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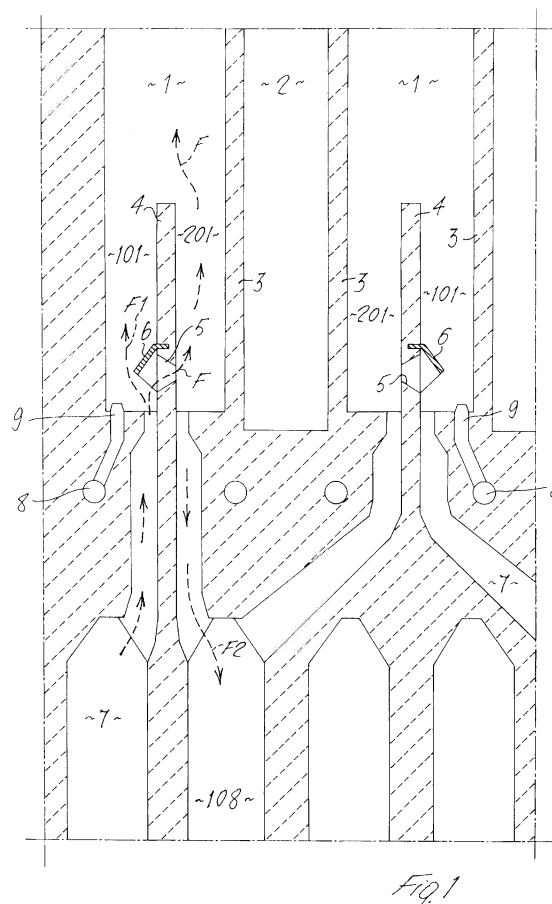
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(54) **Method for reduction of nitrogen oxides in coke-oven flue gases and coke oven combustion chamber therefor**

(57) Method of controlling combustion in coke ovens for reduction of nitrogen oxides in coke-oven gases, characterized in that, in the combustion chambers of the oven, between the two air inlets, a wall is constructed which rises in said chambers to a reduced height between about 1/3 and 1/5 of the height of said chambers, said walls being provided with a hole near their base, and being provided to correspond to the upper limit of said hole, on one side of the said wall housing the nozzle for supply of the combustion gas, with a diverting element for diverting a proportion of the combustion air supplied to said chamber onto the other side of said wall. Said diverting element comprises a plate projecting from said wall. Preferably said wall has a height of about 1 metre.



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Description

[0001] The present invention relates to the control of combustion in coke ovens for reduction of nitrogen oxides in coke-oven gases, to render said gases less polluting when they are discharged to atmosphere. More particularly, the invention relates to equipment that provides said control, and hence reduction of the nitrogen oxides in coke-oven gases, at far lower cost than the conventional equipment. The systems generally used for reduction of the nitrogen oxides in coke ovens are: (a) reduction of flame temperature by recirculating a proportion of the flue gases so as to dilute the fuel gas so as to lower the combustion temperature somewhat and (b) admission of the combustion air in various zones along a suitable pipe in order to "stagger" the flame along the pipe so that a reduction of the temperature of the flame itself is also achieved in this way, by breaking it up into several flamelets with consequent reduction of the production of nitrogen oxides.

[0002] A third system is also known for the reduction of nitrogen oxides in coke-oven gases, described for example in patent US-A-5,017,270 of Krupp Koppers GmbH, which relates substantially to a combination of these two arrangements. In accordance with this patent it is proposed to adopt, in combination, a system for circulation, which in itself is already known, with a system for distribution of air at various levels, again in itself already known.

[0003] According to this known technology, the two channels leading to one combustion chamber of the coke oven both become air ducts and no longer flue gas ducts and moreover the two channels leading to the adjacent chamber become flue gas ducts and extend downwards to a regenerator which, alternately, in a first time segment, for example in the first 20 minutes, accumulates the heat of the flue gases and in the next, gives up this heat to the air. This prior patent envisages outlets at various levels and so combines the effect of recirculation with the effect of distribution of the air at several levels.

[0004] According to the present invention, the problem of reduction of nitrogen oxides is solved with a combustion system in which the flame is not staggered physically but is fractionated owing to an aerodynamic shape. This system has the advantage that it is simpler than the known systems, since it does not involve the ad-hoc construction of a channel, made of refractory bricks, which would make the oven design more complicated. It only requires the construction of a wall in the combustion chambers of the oven, positioned between the two air inlets, rising to a height of only about one metre in the oven, and with a hole near its base equipped with a diverting plate, made of a refractory material, causing the air to go more in one direction than another.

[0005] For a better assessment of the scope of the present invention, it has to be borne in mind that 600-700 different brick moulds are required for constructing a coke oven plant of this type. With the present system, about

ten shapes of bricks are eliminated, because it is no longer necessary to build a long, high channel with several small holes for outlet of the secondary air streams. This constitutes a definite economic advantage in oven construction, in view of the considerable simplification of oven design.

[0006] A further advantage of the design according to the present invention relates to supply of these ovens with gas mixture. It is known that the problem of nitrogen oxides does not exist when the oven is supplied with gas mixture, whereas the problem does exist when the oven is supplied with rich gas. For most of the time, coke oven batteries operate on gas mixture, not on rich gas. Since the gas mixture has low calorific value, it must be preheated, for which it follows the fate of the air. If a simple wall is built in the middle of the combustion chamber, the result is that the air leaves on one side and the gas on the other and in the lower part there is no flame so that this part is poorly heated. We are therefore faced with the problem of finding how to carry air from the gas and vice versa to make it burn at the bottom as well otherwise the device that worked well for the rich gas since there were two air streams, is limiting when operating on gas mixture. The device according to the invention which causes diversion of the gas flow meets this objective. The ovens consume 1/3 of gas for heating and 2/3 for exporting. Since the rich gas is a high-value gas (4000 or more kilocalories), at iron and steel works the aim is to supply the oven with low-value gas from the blast furnace, which is called gas mixture or lean gas, so that all the gas produced by the oven is exported, instead of consuming 1/3. Therefore the coke ovens at iron and steel works, where there is production of gas mixture of low calorific value (about a quarter compared to rich gas, i.e. approx. 1000 kcal), are operated on gas mixture.

[0007] Further aims and advantages of the present invention will become clearer from the following description of one embodiment of the invention, illustrated as a non-limiting example in the appended drawing, in which a portion of a coke oven battery is shown schematically in longitudinal section.

[0008] Referring to the drawing, it shows the combustion chambers or channels 1, and a distillation chamber 2. Refractory walls 3 separate the distillation chamber 2 from the combustion channels 1, and the heat is transmitted through said walls 3 to the coal charge contained in the distillation chambers. To achieve optimum distillation with minimum production of nitrogen oxides, it is necessary for the vertical temperature distribution on walls 3 to be perfectly uniform. For this purpose, according to the present invention, a central wall 4 is erected in the combustion chambers 1, extending to a relatively small height, of about one metre, and dividing the base of chambers 1 into two zones 101, 201 respectively. Near its base, this wall has a through-hole 5, and a plate 6 is arranged corresponding to the top edge of said hole 5, and projects from said wall into zone 101 of chamber 1. A pipe for admission of combustion air is labelled 7, and

a manifold for feed of fuel gas is labelled 8, and communicates with nozzle 9 with its opening in section 101 of chamber 1. As shown by the dashed-line arrow F, a portion of the air from pipe 7 is diverted by plate 6 through hole 5 in chamber 201, whereas another portion of the air continues on its way (arrow F1) in chamber 101, meeting the gas coming from nozzle 9, so that a portion of the gas is caused to burn in chamber 101 i.e. in the bottom part of combustion chamber 1, whereas another portion of the gas moves upwards, beyond wall 201, where it meets the air diverted by plate 6, and burns in the top part of chamber 1. Owing to this arrangement, uniform heating of the whole of combustion chamber 1 is obtained, and owing to the staggering of the combustion flame the emission of nitrogen oxides in the exhaust gases is greatly reduced.

[0009] The exhaust gases flow into the regenerators 108 (arrow F2), heating the air fed to the oven in counter-current to them, and then to the smokestack.

[0010] Of course, the present invention is not limited to the embodiments that have been illustrated and described, but comprises all variants and modifications within the wider scope of the inventive concept, substantially as claimed hereunder.

Claims

1. Method of controlling combustion in coke ovens for reduction of nitrogen oxides in coke-oven gases, **characterized in that**, in the combustion chambers of the oven, between the two air inlets, a wall is constructed which rises in said chambers to a reduced height between about 1/3 and 1/5 of the height of said chambers, said walls being provided with a hole near their base, and being provided to correspond to the upper limit of said hole, on one side of the said wall housing the nozzle for supply of the combustion gas, with a diverting element for diverting a proportion of the combustion air supplied to said chamber onto the other side of said wall.
2. Method according to Claim 1, in which said diverting element comprises a plate projecting from said wall.
3. Coke oven for carrying out the method of Claim 1 or 2, in which said wall has a height of about 1 metre.
4. Coke oven according to Claim 3, for carrying out the method according to either one of the Claims 1 or 2, substantially as described, illustrated and for the purposes explained above.

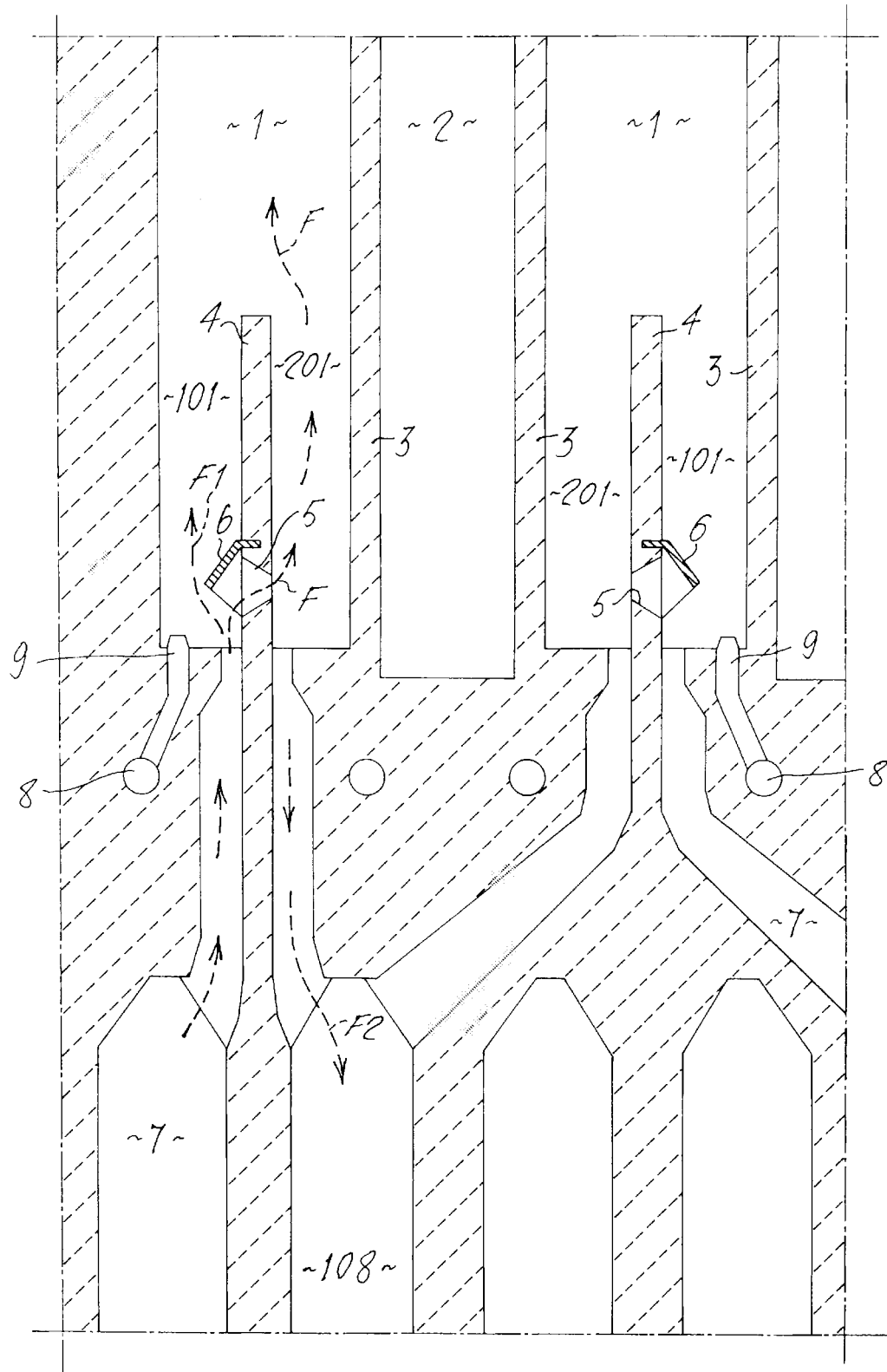


Fig. 1



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EUROPEAN SEARCH REPORT

Application Number
EP 05 10 6709

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.7)
D,A	US 5 017 270 A (JANICKA ET AL) 21 May 1991 (1991-05-21) -----	1-4	C10B21/10 C10B21/20 C10B5/02
A	EP 1 033 396 A (SUMITOMO METAL INDUSTRIES, LTD; THE JAPAN IRON AND STEEL FEDERATION) 6 September 2000 (2000-09-06) -----	1-4	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			C10B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 20 October 2005	Examiner Zuurdeeg, B
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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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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20-10-2005

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 5017270	A	21-05-1991	CN	1036786 A	01-11-1989
			DE	3812558 A1	26-10-1989
			EP	0337112 A1	18-10-1989
			JP	1306494 A	11-12-1989
			JP	3020062 B2	15-03-2000

EP 1033396	A	06-09-2000	DE	60014213 D1	04-11-2004
			US	6797122 B1	28-09-2004
