



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.08.2012 Bulletin 2012/34

(51) Int Cl.:
F23N 1/04 (2006.01) **F23N 3/08 (2006.01)**
F23J 13/02 (2006.01) **F23N 5/00 (2006.01)**
F23N 5/18 (2006.01)

(21) Application number: **12155697.1**

(22) Date of filing: **16.02.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **DRU Verwarming B.V.**
6921 RW Duiven (NL)

(72) Inventor: **Van Laar, Christiaan**
7322 JD Apeldoorn (NL)

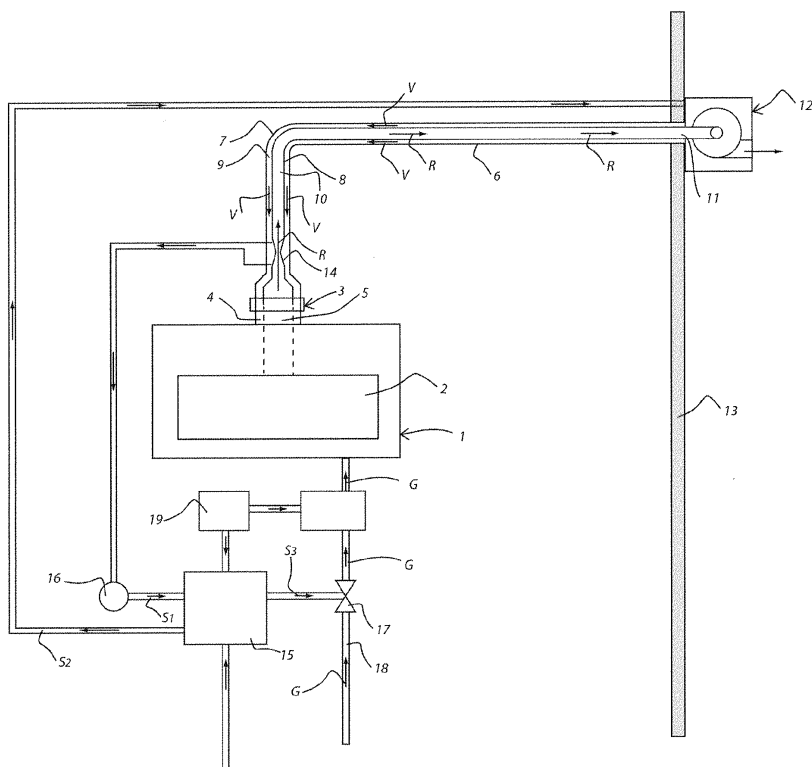
(74) Representative: **Algemeen Octrooi- en Merkenbureau**
P.O. Box 645
5600 AP Eindhoven (NL)

(30) Priority: **21.02.2011 NL 2006270**

(54) **Closed hearth system with forced air flow**

(57) The present invention, relates to a closed hearth system. The system comprises a hearth (1) having an at least substantially closed combustion chamber (2), into which a fuel supply channel (18) for fluid fuel opens, in a wall of which combustion chamber an inlet opening is provided, which inlet opening is connected to a combustion air supply channel (4), and an outlet opening, which outlet opening is connected to a flue gas channel (5).

The system further comprises an air circulation device (12) to be driven by a driving unit, which effects a forced air circulation, which air circulation device is connected to the flue gas channel and which, in use, generates an underpressure in the flue gas channel relative to the pressure in the combustion chamber. The invention further relates to a flue gas channel for use with a closed hearth system and to a method for adapting a closed hearth system.



Description

[0001] The present invention, according to a first aspect thereof, relates to a closed hearth system comprising a hearth having an at least substantially closed combustion chamber, into which a fuel supply channel for fluid fuel opens, in a wall of which combustion chamber an inlet opening is provided, which inlet opening is connected to a combustion air supply channel, and in a wall of which combustion chamber an outlet opening is provided, which outlet opening is connected to a flue gas channel.

[0002] Such closed hearth systems are generally known as gas hearths, for example. They are used, inter alia, for heating living quarters. Usually, imitation wood is provided in the combustion chamber. During use of the hearth system, the gas is led into the combustion chamber at defined places via outlet openings in the fuel supply channel, in which combustion chamber imitation wood or another material may be present, thus conveying an impression of burning wood, burning or smouldering coal or the like upon combustion of the gas. A drawback of the known systems is that placement thereof is possible only in a limited part of a space in order that an adequate discharge of flue gas can be ensured. The flue gas channel of the known systems may only comprise a limited horizontal and/or bend component.

[0003] The object of the present invention is to avoid the above drawback of the known hearth system and to provide a safe closed hearth system with more degrees of freedom as regards the selection of a location for the hearth. According to the present invention, this objective is accomplished by a closed hearth system comprising a hearth having an at least substantially closed combustion chamber, into which a fuel supply channel for fluid fuel opens, in a wall of which combustion chamber an inlet opening is provided, which inlet opening is connected to a combustion air supply channel, and in a wall of which combustion chamber an outlet opening is provided, which outlet opening is connected to a flue gas channel, and an air circulation device to be driven by a driving unit, which effects a forced air circulation, which air circulation device is connected to the flue gas channel and which, in use, generates an underpressure in the flue gas channel relative to the pressure in the combustion chamber. The air circulation device forcibly increases the draught in the flue gas channel. This has the advantage that a flue gas flow through the flue gas channel can overcome a greater resistance on account of the forced air circulation, without the combustion behaviour of the hearth system being adversely affected. The flue gas channel can thus bridge a larger horizontal distance, for example, it may comprise more bends and it may even comprise a downward component in part of the flue gas channel. The underpressure that is generated in the combustion chamber via the flue gas channel leads to an improved seal, as may for example be present between a removable glass pane that is sealingly attached to the

combustion chamber by means of a system comprising cord, tape, metal strips and/or screws. In such a situation, the glass pane is pressed more firmly against the combustion chamber as a result of the relative overpressure in the space to be heated. This enhances safety by reducing the risk of leakage flows of flue gas from the combustion chamber to the (living) space to be heated. The object aimed at is thus achieved with a hearth system according to the present invention.

[0004] WO 2010/057929 A1 describes a closed hearth system comprising a supply circuit with a forced air circulation device in the combustion air supply circuit. Although such a system, in the case of inverse operation, at first sight appears to have the same effect, this is not the case. An important disadvantageous secondary aspect of such a system is that because of the forced supply of combustion air, in combination with the resistance in the flue gas channel, a pump effect ensues, causing the pressure in the system to increase. This rather increases than reduces the risk of leakage flows of flue gas, for example from the combustion chamber to a space to be heated in which the hearth is disposed. In the case of a greater flow resistance to be overcome in the flue gas channel, for example large (horizontal) distances to be bridged and bends in the flue gas channel, the pressure in the hearth system will increase even further.

[0005] With a view to being able to control the combustion in the combustion chamber, it is preferable if the hearth system comprises a control device for controlling the air circulation device. In this way, the discharge of flue gas, and thus indirectly also the supply of fresh combustion air, can be controlled on the basis of input values for the control system.

[0006] In order to make adaptation to a specific arrangement possible, the hearth system preferably comprises first adjusting means by which the driving means can be adjusted in dependence on the arrangement of the system. The system can thus be adjusted, for example once only, in dependence on the distance that the flue gas channel bridges, any bends in the flue gas channel before it finally discharges into (generally, but not absolutely necessary) the outside air, the cross-sectional area of the flue gas channel, etc. In fact, the driving means, or the control system thereof, are adapted to the resistance that flue gas encounters on the way from the combustion chamber to the outside air.

[0007] It is furthermore preferable if the hearth system comprises second adjusting means by which the driving means can be adjusted in dependence on a current operating state of the hearth system. Whereas the first adjusting means, once set, will probably remain unchanged, the second adjusting means are provided for adjusting the driving means in dependence on dynamic factors, such as temperature, draught at the exit of the flue gas channel, etc.

[0008] To achieve an adequate control of the air circulation device and/or the second adjusting means, it is preferable if a sensor that detects the flue gas flow is

provided for delivering and input signal to the control device and/or the second adjusting means.

[0009] It is preferable in that regard if the sensor comprises a venturi for analysing the flue gas discharge flow.

[0010] If the air circulation device is provided on or near an outlet end of the flue gas channel, any noise nuisance caused by the air circulation device can be minimised.

[0011] In a preferred embodiment of the present invention, the combustion air supply channel and the flue gas channel are configured as two pipes which are concentrically oriented relative to each other. In this way it is in the first place possible to realise a relatively compact arrangement. Moreover, with this arrangement exchange of heat can take place between the flow of combustion air and the flow of flue gas, so that combustion air will enter the combustion chamber in slightly heated condition. This has a positive effect on the combustion process in the combustion chamber. The flue gas channel is preferably surrounded by the combustion air supply channel.

[0012] In a preferred embodiment of the present invention, the diameter of the outer one of said concentric pipes is less than 150 mm, furthermore preferably less than 130 mm, even more preferably less than 110 mm. Since the air circulation device enhances the draught of flue gas through the flue gas channel, a concentric pipe having a diameter smaller than the diameter (150 mm) of a usual concentric pipe connected to a hearth system will suffice.

[0013] It is preferable in that regard if the combustion air supply channel widens in the direction of the inlet opening near the connection to the combustion chamber. This has the advantage that a hearth having standard dimensions for the inlet and the outlet opening can be used, whilst the concentric pipe can be narrowed over a large part of its length. This has the advantage that the concentric pipe can be tucked away in a smaller space, or that it will in any case be less conspicuous in a space through which the pipe extends.

[0014] It is preferable, however, if the inlet opening and the outlet opening are provided in the upper wall of the combustion chamber. As is usual with conventional closed hearth systems, the circulation device that forces the air circulation makes it possible to provide the inlet opening and/or the outlet opening in another wall, for example the rear wall or even the bottom, without the combustion being adversely affected, at least not to a significant degree.

[0015] According to a second aspect thereof, the present invention relates to a flue gas channel for use with a closed hearth system, comprising an air circulation device to be driven by a drive unit, which forces the circulation of air. By connecting such a flue gas channel to a hearth having an at least substantially closed combustion chamber, the advantageous effect of a system according to the first aspect of the present invention can be achieved with an existing hearth, which hearth may or may not be already installed.

[0016] According to a further aspect thereof, the present invention relates to a method for adapting a flue gas channel of a closed hearth system, comprising the step of connecting an air circulation device to be driven by a drive unit, which air circulation device forces the circulation of air, to the flue gas channel. Thus a closed hearth system, which may or may not already exist or be installed, can be improved.

[0017] The present invention will be explained hereinafter with reference to the appended figure, which schematically shows an exemplary embodiment of a closed hearth system according to the present invention.

[0018] In the figure, numeral 1 indicates a gas hearth having a substantially closed combustion chamber 2. Present at the top of the combustion chamber 2 is a connecting element 3, with an outer pipe 4 having a diameter of about 150 mm and an inner pipe 5 that form a supply channel for combustion air and a flue gas channel, respectively. Connected to the connecting element 3 is a ventilation channel 6, which comprises two concentric pipes, an outer pipe 7 and an inner pipe 8. Said pipes 7 and 8 define an air supply channel 9. The inner pipe 8 defines a flue gas channel 10. Connected to the end 11 remote from the gas hearth 1 of the flue gas channel 10 is a fan 12, which, in use, generates an underpressure in the flue gas channel 10, as a result of which flue gas is forcibly drawn from the combustion chamber 2 through the flue gas channel 10. Flue gas is eventually discharged into the environment outside a building that is symbolically represented by a wall 13 in the figure. Since the combustion chamber 2 forms part of a closed hearth system, which means that combustion air can enter the combustion chamber 2 at least substantially exclusively through the air supply channel 9, the underpressure in the flue gas channel 10 will result in an underpressure prevailing in the combustion chamber 2 as well, so that fresh combustion air is forcibly drawn into the combustion chamber 2 through the air supply channel 9. The flue gas flow and the combustion air flow are indicated by the arrows R and V, respectively, in the figure.

[0019] The fan 12 comprises first adjusting means (not shown), by which the force of the fan (at least in a particular setting), can be geared to the resistance that flue gas encounters in the flue gas channel 10. Said resistance depends, inter-alia, on the total length of the flue gas channel 10, on the horizontal distance to be bridged between the combustion chamber 2 and the end 11 of the flue gas channel, on bends provided in the flue gas channel 10 and on the diameter of the flue gas channel 10. The first adjusting means primarily function to effect a setting, upon installation, on the basis of static values. The fan 12 moreover comprises second adjusting means, by which the fan 12 can be adjusted in dependence on the dynamic factors in use, as will be explained in more detail hereinafter. Based on flow data measured at the venturi 14, the draft in the combustion chamber 2 generated by the flue gas channel 10 is determined by a flow sensor 16. The flow sensor 16 sends a signal (ar-

row S_1) to the control unit 15 on the basis of the measured value. The control unit 15 in turn sends control signals (arrows S_2 , S_3) to, respectively, the fan 12 and a solenoid valve 17 in a gas pipe 18 through which gas is supplied to the combustion chamber 2 (see arrows G). The control unit can thus control an optimum combustion of gas in the combustion chamber 2. Furthermore, a control element 19 is provided, by means of which a user can control the combustion in the combustion chamber 2. The control element 19 may comprise a receiver for a remote control unit.

[0020] In the appended figure and the above description only one embodiment of a closed hearth system according to the invention is shown and described. It will be understood, however, that many variants, which may or may not be obvious to the skilled person, are conceivable within the scope of the present invention as defined in the appended claims. Thus it is conceivable that a separate air supply channel and a separate flue gas channel are provided. It is also conceivable that the air supply channel and the flue gas channel are integrated in a ventilation channel, but that said channels are not defined by concentric pipes. Although it is preferable to measure the discharge of flue gas, this is not necessary, or it can be done in a way other than by measuring a venturi effect at the location of a constriction at one end of the flue gas channel, as in the present embodiment. In the figure, the fan is shown to be present at the end of the flue gas channel remote from the combustion chamber. This is attractive in view of any noise nuisance near the gas hearth. It is conceivable, however, for a fan to be provided at any location in the flue gas channel. In the present embodiment, a system comprising a gas hearth as described. It is conceivable, however, for a hearth fuelled by another combustible fluid to be incorporated in the hearth system. Furthermore, the diameter of the flue gas channel and/or the air supply channel may be different from the dimensions used in the present embodiment. Because the fan can force the discharge of flue gas to a larger or smaller extent, the diameter of the aforesaid channels may be selected partially on the bases of other criteria, for example aesthetic criteria. It is furthermore important that it is not absolutely necessary for the combustion air supply channel and the flue gas channel to have a circular cross-section. In those cases in which a diameter of a pipe is mentioned herein, for example a diameter of 150 mm, this will correspond to the cross-sectional area thereof, approximately 175 cm² in the present case. The pipe may have a square or a rectangular cross-section, for example. It is also possible to use a different cross-sectional area, for that matter, for example (corresponding to) a diameter of 130 mm or 200 mm.

Claims

1. A closed hearth system comprising a hearth having

an at least substantially closed combustion chamber, into which a fuel supply channel for fluid fuel opens, in a wall of which combustion chamber an inlet opening is provided, which inlet opening is connected to a combustion air supply channel, and in a wall of which combustion chamber an outlet opening is provided, which outlet opening is connected to a flue gas channel, and an air circulation device to be driven by a driving unit, which effects a forced air circulation, which air circulation device is connected to the flue gas channel and which, in use, generates an underpressure in the flue gas channel relative to the pressure in the combustion chamber.

2. A closed hearth system according to claim 1, **characterised in that** the hearth system comprises a control device for controlling the air circulation device.
3. A closed hearth system according to claim 1 or 2, **characterised in that** the hearth system comprises first adjusting means by which the driving means can be adjusted in dependence on the arrangement of the system.
4. A closed hearth system according to one or more of claims 1 - 3, **characterised in that** the hearth system comprises second adjusting means by which the driving means can be adjusted in dependence on a current operating state of the hearth system.
5. A closed hearth system according to one or more of claims 2 - 4, **characterised in that** a sensor that detects the flue gas flow is provided for delivering and input signal to the control device and/or the second adjusting means.
6. A closed hearth system according to claim 5, **characterised in that** the sensor comprises a venturi.
7. A closed hearth system according to one or more of the preceding claims, **characterised in that** the air circulation device is provided on or near an outlet end of the flue gas channel.
8. A closed hearth system according to one or more of the preceding claims, **characterised in that** the combustion air supply channel and the flue gas channel are configured as two pipes which are concentrically oriented relative to each other.
9. A closed hearth system according to claim 8, **characterised in that** the external diameter of the outer one of the two concentric pipes is less than 130 mm.
10. A closed hearth system according to one or more of the preceding claims, **characterised in that** the combustion air supply channel widens in the direc-

tion of the inlet opening near the connection to the combustion chamber.

11. A closed hearth system according to one or more of the preceding claims, **characterised in that** the inlet opening and the outlet opening are provided in the upper wall of the combustion chamber. 5
12. A flue gas channel for use with a closed hearth system, comprising an air circulation device to be driven by a drive unit, which forces the circulation of air. 10
13. A method for adapting a flue gas channel of a closed hearth system, comprising the step of connecting an air circulation device to be driven by a drive unit, which air circulation device forces the circulation of air, to the flue gas channel. 15

20

25

30

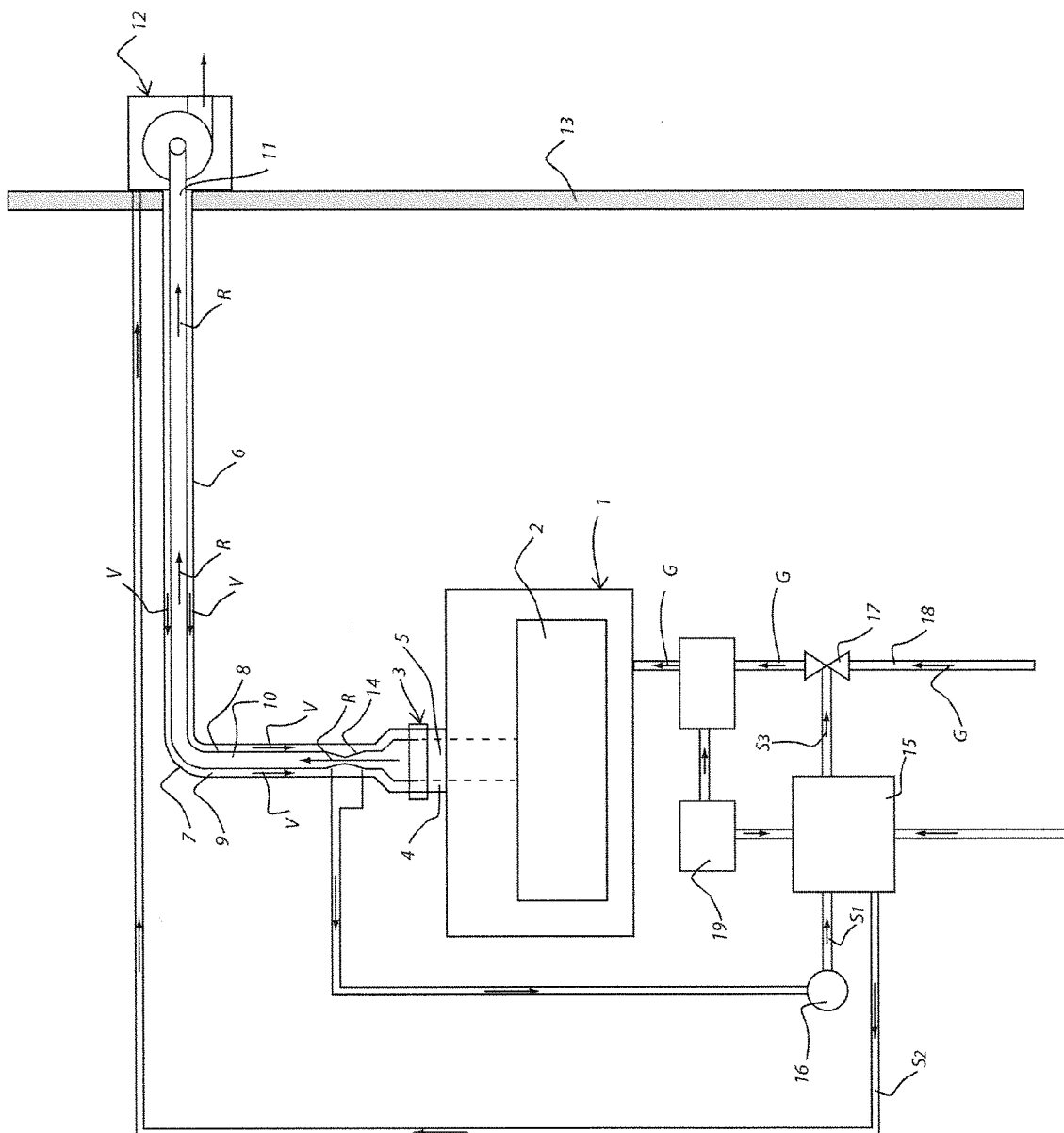
35

40

45

50

55



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2010057929 A1 [0004]