

The invention relates to a method of supplying combustion air in grate firing, in which primary combustion air is passed through the fuel and secondary combustion air is introduced directly into the exhaust gas flow, and in which, furthermore, some of the exhaust gas is tapped off from the exhaust gas flow and returned to the combustion process, the exhaust gas being tapped off immediately above the fuel in the region of a large unused primary air portion and being returned to the combustion air. The invention also relates to a firing installation for carrying out the method.

In a known method of this kind (DE-B-1 019 788), the exhaust gas tapped off is supplied exclusively to the nozzles for supplying secondary combustion air in order to achieve intensive secondary combustion producing a strong swirling and circulating motion of the gas/air mixture, the heavy fuels blown out of the coal bed being returned to the grate as a result of the circulation of the air in the combustion chamber. This large mixing penetrative effect results in complete combustion with very little excess air and at very high temperatures. This thorough mixing would only be possible with a particularly large quantity of fresh air, as a result of which the excess air would be increased to a unnecessarily high extent. In order, on the one hand, to prevent an excessive proportion of excess air and, on the other hand, to obtain a particularly large quantity of gas for achieving thorough mixing and swirling, this known method has recourse to this flue gas return. There is no reduction of the quantity of fresh air, either with respect to the primary air or with respect to the secondary air. Instead, there is an increase in the total quantity of exhaust gas.



This increased quantity of exhaust gas means that the dimensions of the device following the grate, e.g. a waste-heat boiler and exhaust gas purification devices, must be larger.

As, in the known method described at the outset, the exhaust gas return is carried out in order to prevent an increased fresh air content, in order to achieve intensive swirling and improved combustion, the fresh air content is still as high as in other known firing installations, in which the combustion air is supplied hyperstoichiometrically with a stoichiometric ratio in the region of 1.4 to 2.2. However, any stoichiometric method of operation necessitates a reduction in the efficiency of a waste-heat boiler following the grate system as the excess combustion air must also be heated almost as ballast. Furthermore, an excessive air content also results in a larger quantity of harmful substances, such as carbon monoxide and nitrogen oxides.

The aim of the invention is to provide a method and a firing installation for carrying out the method, with the aid of which the quantity of the exhaust gas flow and thus the disadvantages resulting from the excess air described can be reduced.

This problem is solved by the features specified in claim 1. In this manner, the entire exhaust gas flow is reduced by that portion tapped off in the rear combustion chamber region and returned to the combustion air, which is reduced in accordance with this portion. This exhaust gas can therefore serve to replace part of the fresh combustion air as the composition of the exhaust gas almost corresponds to that of the fresh combustion air as a result of the absence of a chemical reaction in the rear part of the grate.

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As a result of the reduction of the total exhaust gas volume, the units following the combustion chamber can be smaller, allowing for a considerable saving in installation costs. A further advantage of this method of operation according to the invention consists of a reduction in the discharge of harmful substances such as carbon monoxide and nitrogen oxides. This effect is based, on the one hand, in the case of carbon monoxide, on intensive secondary combustion of a gas flow loaded to a relatively great extent with this harmful substance. In the case of nitrogen oxides, the reduction in the concentration observed can be explained by the reduction of the oxygen content in the exhaust gas.

The quantity of exhaust gas tapped off can then be mixed with the primary combustion air and the secondary combustion air. In the combustion of household waste, it is advantageous for the quantity of exhaust gas tapped off to be used exclusively as secondary combustion air, as the portion of combustion air supplied in the rear grate region and then tapped off generally corresponds relatively precisely to that quantity required as secondary combustion air.

If, in an advantageous embodiment of the method, the quantity of exhaust gas tapped off corresponds with respect to volume to that primary air supplied in the rear primary air zones having a high unused primary air portion, it is possible to maximise the benefits that can be obtained.

However, it may also be advantageous for the quantity of gas tapped off with respect to volume to be smaller or larger than the quantity of primary air supplied to the grate in the rear primary air zones having a high unused primary air portion.

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Advantageous embodiments of the firing installation for carrying out the method will be clear from claims 8 to 11.

The invention will now be described in more detail with reference to several embodiments shown in the accompanying drawings, in which:

Fig. 1 is a diagrammatic longitudinal section through a first embodiment of a firing installation;

Fig. 2 is a representation of a second embodiment corresponding to Fig. 1, and

Fig. 3 is a cross section through a firing installation corresponding to another embodiment.

As can be seen from Figures 1 and 2, a firing installation has a feed hopper 1 with an adjacent feed chute 2 for feeding fuel on to a feeding plate 3, on which reciprocating feed pistons 4 are provided in order to feed the fuel coming from the feed chute 2 on to a grate 5, on which combustion of the fuel takes place, irrespective of whether it is an inclined or horizontal grate and of the principle thereof.

A device for supplying primary combustion air designated in general by the reference numeral 6 is arranged below the grate 5 and can include a plurality of chambers 7 to 11 to which primary combustion air is supplied by means of a ventilator 12 via a line 13. By virtue of the arrangement of the chambers 7 to 11, the grate is divided into a plurality of overfeed zones, so that the primary combustion air can be adjusted in various ways according to the requirements of the grate.



The combustion chamber 14 which passes in its front part into an exhaust gas flue 15 to which units (not shown), e.g. a waste-heat boiler and an exhaust gas purification installation are connected is situated above the grate 5. In the rear region the combustion chamber 14 is defined by a roof 16, a rear wall 17 and side walls 18, the latter being particularly clear from Fig. 3.

Combustion of the fuel designated by the reference numeral 19 is effected on the front part of the grate 5 above which the exhaust gas flue 15 is situated. In this region, most of the primary combustion air is supplied through the chambers 7, 8 and 9. Only burnt fuel, i.e. slag, is situated on the rear part of the grate 5 and in this region primary combustion air is supplied via the chambers 10 and 11 essentially only for cooling this slag and in particular for cooling the grate, in order to maintain the operational reliability thereof.

The burnt components then fall into a slag outlet 20 at the end of the grate 5. Nozzles 21 and 22 are provided in the lower region of the exhaust gas flue 15 and supply secondary combustion air to the ascending exhaust gas in order to effect intensive secondary combustion of the combustible portions contained in the exhaust gas.

In the embodiments shown, exhaust gas is then tapped off essentially in the rear part of the combustion chamber defined by the roof 16, rear wall 17 and side walls 18. To this end, in the embodiment according to Fig. 1, an exhaust opening 23 is provided in the roof 16 so that exhaust gas can be tapped off by means of a ventilator 25 via an exhaust line 24 connected to the suction end of the ventilator. A line 26 is connected to



the pressure end of the ventilator and forces the quantity of exhaust gas tapped off into the line 13 via which primary combustion air is supplied to the chambers 7 to 11.

In the embodiment according to Fig. 2, the exhaust opening 23 is provided in the rear wall 17. In this embodiment, the line 26 connected to the pressure end of the ventilator 25 is connected, e.g. to the nozzle 21 which serves to supply part of the secondary combustion air.

The embodiment according to Fig. 3 shows the arrangement of two exhaust openings 23 in the side walls 18 of the combustion chamber 14, the adjacent exhaust lines 24 of which are connected to the suction end of the ventilator 12. The exhaust lines have branch pieces 27 with stop valves 28 via which additional fresh air can be drawn in and mixed with the exhaust gas.

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CLAIMS

1. Method of supplying combustion air in grate firing, in which primary combustion air is passed through the fuel and secondary combustion air is introduced directly into the exhaust gas flow, and in which, furthermore, some of the exhaust gas is tapped off from the exhaust gas flow and returned to the combustion process, the exhaust gas being tapped off immediately above the fuel in the region of a large unused primary air portion and being returned to the combustion air, characterised in that the combustion air is reduced in accordance with the quantity of exhaust gas to be mixed with it, so that the entire exhaust gas flow is reduced by that portion tapped off in the rear combustion chamber region and returned to the combustion air.
2. Method according to claim 1, characterised in that the quantity of exhaust gas tapped off is mixed with the primary combustion air.
3. Method according to claim 1, characterised in that the quantity of exhaust gas tapped off is mixed with the secondary combustion air.
4. Method according to claim 1 in the combustion of household waste, characterised in that the quantity of exhaust gas tapped off is used exclusively as secondary combustion air.
5. Method according to one of claims 1 to 4, characterised in that, with respect to volume, the quantity of exhaust gas tapped off corresponds to that quantity of primary

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combustion air supplied to the grate in the rear primary air zones having a large unused primary air portion.

6. Method according to one of claims 1 to 4, characterised in that, with respect to volume, the quantity of exhaust gas tapped off is smaller than the quantity of primary combustion air supplied to the grate in the rear primary air zones having a large unused primary air portion.
7. Method according to one of claims 1 to 4, characterised in that, with respect to volume, the quantity of exhaust gas tapped off is greater than the quantity of primary air supplied to the grate in the rear primary air zones having a large unused primary air portion.
8. Firing installation for carrying out the method according to claim 1 or claim 2, comprising a grate (5), a device (7-11) below the grate (5) for supplying primary combustion air through the grate (5), and nozzles (21, 22) opening into the combustion chamber (14) above the grate (5) for supplying secondary combustion air, at least one exhaust line (23, 24) for exhaust gas being provided in the combustion chamber (14) above the grate (5), characterised in that the exhaust line (24) is connected to the suction end of a ventilator (25), the pressure end of which is connected via a line (26) to the line (13) for primary combustion air.
9. Firing installation for carrying out the method according to claims 1 and 3 or claim 4, comprising a grate (5), a device (7-11) below the grate (5) for supplying primary combustion air through the grate (5), and nozzles (21, 22)

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opening into the combustion chamber (14) above the grate (5) for supplying secondary combustion air, at least one exhaust line (23, 24) for exhaust gas being provided in the combustion chamber (14) above the grate (5), characterised in that the exhaust line (24) is connected to the suction end of a ventilator (25), the pressure end of which is connected via a line (26) to the nozzles (21, 22) opening into the combustion chamber (14) above the grate (5) for supplying secondary combustion air.

10. Firing installation according to claim 8 or claim 9, characterised in that the inlet opening (23) of the exhaust line (24) is provided above the grate (5) in at least one side wall (18) of the combustion chamber (14).
11. Firing installation according to claim 8 or claim 9, characterised in that the inlet opening (23) of the exhaust line (24) is provided above the grate (5) in the rear wall (17) of the combustion chamber (14).suction

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