of the combustion fluid inlets has a closure element operable between an open position and a closed position for blocking the corresponding inlet and controlling the supply of combustion fluid to the combustion chamber. The furnace assembly includes one or more temperature sensors installed in the furnace housing for measuring the temperature at corresponding locations of the sensors; and a control unit for controlling the closure elements, the control unit being operatively coupled to the temperature sensors and configured to adjust the closure elements based on the measured temperatures.

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SOLID FUEL BURNING APPLIANCE AND METHOD TO CONTROL SAME

TECHNICAL FIELD OF THE INVENTION

[0001] The technical field relates to a furnace assembly and a corresponding method to control same.

BRIEF SUMMARY OF THE INVENTION

[0002] According to a general aspect, there is provided a furnace assembly comprising a furnace housing defining a combustion chamber therein for receiving solid fuel and combustion fluid (or any other suitable material), a plurality of combustion fluid inlets in fluid communication with the combustion chamber. One or more of the combustion fluid inlets has a closure element operable between an open position and a closed position for blocking the corresponding inlet and controlling the supply of combustion fluid to the combustion chamber. The furnace assembly includes one or more temperature sensors installed in the furnace housing, or at least proximate thereto, for measuring the temperature at corresponding locations of the sensors; and a control unit for controlling the closure elements, the control unit being operatively coupled to the temperature sensors and configured to modify a configuration of the closure elements based on the measured temperatures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] Fig. 1 is a perspective view of a furnace assembly in accordance with an embodiment;

[0004] Fig. 2 is a front elevation view of a furnace assembly, showing a plenum and outlet conduits connected to the furnace and extending therefrom according to an embodiment;

[0005] Fig. 3 is a front elevation view of an alternate embodiment of a furnace assembly, showing a second furnace fluidly connected to a first furnace;

[0006] Figs. 4 and 5 are front and side elevation views of a furnace assembly, according to an embodiment, showing various conduits of the furnace assembly extending therefrom;

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[0007] Figs. 6A and 6B are rear views of the furnace assembly, showing three separate combustion fluid inlets, with closure elements positioned proximate two of the inlets in an open position (Fig. 6A) and a closed position (Fig. 6B);

[0008] Fig. 7 is a photograph of the furnace assembly shown in Fig. 1, showing an interior of a combustion chamber;

[0009] Fig. 8 is a flowchart of a method of operating the furnace assembly, according to an embodiment; and

[0010] Fig. 9 is a flowchart of a method of operating a ventilator connected to the furnace housing, according to an embodiment.

[0011] It will be noted that throughout the appended drawings, like features are identified by like reference numerals.

DETAILED DESCRIPTION

[0012] In the following description, the same numerical references refer to similar elements. Furthermore, for the sake of simplicity and clarity, namely so as to not unduly burden the figures with several references numbers, not all figures contain references to all the components and features, and references to some components and features may be found in only one figure, and components and features of the present disclosure which are illustrated in other figures can be easily inferred therefrom. The embodiments, geometrical configurations, materials mentioned and/or dimensions shown in the figures are optional, and are given for exemplification purposes only.

[0013] Moreover, although the embodiments of the furnace assembly and corresponding parts thereof consist of certain geometrical configurations as explained and illustrated herein, not all of these components and geometries are essential and thus should not be taken in their restrictive sense. It is to be understood, as also apparent to a person skilled in the art, that other suitable components and cooperation thereinbetween, as well as other suitable geometrical configurations, may be used for the furnace assembly, as will be briefly explained herein and as can be easily inferred herefrom by a person skilled in the art.

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[0014] Moreover, it will be appreciated that positional descriptions such as “above”, “below”, “forward”, “rearward” “left”, “right” and the like should, unless otherwise indicated, be taken in the context of the figures and correspond to the position and orientation of the furnace assembly and corresponding parts when in use or during assembly.

[0015] To provide a more concise description, some of the quantitative expressions given herein may be qualified with the term "about". It is understood that whether the term "about" is used explicitly or not, every quantity given herein is meant to refer to an actual given value, and it is also meant to refer to the approximation to such given value that would reasonably be inferred based on the ordinary skill in the art, including approximations due to the experimental and/or measurement conditions for such given value.

[0016] In the following description, an embodiment is an example or implementation of the invention(s). The various appearances of “one embodiment,” “an embodiment” or “some embodiments” do not necessarily all refer to the same embodiments.

[0017] Although various features of the invention may be described in the context of a single embodiment, the features may also be provided separately or in any suitable combination. Conversely, although the invention may be described herein in the context of separate embodiments for clarity, the invention may also be implemented in a single embodiment.

[0018] Reference in the specification to “some embodiments”, “an embodiment”, “one embodiment” or “other embodiments” means that a particular feature, structure, or characteristic described in connection with the embodiments is included in at least some embodiments, but not necessarily all embodiments, of the inventions.

[0019] It is to be understood that the phraseology and terminology employed herein is not to be construed as limiting and are for descriptive purpose only.

[0020] The principles and uses of the teachings of the present invention may be better understood with reference to the accompanying description, figures and examples.

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[0021] It is to be understood that the details set forth herein do not construe a limitation to an application of the invention.

[0022] Furthermore, it is to be understood that the invention can be carried out or practiced in various ways and that the invention can be implemented in embodiments other than the ones outlined in the description above.

[0023] It is to be understood that the terms "including", "comprising" and grammatical variants thereof do not preclude the addition of one or more components, features, steps, or integers or groups thereof and that the terms are to be construed as specifying components, features, steps or integers.

[0024] If the specification or claims refer to "an additional" element, that does not preclude there being more than one of the additional element.

[0025] It is to be understood that where the claims or specification refer to "a" or "an" element, such reference is not be construed that there is only one of that element.

[0026] It is to be understood that where the specification states that a component, feature, structure, or characteristic "may", "might", "can" or "could" be included, that particular component, feature, structure, or characteristic is not required to be included.

[0027] Meanings of technical and scientific terms used herein are to be commonly understood as by one of ordinary skill in the art to which the invention belongs, unless otherwise defined.

[0028] The present invention may be implemented in the testing or practice with methods and materials equivalent or similar to those described herein.

[0029] Referring to Fig. 1, there is shown an embodiment of a fuel burning appliance or "furnace assembly" 10. The furnace assembly 10 includes a furnace housing 12 having a door 14 for covering an access to an interior of the furnace housing 12. As will be described further below, the interior of the furnace housing comprises a combustion chamber 16 configured to contain fuel (e.g., wood) for burning within the furnace housing 12.

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[0030] With reference to Figs. 2 and 3, the furnace assembly 10 can include a heat exchanger 20 for recovering heat generated during the fuel combustion and supplying heat to various locations (e.g., buildings, rooms, houses, etc.). The heat exchanger 20 illustratively includes a plenum 22 mounted to the furnace housing 12 for establishing fluid communication between the combustion chamber 16 and various conduits 24 extending from the plenum 22. The heat exchanger 20 enables a heat output of the furnace assembly 10 (i.e., from burning fuel) to circulate to desired locations. As seen in Figs. 2 and 3, the heat exchanger 20 can include a plurality of conduits 24 extending from the plenum 22, thereby enabling the furnace assembly 10 to provide heat to more than a single location. It should be noted that the furnace assembly 10 further includes an evacuation conduit 33 configured to be fluidly connected to a chimney to allow undesired particles (e.g., smoke, gases, etc.) to be safely released in an exterior environment.

[0031] The furnace housing 12 can include one or more combustion fluid intakes 30 to allow combustion fluids to access the combustion chamber 16 and enable combustion of the fuel provided therein. The combustion fluid intake 30 can include an intake conduit 32 adapted to carry fluid to a fluid inlet 34 (such as an air inlet), provided in the furnace housing and communicating with the combustion chamber 16 or other components of the furnace assembly 10. In one embodiment, and as seen in Fig. 2, the fluid inlet 34 can include a fluid inlet port provided directly on the furnace housing 12 such that the intake conduit 32 is connected to a side of the furnace housing 12 and in fluid communication with the fluid inlet port. However, in other embodiment, and with reference to Fig. 3, the furnace assembly 10 can be coupled to a second furnace 13, such as a gas, oil or electric furnace, with the combustion fluid intake 30 being provided on the second furnace 13. It is understood that the plenum 22 of both furnaces are connected to one another and cooperate to route the heat output to the heat exchanger conduits 24.

[0032] Figs. 4 and 5 illustrate possible embodiments of the furnace assembly 10 installed in a substantially confined space, showing the evacuation conduit 33 connected to a rear side of the furnace housing 12 (Fig. 5), and the heat exchanger conduits 24 extending from the plenum 22 opposite the evacuation conduit 33 (i.e., towards the front of the furnace housing 12).

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[0033] Now referring to Figs. 6A and 6B, along with Figs. 1 to 5, the furnace assembly 10 comprises a control unit 40 configured to improve combustion of the fuel contained within the combustion chamber, improve heat distribution and therefore improve the efficiency of the furnace assembly 10. The control unit 40 can be adapted to control the combustion fluid intake into the combustion chamber 16 via the air inlet(s) 34, for example. In some embodiments, the furnace housing 12 can be provided with a plurality of air inlets 34 to increase the amount of combustion fluid being provided to the combustion chamber 16, and provide different entry points to the combustion chamber, for example. One or more air inlets can be provided with a closure element 42, such as and without being limitative a pivotable shutter, operatively connected to the control unit 40 and operable between an open position for allowing combustion fluid to be circulated into the combustion chamber 16 via the corresponding air inlet, and a closed position for blocking the air inlet 34 and at least partially prevent combustion fluid from being supplied to the combustion chamber 16. It should be noted that the closure elements 42 can be positioned in intermediate positions between the fully open and fully closed positions to further control the amount of combustion fluid, such as air, being supplied to the combustion chamber.

[0034] Still with reference to Figures 6A and 6B, the illustrated embodiment includes three air inlets 34, which can be divided into a primary air inlet 35, a secondary air inlet 36 and a tertiary air inlet 37. In Figures 6A and 6B, the air inlet port of each one the air inlets 35, 36, and 37 is shown, with their respective closure element 37, if any. The primary air inlet 35 and the tertiary air inlet 37 are respectively provided with a closure element 42, while the second air inlet 36 remains open to provide combustion fluid to a desired area of the furnace assembly 10. However, it is appreciated that other configurations are possible regarding the use of closure elements 42 for controlling the air intake within the furnace housing 12. The control unit 40 is configured to regulate the amount of combustion fluid being provided to the combustion chamber 16 by operating the closure elements 42 between the open, closed and/or intermediate positions. Therefore, fuel (e.g., wood) can be burned under controlled conditions in order to produce a more efficient and clean combustion. The control unit 40 can be coupled to each closure element via respective actuators, such as and without being

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limitative motors 46, although other methods of controlling the closure elements are possible and may be used.

[0035] As seen in Figure 6B, the closure elements 42 are illustrated in a fully closed position preventing air to access to the air inlet port of the respective air inlet, whereas the closure elements 42 are open in Figure 6A. More specifically, the closure element of the tertiary inlet is partially open, and the closure element of the primary inlet is fully open. The motors 46 can be configured to open the closure elements 42 via a rotation movement. For example and without being limitative, the fully open position can be achieved via a rotation of the closure element by about 180 degrees from the closed position.

[0036] The primary inlet 35 can be configured to enable a supply of combustion fluid proximate a top portion of the combustion chamber, towards the front (i.e., near the door 14), such that combustion fluid is provided substantially above the fuel within the combustion chamber. This primary supply of combustion fluid can be adapted to create a flow of air along an inner surface of the door 14, therefore preventing, or at least reducing the number of particles being deposited on the door (e.g., soot, combustion by-products, etc.). Thus, the primary inlet 35 can include the air inlet port described above, an air outlet port located above the fuel within the combustion chamber, and an air conduit extending between the air inlet port and the air outlet port. It should be noted that, in this embodiment, the primary air flow is routed along the inner surface of the door in order to reach the fuel in a lower half of the combustion chamber.

[0037] The secondary air inlet 36 can be configured to enable a supply of combustion fluid proximate the rear surface of the furnace housing 12 to enable a generally constant supply of combustion fluid to the combustion chamber (e.g., above the fuel). Thus, the secondary inlet 35 can include the air inlet port described above, an air outlet port located in the furnace housing 12 defining the combustion chamber 16, such as below a heat deflector provided therein, but above the fuel, for example, and an air conduit extending between the air inlet port and the air outlet port. The tertiary air inlet 37 can be configured to enable a supply of combustion fluid proximate a bottom surface, or floor of the furnace housing 12, thereby enabling a supply of combustion

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fluid generally below the fuel within. Thus, the tertiary inlet 35 can include the air inlet port described above, an air outlet port located in a bottom wall of the furnace housing 12 defining the combustion chamber 16, and an air conduit extending between the air inlet port and the air outlet port. As seen in Figure 7, the air outlet port of the tertiary inlet 37 can be provided with and covered by a grate, or grill 38, to prevent fuel from entering the ducts connected to the inlet. It is appreciated that the position, configuration and number of air inlets described herein is exemplary, and that other configurations are possible for providing combustion fluid to the combustion chamber.

[0038] The furnace assembly 10 can include one or more temperature sensors (not shown) installed within or in proximity of the combustion chamber, or elsewhere, configured to measure or estimate, in real-time, the temperature within the combustion chamber, or at any other various locations in and/or around the furnace. In this embodiment, the furnace assembly includes a first temperature sensor (not shown) mounted within the combustion chamber 16 adapted to measure the temperature proximate the burning fuel. The furnace assembly further includes a second temperature sensor (not shown) installed within the furnace housing above the heat deflector provided therein. It should be noted that the first and second temperature sensors can be installed on either sides of the heat deflector within the furnace housing. A third temperature sensor (not shown) can be installed within (or proximate) the plenum 22, thereby measuring the temperature of the air flowing through the plenum and being routed to the conduits 24.

[0039] As will be described further below, the temperature sensors can be operatively connected to the control unit 40. Therefore, depending on the measured temperatures, the control unit 40 can modify a configuration of one or more of the closure elements 42 to adjust the openings of the air inlet ports and control the supply of combustion fluid to the combustion chamber.

[0040] Moreover, the furnace assembly 10 can be linked to a remote thermostat and operated via actuation of the thermostat. For example, when a request is inputted to the thermostat to increase the temperature of an environment, such as a room, the control unit 40 will set the furnace assembly in a corresponding configuration to increase the heat output. Once the temperature of the environment reaches the

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desired temperature, the control unit 40 can operate the furnace assembly to reduce the heat output accordingly.

[0041] A ventilator 50 can be provided to the furnace assembly 10 and is configured to improve circulation of the heat output from the combustion chamber 16 to the conduits 24 of the heat exchanger 20. The third sensor, along with the ventilator, can be coupled to the control unit 40 such that the temperature within the plenum 22 can be maintained within a substantially safe range of temperatures while simultaneously regulating the heat output of the furnace assembly 10. As will be described further below, the ventilator can be operatively connected to the thermostat such that the ventilator is at least partially dependent on the input of the thermostat, similar to the position of the closure elements.

[0042] In the present embodiment, the furnace assembly 10 comprises an ignition actuator 48 operable to selectively increase the amount of combustion fluid being provided to the combustion chamber 16. With reference to Fig. 1, the ignition actuator 45 can include a button 49 disposed on a front surface of the furnace housing 12, although other configurations are possible. When the button is pushed, the control unit 40 operates one or more of the closure elements in the open position to effectively increase the amount of combustion fluid being supplied to the combustion chamber. This can be useful when loading the combustion chamber with additional fuel, such as adding more wood, for example, or for initially igniting the fuel. The ignition actuator 48 can initiate a reload sequence configured to increase the amount of combustion fluid provided to desired locations within the combustion chamber for a predetermined amount of time.

[0043] The button 49 can include visual indicators, such as lights (e.g., LEDs), to indicate the status of the furnace assembly 10. For example, the light can indicate that; the temperature requested (via the thermostat) has been reached, the temperature is below or above a requested temperature, the furnace temperature is too high (or too low), there is residual heat within the combustion chamber 16, etc.

[0044] Operation of the furnace assembly will now be described. Broadly described, combustion is initiated within the combustion chamber in order to raise the temperature therein. Then, the plenum enables fluid communication between the

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combustion chamber and the heating conduits to heat the desired locations via various conduits.

[0045] With reference to Fig. 8, there is shown an exemplary operating method (or control logic) for using the furnace assembly. Initially, the furnace assembly is in a standby configuration 100, with the temperature within the combustion chamber being relatively cold. While in the standby configuration, at least one of the closure elements (i.e., the closure elements of the primary inlet and third "grill" inlet) can be fully closed (i.e., at an opening of 0 degrees). In some embodiments, when in the standby configuration 100, the closure element of the primary inlet can be opened at a minimum opening angle (e.g., between 0.5 and 15 degrees) to allow air to be provided to the combustion chamber at a low rate. At step 110, the furnace assembly is initiated by pressing the button. The closure elements are opened, thereby providing combustion fluid to the combustion chamber and igniting the fuel to produce heat. In this embodiment, the primary closure element is fully open, while the grill closure element is partially opened, such as at an opening between about 10 and 75 degrees.

[0046] Step 110 lasts until the temperature measured by a sensor within the furnace housing (e.g., the second sensor) reaches a certain temperature, such as a temperature between about 300F and 800F, and at least a minute has elapsed since the grill closure element was opened. Then, at step 120, the temperature within the combustion chamber is set to increase to a target temperature. For example, in the present embodiment, if a request was inputted into the thermostat the target temperature is set between 500F and 1200F, whereas if no request was inputted, the target temperature is slightly lower, such as between 400F and 1100F, for example. During the second step 120, the grill closure element is fully closed, and the primary closure element is partially closed (e.g., at an opening of 90 degrees) to reduce the input of combustion fluid to the combustion chamber.

[0047] After the target temperature has been reached, or after a set amount of time, such as between about one and ten minutes has elapsed since the start of step 120, step 130 includes controlling the primary closure element, while keeping the grill element closed, to control the intake of combustion fluid into the combustion chamber in order to maintain the temperature at the target temperature described above. It

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should be noted that steps 110 to 130 can represent a preheating sequence of the furnace assembly.

[0048] Depending on if a temperature request was inputted via the thermostat, the operating method includes step 140a if a request was inputted, and step 140b if no request was inputted. In this embodiment, step 140a (i.e., COMBUSTION_HIGH) is initiated after a predetermined amount of time, such as after 5, 10, 15, 20, 30, 45 or 60 minutes of having the temperature within the combustion chamber maintained at, or at least proximate to the target temperature during the preheating sequence, and includes an increase in the target temperature. The control unit is adapted to operate the closure elements of the inlets in order to provide sufficient combustion fluid to increase the temperature, and therefore increase the heat output of the furnace assembly. In this embodiment, during step 140a, the grill closure element is kept closed, while the primary closure element is adjusted, such between an opening of 15 degrees and 180 degrees (i.e., fully opened), although it is appreciated that other configurations are possible.

[0049] The furnace assembly 10 is configured to automatically detect when a portion of the fuel has burned. For example, when wood has burned, embers remain within the combustion chamber and continues to provide a heat output for a time. Therefore, once the embers are detected, step 150a (COAL_HIGH) is initiated. In this embodiment, the furnace assembly 10 initiates step 150a once the difference between the measured temperatures of the first and second temperature sensors is at or above a temperature, such as a temperature between 150F and 500F, and when the measured temperature of the first sensors is below a predetermined threshold, such as between 400F and 1000F. It should be understood that step 150a includes controlling the closure elements in an attempt to optimize the heat output. As an example, the grill closure element is adjustable between 0 and 90 degrees, while the primary closure element is adjustable between 0 and 180 degrees to maintain the temperature around the target temperature.

[0050] Finally, once the embers within the combustion chamber begin to become extinguished, the furnace assembly 10 reverts back to the standby configurations 100. In this embodiment, the standby configuration is initiated (from the COAL_HIGH

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configuration) once the temperature measured by both the first and second sensors drops below a predetermined threshold, such as below a temperature between 50F and 500F. At this point, additional fuel can be added to the furnace housing, and the button actuated to start the preheating sequence once again.

[0051] Returning to step 130, if no thermostat request was inputted, step 140b is initiated. In this embodiment, step 140b includes adjusting the closure elements of the inlets to maintain the combustion within the combustion chamber, although the target temperature is lower than the target temperature of step 140a since there is no request from the thermostat to provide additional heat output. As seen in Fig. 8, step 140b can loop between two configurations in order to maintain the temperature at, or around, a target temperature and keep the furnace housing heated without necessarily outputting heat. As such, the combustion chamber is kept at a certain temperature and is ready to output heat should a thermostat request be inputted during step 140b.

[0052] In the present embodiment, the loop configurations include step 145a (COMBUSTION_LOW) and step 145b (COMBUSTION_LOW_PHASE2). Steps 145a includes closing the grill closure element and adjusting the primary closure element between openings of 0 and 180 degrees, such as openings between 25 and 55 degrees, in an attempt to maintain the temperature around a target temperature, such as a temperature between 600F and 1000F, for example. After some time, such as after 10, 15, 20, 25, 35 or 45 minutes since step 145a was initiated, or if the temperature measured by the first sensor exceeds a predetermined temperature, such as a temperature between 400F and 900F, step 145b is automatically initiated. During step 145b, the grill is kept closed, while the primary closure element is set to a fixed opening, for example. Moreover, if the temperature measured by the first sensor drops below a certain threshold, the furnace will revert to step 145a and reopen the primary closure element to increase the combustion fluid supply, thus increasing the temperature. As mentioned above, the furnace will loop between 145a and 145b depending on the measured temperature of the furnace. As such, the fuel within the combustion chamber remains ignited, although the heat output is lowered.

[0053] During step 140b, if a thermostat request is inputted, the furnace assembly will switch to step 140a described above. However, if no input is detected, and the

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temperature within the furnace lowers to a predetermined threshold, the furnace enters step 160 (FLAME_LOSS). In this embodiment, step 160 is initiated when the temperature measured by the second sensor drops below a flame threshold, such as 600F, and the difference between the first and second sensors is at or below a temperature between 30F and 125F, for example. The furnace assembly automatically interprets this state as a loss of the flame within the combustion chamber. As such, the grill closure element is fully opened to reignite the fuel and return the furnace assembly to step 140b. In this embodiment, once the temperature of the second sensor exceeds the flame threshold, or any other suitable temperature, the furnace assembly returns to the loop of step 140b (i.e., the loop between 145a and 145b).

[0054] Similar to step 150a, once the fuel within the combustion chamber has substantially burned, the furnace goes from step 140b to step 150b (COAL_LOW). In this embodiment, the furnace assembly 10 initiates step 150b once the difference between the measured temperatures of the first and second temperature sensors is at or above a predetermined temperature, such as between 100F and 500F, and when the measured temperature of the first sensors is below a certain temperature, such as a temperature between 400F and 900F. It should be understood that step 150b includes controlling the closure elements in order to optimize the lifespan of the embers, although there is no target temperature at this stage. As an example, the grill closure element is closed (0 degrees), while the primary closure element is set to a fixed opening. Once the embers within the combustion chamber begin to become extinguished, the furnace assembly 10 reverts back to the standby configurations 100. In this embodiment, the standby configuration is initiated (from the COAL_LOW configuration) once the temperature measured by both the first and second sensors drops below a predetermined threshold, such as below a temperature between 50F and 500F.

[0055] It should be noted that the furnace assembly can switch between steps 140a and 140b, and between 150a and 150b, depending on the requested input to the thermostat. The closure elements are then adjusted to respect the opening range of the corresponding step when switching from a HIGH to a LOW configuration, or vice-versa.

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[0056] With reference to Figure 9, as mentioned above, the ventilator can be operatively connected to the control unit such that the ventilator is configured to activate automatically based on the measured temperatures and/or the input of the thermostat. In this embodiment, when a request is inputted via the thermostat, the ventilator (or FAN) is adapted to activate (i.e., go from FAN OFF to FAN SPEED 1) if the temperature measured by the third sensor (positioned within the plenum) exceeds a predetermined threshold, such as a temperature between 50F and 200F, for example. The ventilator turns off once the temperature within the plenum drops below a lower threshold. Alternatively, if no request was inputted, the ventilator will activate once the temperature within the plenum exceeds a high threshold and turn off when the temperature lowers back down. It should be understood that the ventilator activates even though no request was inputted via the thermostat in order to prevent the furnace from overheating, for example.

[0057] It is appreciated that the temperatures are monitored/measured in real-time, and that the control unit can operate the closure elements and the ventilator accordingly (and also in real-time) to adjust the supply of combustion fluid, and therefore the temperature within the combustion chamber. The adjustments are automatic and autonomous to increase efficiency of the furnace assembly 10.

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CLAIMS:

1. A furnace assembly comprising:

a furnace housing having a combustion chamber therein for receiving fuel and combustion fluid;

a plurality of combustion fluid inlets in fluid communication with the combustion chamber, wherein one or more of the combustion fluid inlets having a closure element operable between an open position to enable the supply of the combustion fluid through the corresponding inlet, and a closed position for blocking the corresponding inlet and preventing combustion fluid to be supplied to the combustion chamber;

one or more temperature sensors installed in the furnace housing for measuring the temperature at corresponding locations of the sensors; and

a control unit for controlling the closure elements, the control unit being operatively coupled to the temperature sensors and configured to adjust the closure elements based on the measured temperatures.

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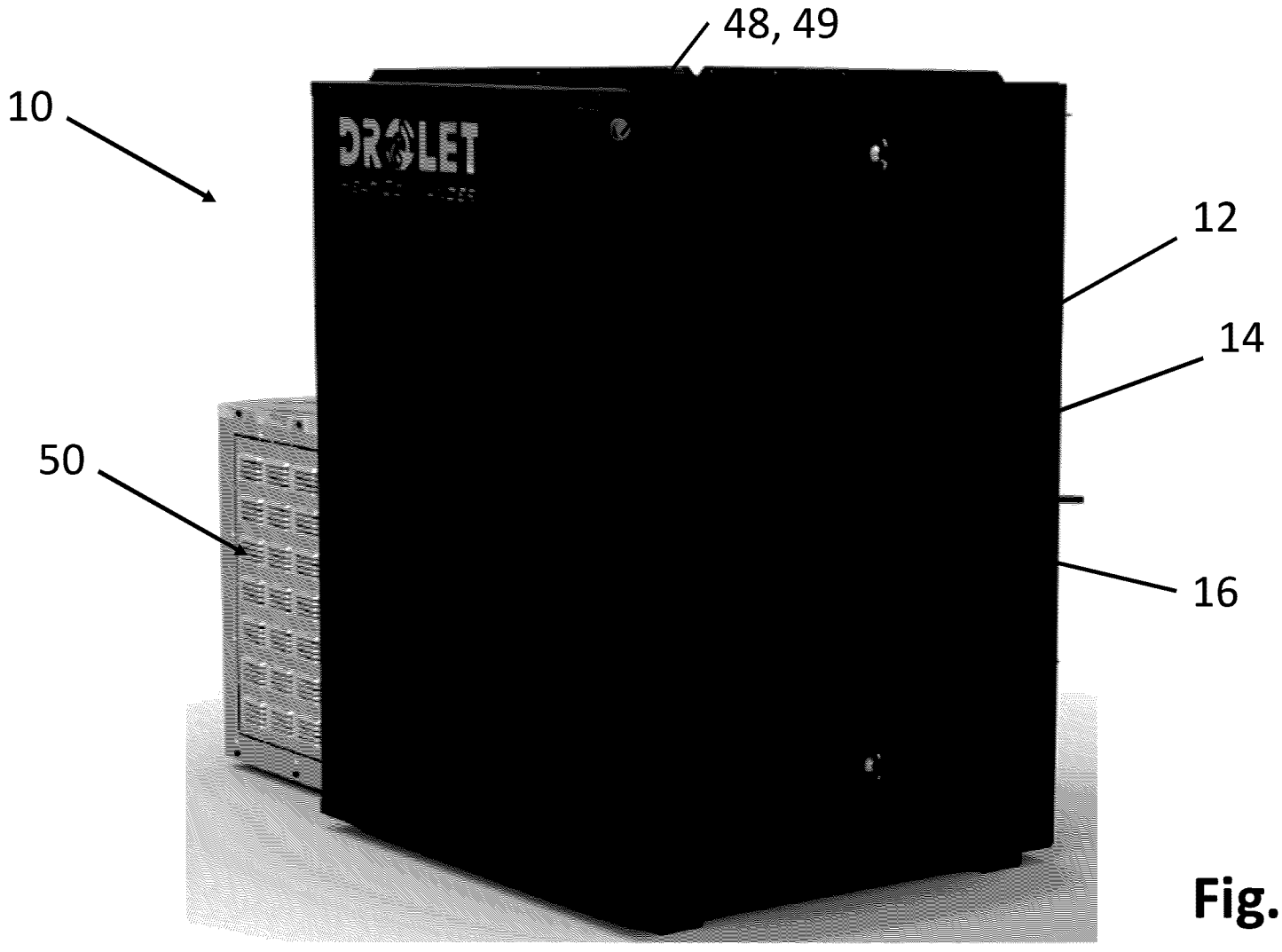


Fig. 1

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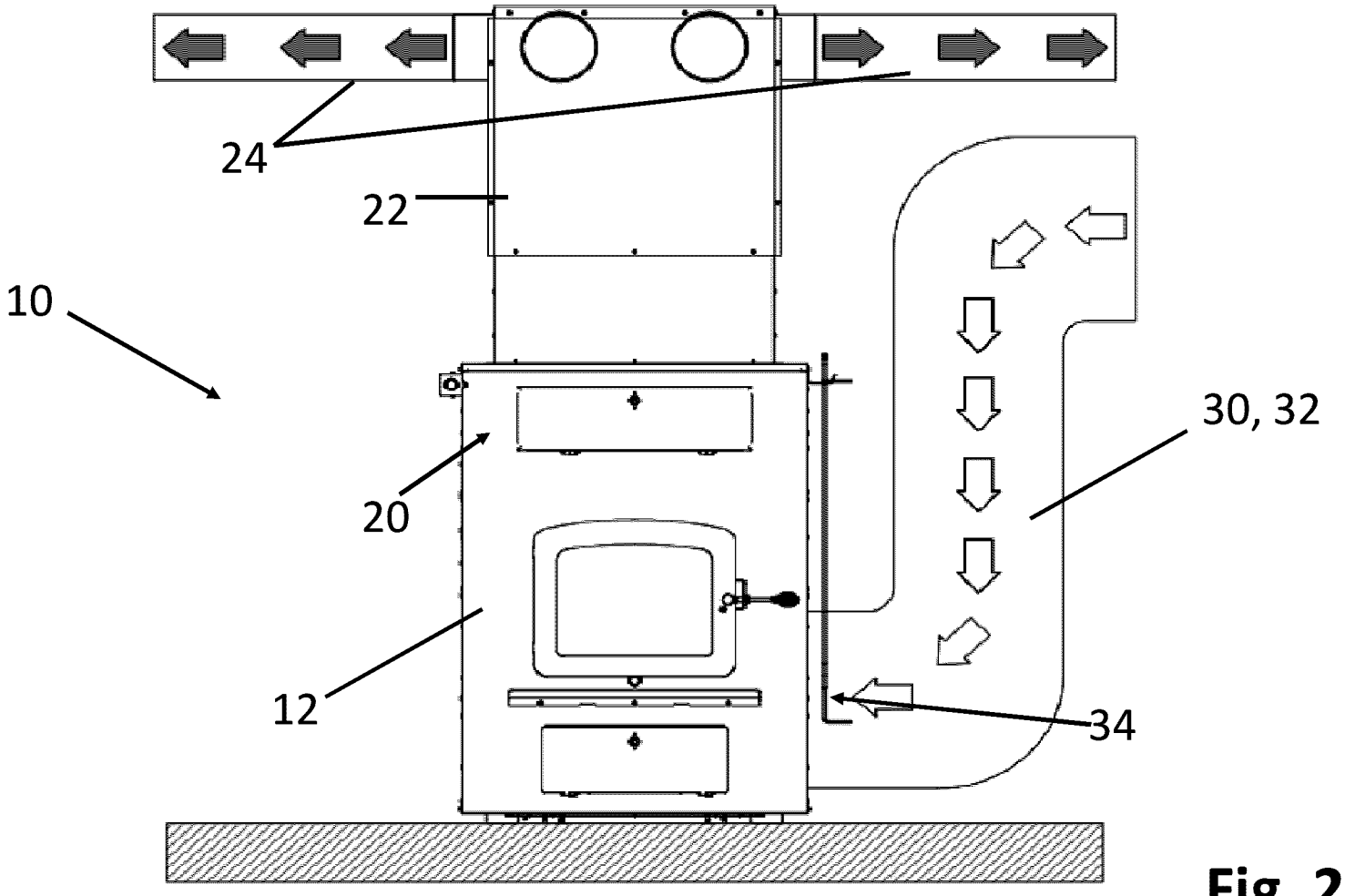


Fig. 2

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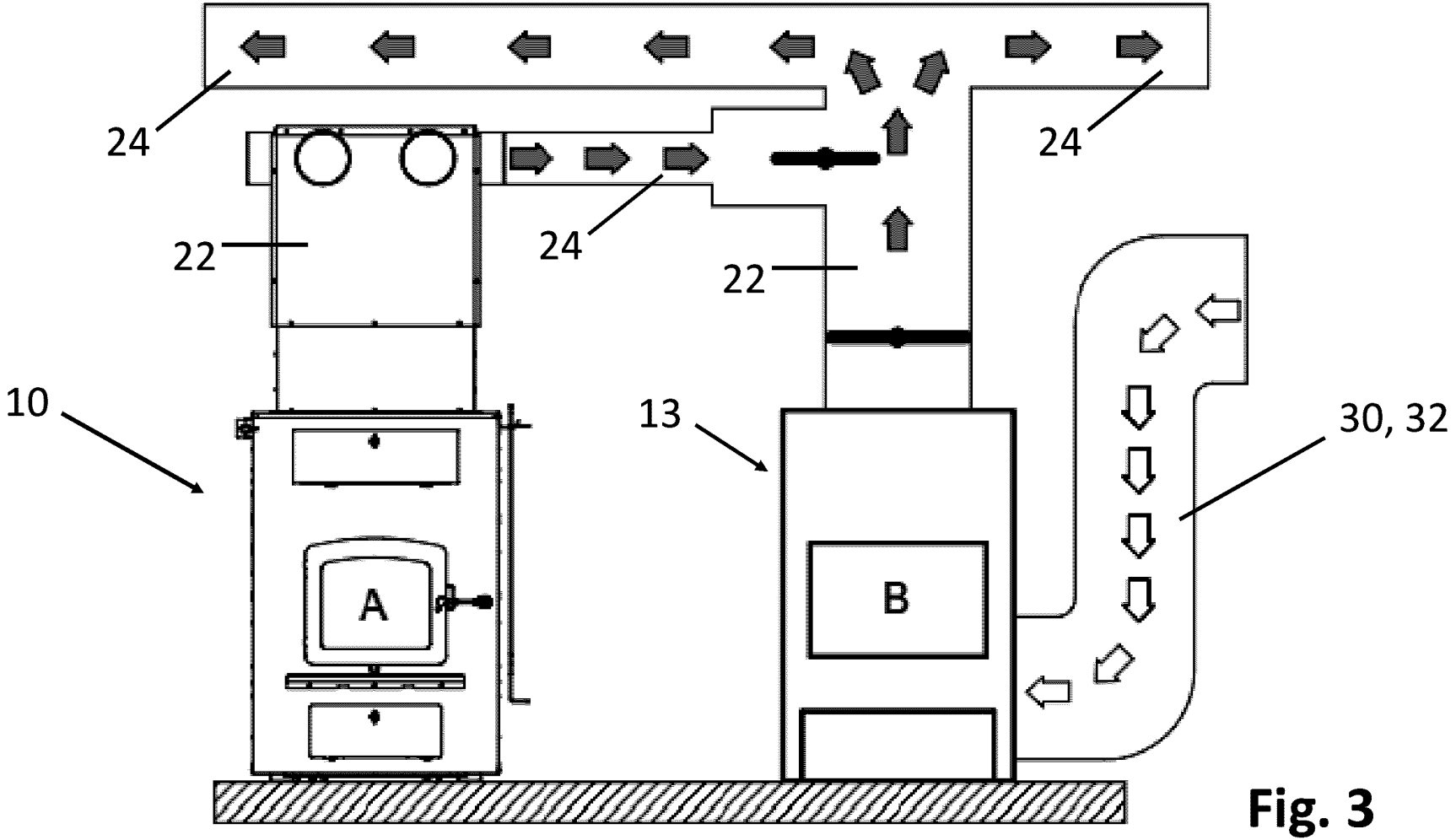


Fig. 3

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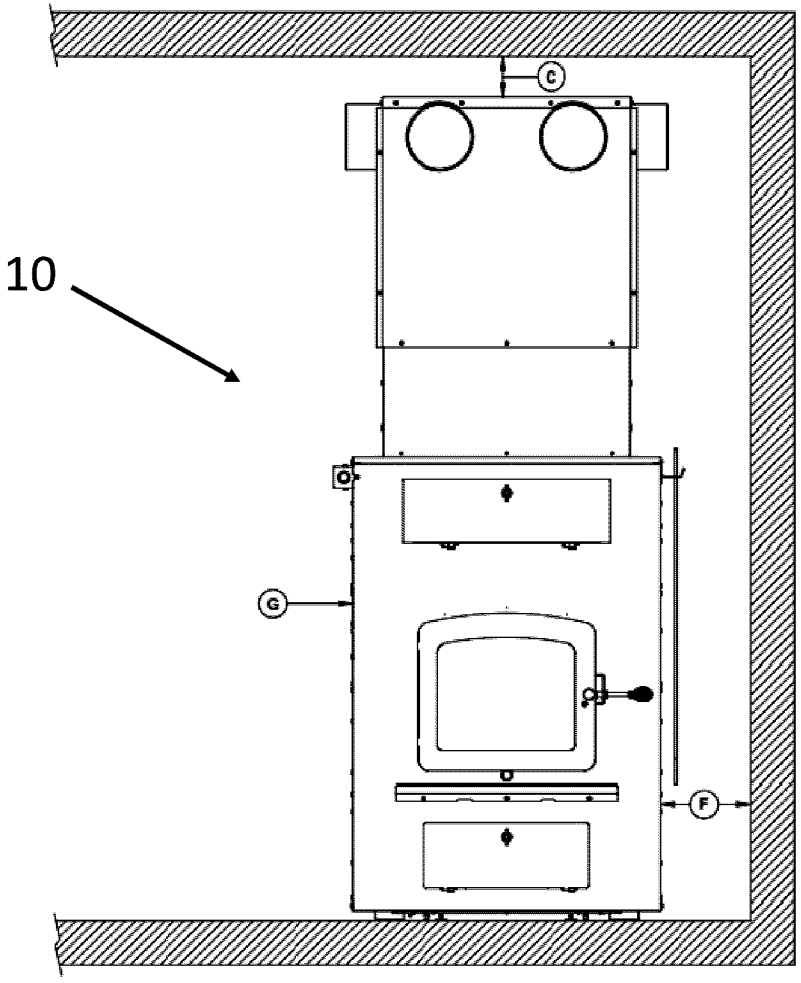


Fig. 4

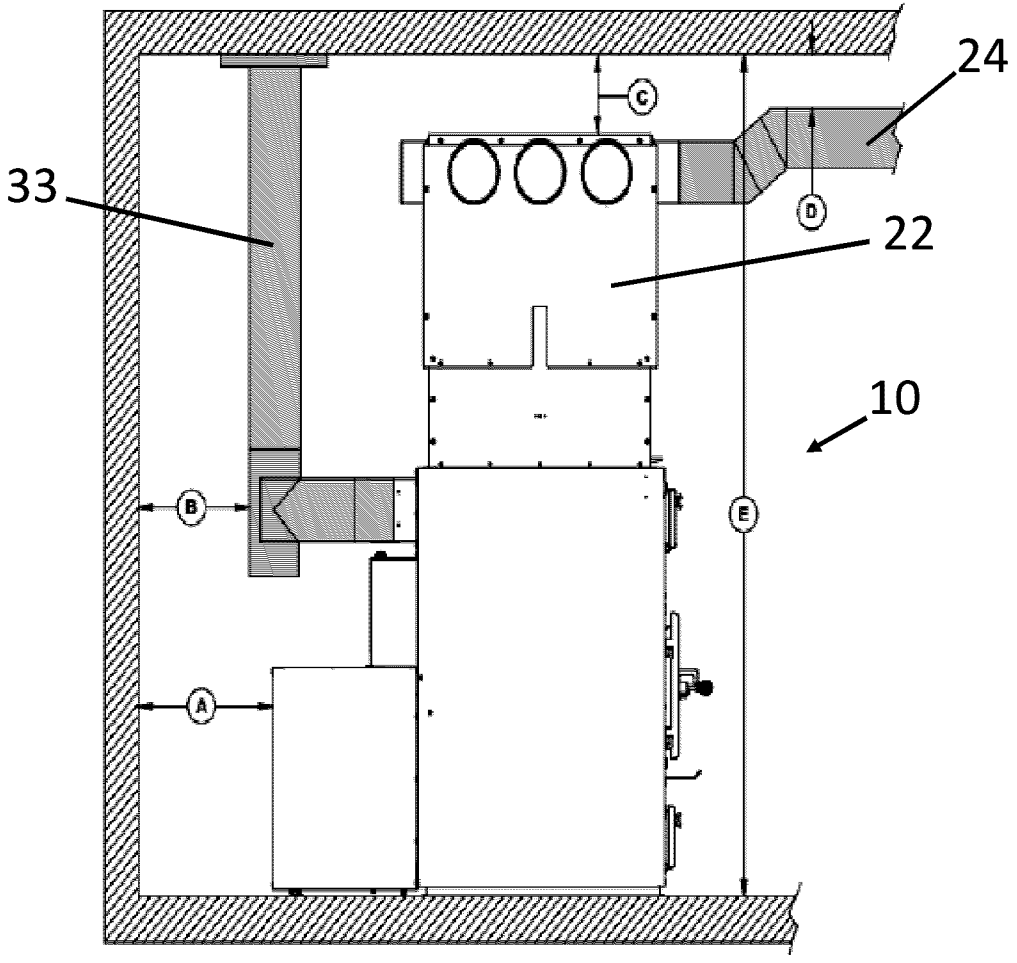


Fig. 5

Date Reçue/Date Received 2020-10-26

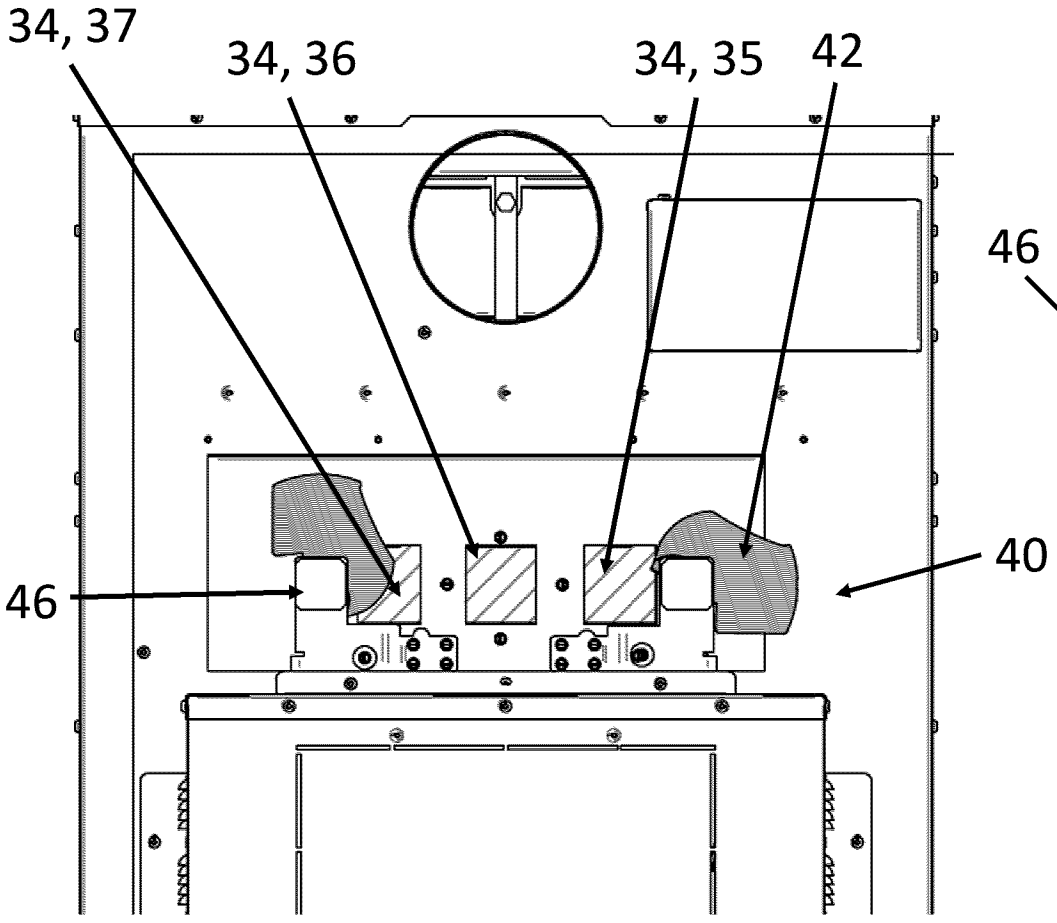


Fig. 6A

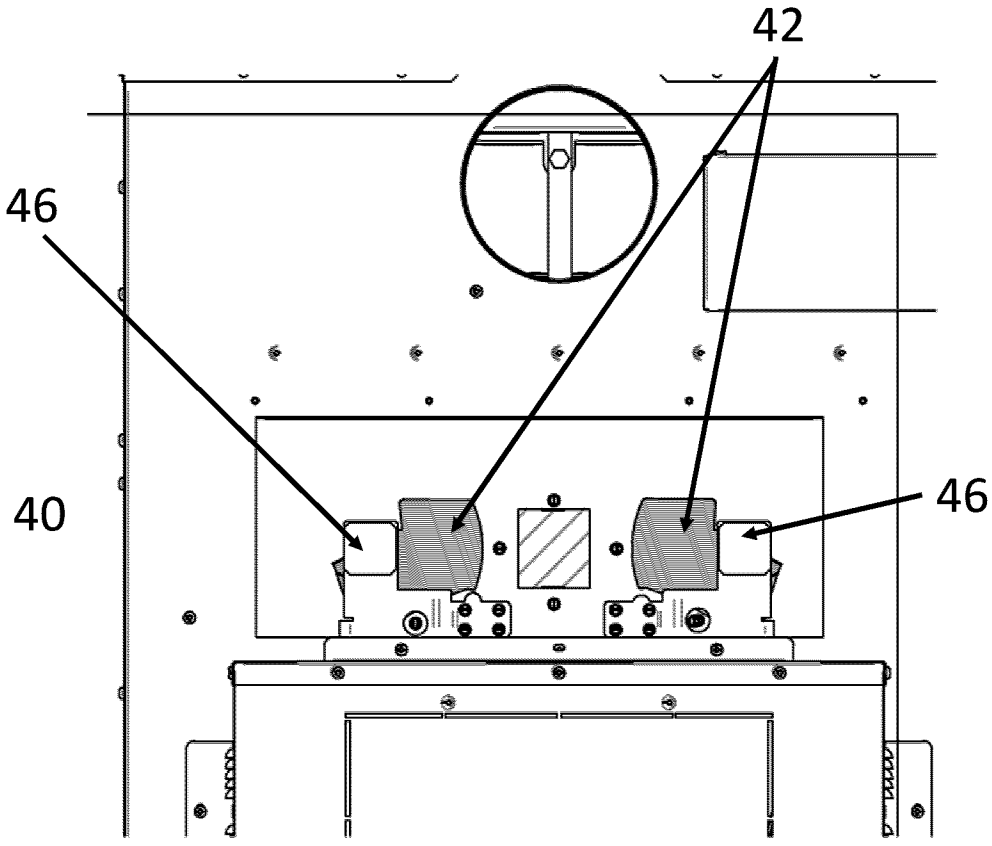


Fig. 6B

Date Reçue/Date Received 2020-10-26



Fig. 7

Date Reçue/Date Received 2020-10-26

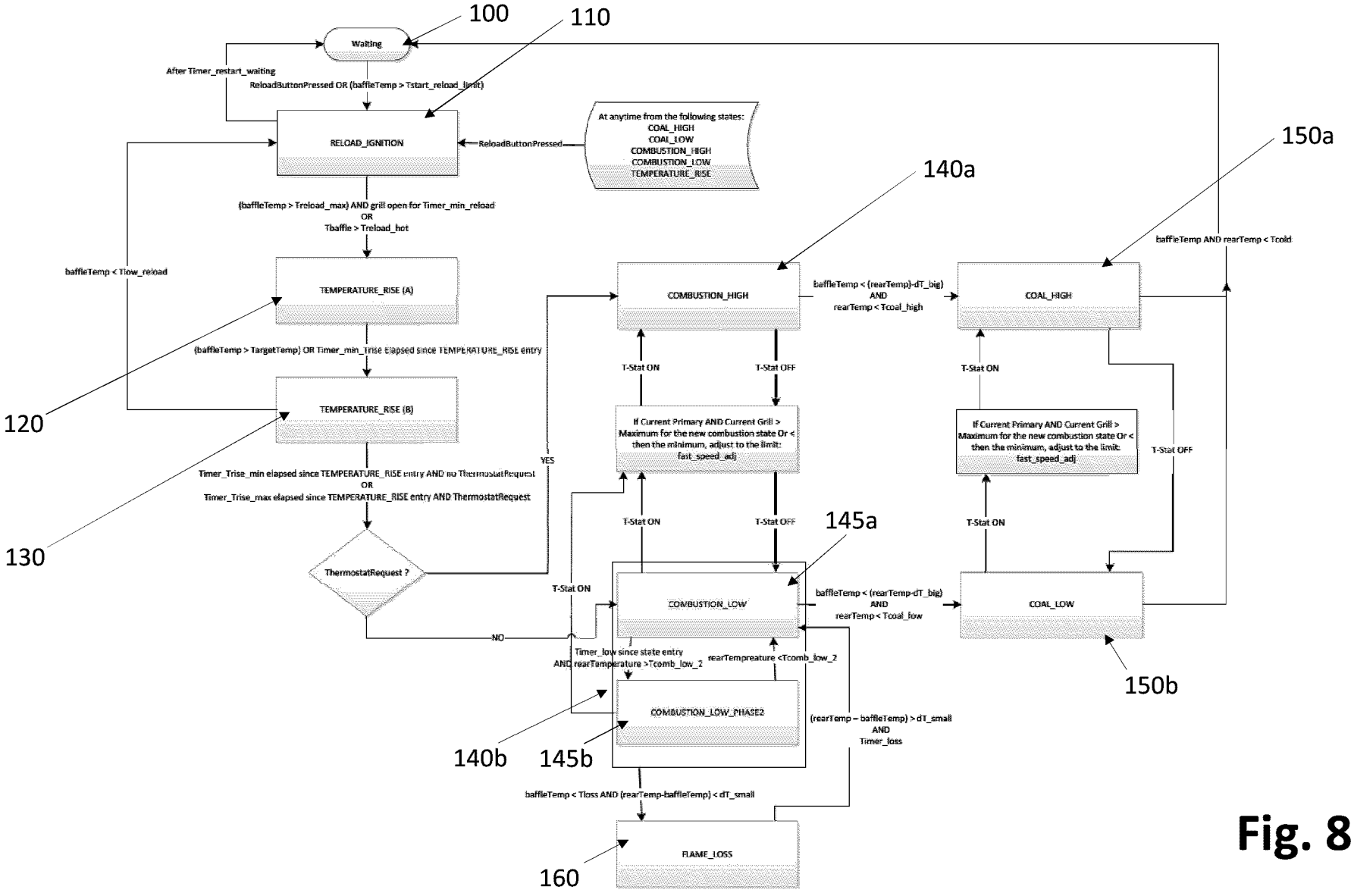


Fig. 8

Date Reçue/Date Received 2020-10-26

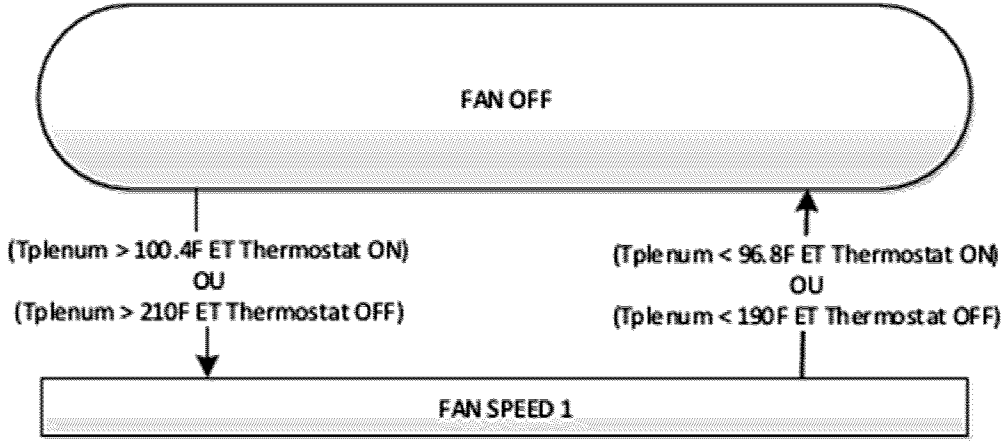
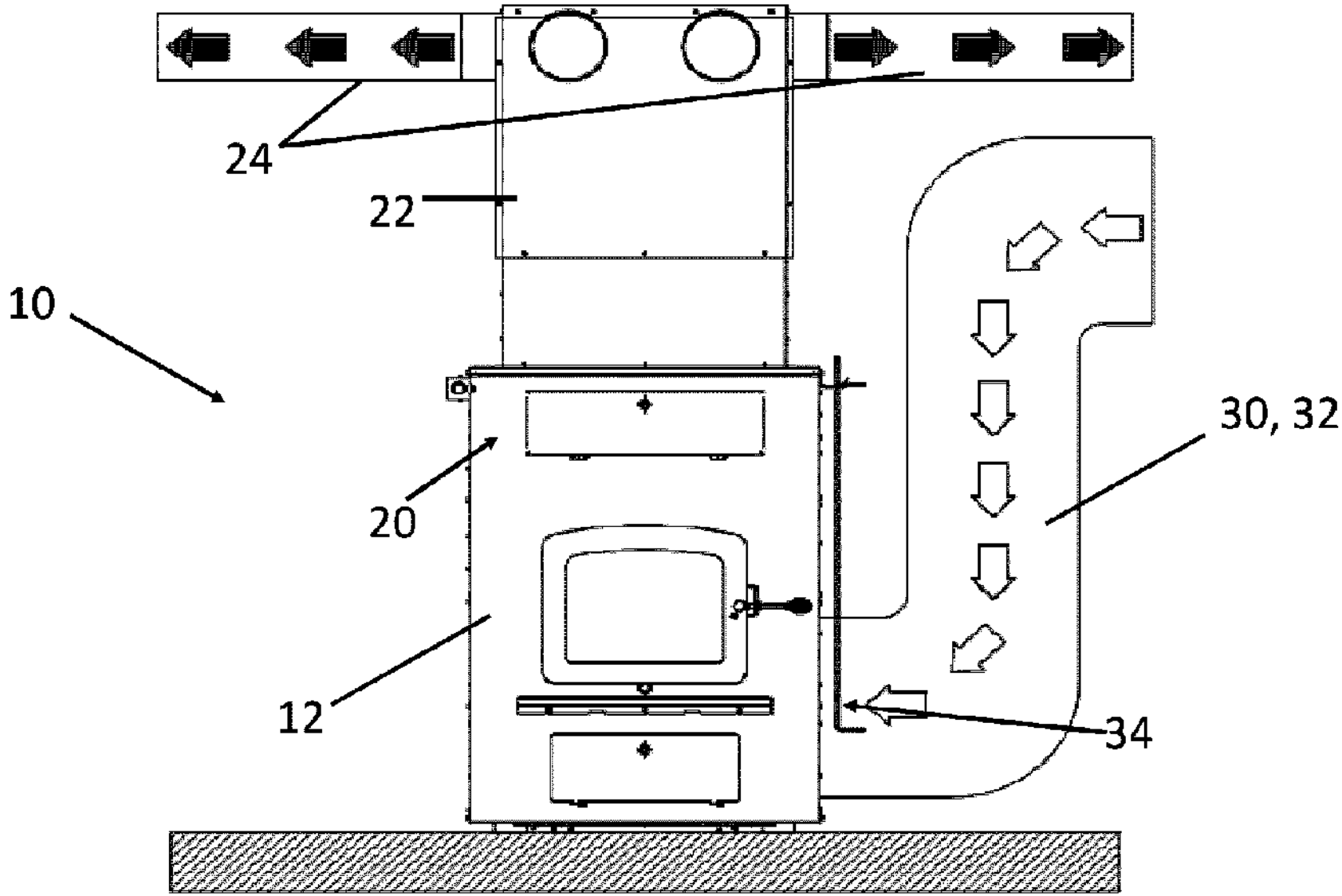


Fig. 9

Date Reçue/Date Received 2020-10-26


24
22
10
20
30, 32
12
34