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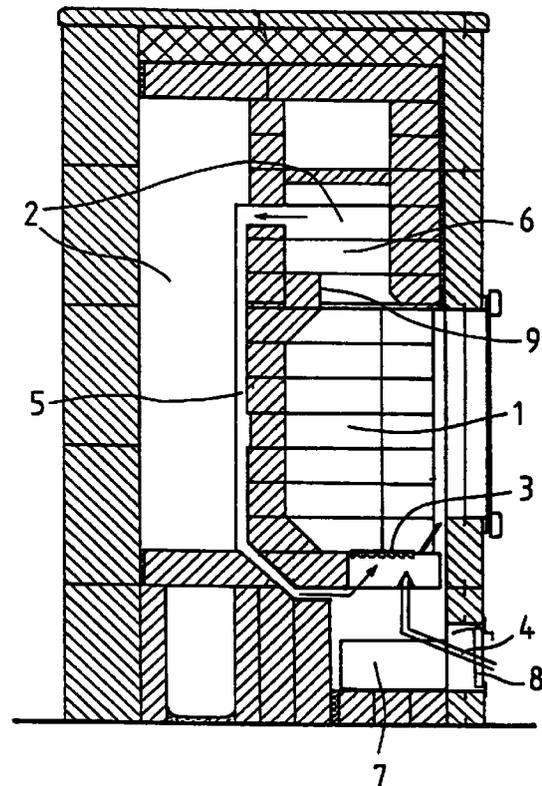
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(54) **Fireplace**

(57) The invention relates to a fireplace comprising a firebox (1), a system of combustion gas channels (2) after the firebox for passing the combustion gases into a flue, a grate (3) on the bottom of the fireplace and a primary air duct (4) for supplying primary air into the fireplace. Moreover, the fireplace comprises a return channel (5) for returning part of the combustion gases from the combustion gas channel system after the firebox into a space in the fireplace where a lower pressure prevails.



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## Description

The present invention relates to a fireplace as defined in the preamble of claim 1. The fireplace may be built of soapstone or bricks or it may be a stove or other fireplace designed for the burning of solid material.

To achieve as clean a combustion process as possible in the fireplace, it is necessary that extra oxygen be available in the process. The amount of excess air varies at different phases of the combustion process. Especially at the final phase of combustion, there may be a large amount of excess air. The extra combustion air has a cooling effect on the combustion process, resulting in incomplete combustion and a reduced efficiency.

The object of the present invention is to eliminate the drawbacks mentioned above. A specific object of the present invention is to present a new type of fireplace in which more complete combustion is achieved and harmful emissions are reduced as compared with existing fireplaces.

As for the features characteristic of the invention, reference is made to the claims.

The fireplace of the invention comprises a firebox for burning solid fuel and a system of combustion gas channels to convey the combustion gases into a flue. Moreover, the bottom of the fireplace is provided with a grate and the fireplace comprises a primary air duct for supplying primary air into the fireplace. The grate may be of an open type, i.e. the required primary air is passed through it. In this case, the primary air is generally passed into a space below the grate via combustion air holes in the ash scuttle. However, the grate may also be of a solid structure, in which case primary air is supplied into the combustion process from the areas around the grate. According to the invention, the fireplace comprises a return channel designed to pass some of the combustion gases from the combustion gas channel system after the firebox back into a space or spaces in the fireplace where a lower pressure prevails.

The invention is based on the fact that different pressure conditions prevail in different parts of the fireplace during combustion. In the combustion gas channel immediately after the firebox or in an afterburner in said channel, underpressure is lowest, i.e. pressure is highest, whereas underpressure is highest and pressure lowest in the flue connection of the fireplace and in the primary air supply space, e.g. below the grate. The invention makes use of these pressure differences which naturally prevail in the fireplace during the combustion process, so that the gases are caused to flow from one space into another exclusively by the pressure differences without the use of blowers or equivalent actuating elements.

The return channel preferably starts from an afterburner space after the firebox, but it may also start from the combustion gas channel after the afterburner or from the part between the firebox and the afterburner or

even right from the top of the firebox. The starting orifice of the return channel is preferably located in a place where underpressure is lowest.

The return channel preferably leads into a space below the grate, e.g. into the primary air duct or into the ash box. The return channel may also lead into the firebox, opening into the space above the grate, in the midst of or above the fuel. The combustion gases can also be circulated into a secondary combustion air duct if the fireplace has one.

The fireplace may also have two or more return channels and their starting and opening orifices may vary and be located in different parts of the fireplace. The essential point is that a lower underpressure prevails in the area of the starting orifice of the return channel than in the area of its opening orifice, so that this pressure difference will produce in the fireplace a reverse flow according to the invention.

The return channel may also be provided with suitable known regulating elements for the regulation of gas flow.

The fireplace of the invention has significant advantages as compared with prior art. The return channel of the invention reduces the amount of primary air needed, which means that the combustion air does not cause cooling of the combustion process, more complete combustion occurs, emissions are reduced and the efficiency is improved as the amount of excess air is reduced. As the temperature of the combustion gases is as high as 300 - 400 °C, the return channels accumulate heat energy from the combustion gases, thus improving the efficiency and allowing faster and more uniform heating-up of the fireplace. Moreover, due to the circulation of gases, advantageous gas currents in the firebox are produced, preventing the firebox door from getting sooted.

In the following, the invention will be described in detail by referring to the attached drawing, which presents a sectioned view of a fireplace according to the invention.

The fireplace as presented in the drawing comprises a firebox 1 with a grate 3 on its bottom. Below the grate there is an ash box 7, via which a primary air flow 4 is passed into the firebox through an ash scuttle 8 and a grate 3.

The combustion gases are passed from above the firebox 1 into a flue (not shown) via a system of combustion gas channels 2. The combustion gas channel above the firebox is provided with a venturi 9, which, however, is not indispensable to the operation of the structure and after which the combustion gas channel expands into an afterburner space 6, where the combustion gases are mixed and burned. A return channel 5 starts from the afterburner and runs downward alongside a combustion gas channel 2 and opens into the ash box 7 below the grate 3. The return channel 5 may be built in the wall structures of the fireplace or it may be a separate channel made e.g. of stone or metal and

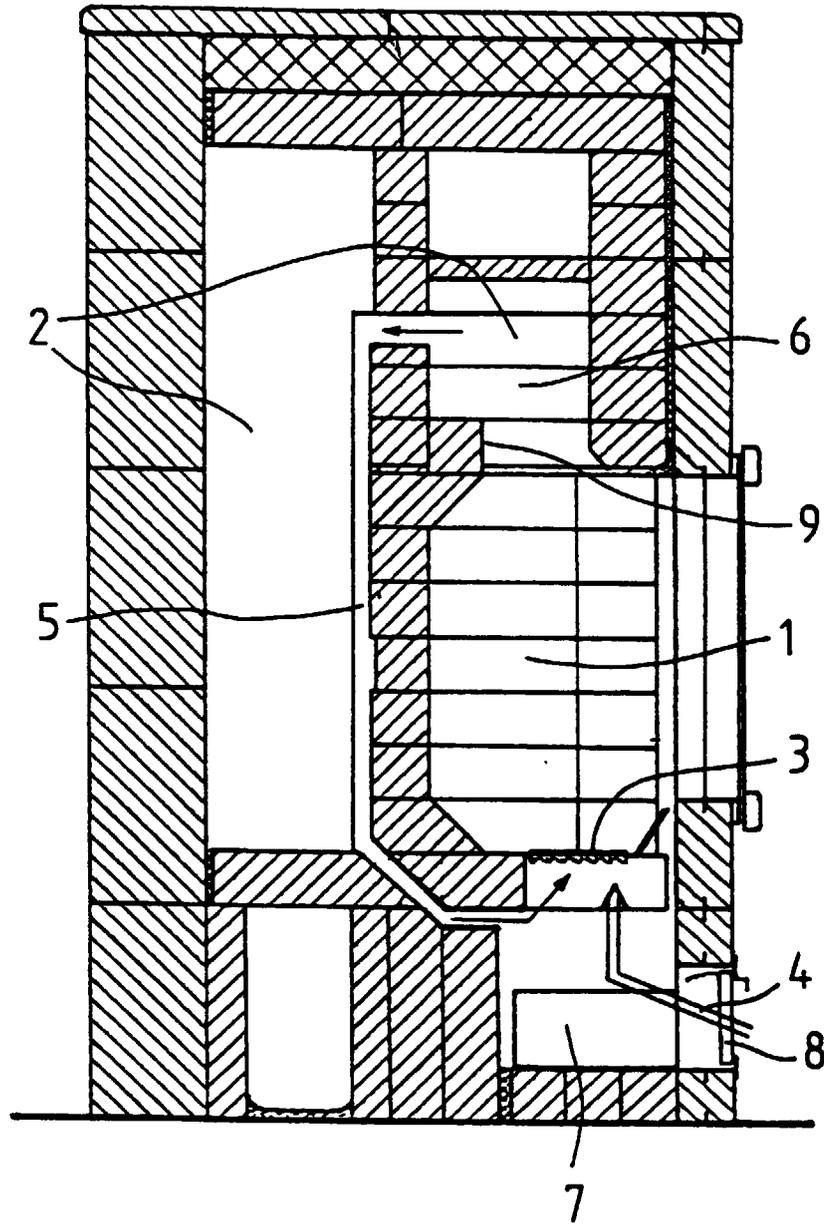
placed on the outer surface of the firebox wall or on its inner surface on the side of the firebox.

Since, of the spaces inside the fireplace, the afterburner 6 has the lowest negative pressure whereas below the grate 3 a considerably higher negative pressure prevails, this will cause part of the combustion gases in the afterburner 6 to circulate via the return channel into the primary air supply space below the grate, so these gases are mixed with the primary air, thus heating it. Therefore, due to this circulation, the gas fed in through the grate 3 is hotter than normal combustion air, so the combustion takes place at a higher temperature. The oxygen remaining in the recirculated combustion gas participates in the combustion process again and any unburned components of the recirculated combustion gas are ignited, leading to more complete combustion as hydrocarbon and carbon monoxide are burned further into carbon dioxide.

In the foregoing, the invention has been described by way of example by referring to the attached drawing, but different embodiments of the invention are possible within the scope of the inventive idea defined by the claims.

#### Claims

1. Fireplace comprising a firebox (1), a system of combustion gas channels (2) after the firebox for passing the combustion gases into a flue, a grate (3) on the bottom of the fireplace and a primary air duct (4) for supplying primary air into the fireplace, **characterised** in that the fireplace comprises a return channel (5) for returning part of the combustion gases from the combustion gas channel system after the firebox into a space in the fireplace where a lower pressure prevails.
2. Fireplace as defined in claim 1, **characterised** in that the return channel starts from an afterburner space (6).
3. Fireplace as defined in claim 1, **characterised** in that the return channel leads into a space below the grate (3).
4. Fireplace as defined in claim 1, **characterised** in that the return channel (5) leads into the primary air duct (4).
5. Fireplace as defined in claim 1, **characterised** in that the return channel (5) leads into the firebox (1), opening above the grate (3).
6. Fireplace as defined in claim 1, **characterised** in that the return channel (5) leads into the firebox (1), opening in the midst of the fuel.
7. Fireplace as defined in claim 1, **characterised** in that the return channel (5) leads into the firebox (1), opening above the fuel.
8. Fireplace as defined in claim 1, **characterised** in that the return channel (5) leads to the area of the grate.
9. Fireplace as defined in any one of claims 1 - 8, **characterised** in that the fireplace comprises two or more return channels.
10. Fireplace as defined in any one of claims 1 - 8, **characterised** in that the return channel is provided with a regulating element for the regulation of the returning gas flow.





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EUROPEAN SEARCH REPORT

Application Number  
EP 98 66 0053

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 4 438 756 A (CHAMBERLAIN JOSEPH G ET AL) 27 March 1984 * column 10, line 49 - column 11, line 26; figure 7 *	1-3	F24B1/189 F24B1/00
A	GB 2 160 309 A (ASPREY GEOFFREY) 18 December 1985 * abstract *	1,3	
A	DE 35 26 636 A (SCHAKO METALLWARENFABRIK) 12 March 1987		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			F24B F23B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		5 October 1998	Vanheusden, J
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X : particularly relevant if taken alone		T : theory or principle underlying the invention	
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