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(54) **GAS BURNER WITH STAGED COMBUSTION**

(57) A gas burner (1) with
a cylindrical casing (3)
being open from below for the flow of the combustion air,
and
having a gas burner output,
a central primary head (15),
arranged in the axis of the cylindrical casing (3), and hav-
ing
axial main performance nozzles (19),
a swirler (13), and
radial stabilization nozzles (20) around the circumfer-
ence of the central primary head (15) provided in front of
the swirler (13) in the direction of the gas burner output,
and
a fuel tube (7, 8, 9, 10, 11, 16, 22) with a gas distributor
(16) and a tube portion (11),
a reduction piece (12) being
arranged on the tube portion (11) leading from the gas
distributor (16) to the central primary head (15), and
provided with a passing-through opening (17) being
smaller than an opening in the tube portion (11),
wherein
the central primary head (15) is arranged on the reduction
piece (12),
in front of the central primary head (15), the fuel tube (7,
8, 9, 10, 11, 16, 22) is divided into a plurality of tubes (5)
arranged in a circle, and
the fuel nozzles (18) of the plurality of tubes (5) are ar-
ranged on the gas burner output of the casing (3) and
orientated into the gas burner output.

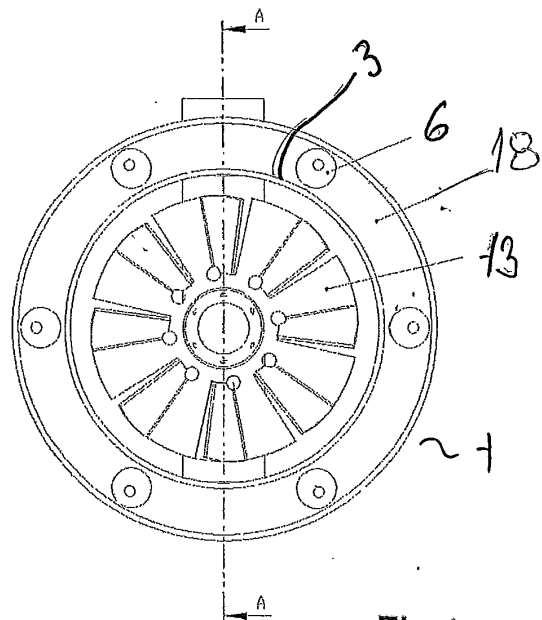


Fig.1

Description

Background of the invention

[0001] The invention concerns a gas burner with the combustion head with axial main performance nozzles, which is arranged in the axis of a cylindrical casing which is open from below for the flow of the combustion air, wherein there are other fuel nozzles arranged on the output of the casing, wherein in front of the primary head, the fuel tube is divided into a plurality of tubes arranged in a circle, whose nozzles are orientated into the gas burner discharge.

State of the art

[0002] Gas burners are designed to combustion of gaseous fuels and serve primarily as a source of heat for overpressure and underpressure hot water boilers. However, they can be used for other appliances with adequate space for combustion which will not be stressed by external heat. Structurally these gas burners are designed as monobloc, i.e. the swirler and all components are part of the gas burner body. The gas burner operation is fully automatic, also suitable for unattended control of boiler rooms. In terms of a mixing method of natural gas with air, block burners belong to burners without premixing of gas with air. The mixing takes place until the gas burner output while simultaneous combustion of the created mixture. According to the combustion method, block burners belong to burners with free flame. For this reason are gas burners provided with a combustion head, which combusts the fuel in one step. During one-step combustion occur temperature peaks, which cause creating of thermal NO_x . This combustion process does not enable to reduce NO_x emissions sufficiently. The aim of this invention is to reduce emissions of thermal NO_x .

[0003] From a structural viewpoint, there are many burners whose combustion head is arranged in the axis of cylindrical casing which is open from below where flows the combustion air, mixed with the fuel outcoming from the outside nozzles on the head and then there are other gas nozzles arranged on the discharge of the casing. Such an arrangement is known e.g. from the document EP 1335163 A1. It is also common that in front of the primary head, the fuel tube is divided into a plurality of tubes arranged in a circle whose nozzles lead to the gas burner output. Such an arrangement is known e.g. from the document US 4,505,666.

[0004] The aim of invention is to present a gas burner, which would allow to reduce emissions of thermal NO_x .

Summary of the invention

[0005] The above mentioned disadvantages are eliminated by the gas burner according to the invention, which principle consists especially in that on the tube portion leading from the gas distributor to the central pri-

mary head a reduction piece is arranged, provided with a passing-through opening which is smaller than the opening in the tube portion, and on the reduction piece the primary head is arranged provided with the swirler and in front of the swirler in the direction of the gas burner output, radial stabilization nozzles around the circumference of the head are provided.

Description of drawings

[0006] The invention will be described by use of drawings in which Fig.1 shows a front view of the gas burner according to the invention, Fig. 2 is a sectional view of the gas burner opening according to line A-A of Fig. 1 in the scale 1:2 and Fig. 3 is a sectional view of a gas burner according to line B-B of Fig.2.

Preferred embodiment of the invention

[0007] From Fig.2 it can be seen that the gas burner consists of a gaseous part which consists of the gas supply 7 tube, an elbow 8 and an income tube portion 9. There is also a not shown air box in front of the gaseous part. The income tube portion 9 leads into a gas distributor 16 from which extends a tube portion 11 on which a reduction piece 12 is arranged. There is a thread at the end of the reduction piece 12, through which a primary head 15 is installed. The primary head 15 is provided with a radially arranged swirler 13 on its lateral surface. The reduction piece 12 is provided with a passing-through opening 17 which reduces passing of gas. On the front of the primary head 15 there are provided axial main performance nozzles 19 and stabilization nozzles 20 on its cylindrical casing, namely in front of the swirler 13, viewed from a gas burner output. Secondary gas is supplied from a gas distributor 16 into secondary heads 6 via distribution tubes 10. At the ends of outer walls 21 of distribution tubes 10 there is perpendicularly arranged the cylindrical casing 3, creating the primary combustion channel. The gas is distributed from a ring 22 consisting of a rear wall 4, a longitudinal wall 2 and a front wall 23 by six tubes 5 to six secondary heads 6 with nozzles 18. Where is no tube 5, there is the front wall 23 which closes the ring 22. There is a collar 14 above the front wall 23.

[0008] In Fig. 1 and 3 the construction of the gas burner parts is illustrated from other view.

[0009] Gas-air mixture of the first (primary) stage is formed by the swirler 13 of the central primary head 15. The system of nozzles 19,20 of the primary head 15 is formed in such a way that a part of these nozzles, namely the axial nozzles 19 are main performance nozzles and the other nozzles 20 are stabilization nozzles, which secure combustion stability.

[0010] Radial nozzles 20 create turbulent swirling of the gas/air mixture. Their placement in the vicinity of swirler 13 is important because of streaming of the combustion air, which has in this area lower velocity. In this way a very stable area of flame is created, which lights up

and stabilize the performance nozzles 19.

[0011] In the primary section within the cylindrical casing 3 the pressure is reduced, in a comparison with the secondary section in the tube portion 11 by use of the reduction piece 12. The discharge of gas is in the area of cylindrical casing 3 lower, which is a prerequisite for good combustion stability. The secondary section has six secondary heads 6 placed around the outer circumference of the casing 3 forming the flame tube. The secondary gas flows radially from the nozzels in secondary heads 6 and enters the gas-air mixture.

[0012] The first stage is the combustion in the flame tube with huge surplus of combustion air. The first stage has an output of about 20%. In the second stage remaining gas needed for a specific power output in a mode with surplus of air, ideally in the range of 1.05 to 1.2 times of the stoichiometric ratio is combusted.

[0013] The swirler 13 creates turbulent air flow before mixing of the oxidizer with fuel. Turbulent air flow ensures a perfect mixing with fuel. The secondary section has six secondary heads placed around the outer circumference of the inner flame tube. The secondary gas flows radially from the nozzles and does not create a rotary motion. Gas distribution is realized by the distribution ring 22 into which gas flows through two intake tube 8. NO_x emissions in this arrangement are at the level of about 25 ppm / Nm³ combustion products.

Claims

1. Gas burner with the combustion head with axial main performance nozzles, which is arranged in the axis of a cylindrical casing which is open from below for the flow of the combustion air, wherein there are other fuel nozzles arranged on the output of the casing, wherein in front of the primary head, the fuel tube is divided into a plurality of tubes arranged in a circle, whose nozzles are orientated into the gas burner discharge, **characterized in that**, on the tube portion (11) leading from the gas distributor (16) to the central primary head (15) a reduction piece (12) is arranged, provided with a passing-through opening (17) which is smaller than the opening in the tube portion (11), and on the reduction piece (12) the primary head (15) is arranged provided with the swirler (13) and in front of the swirler (13) in the direction of the gas burner (1) output, radial stabilization nozzles (20) around the circumference of the head (15) are provided.

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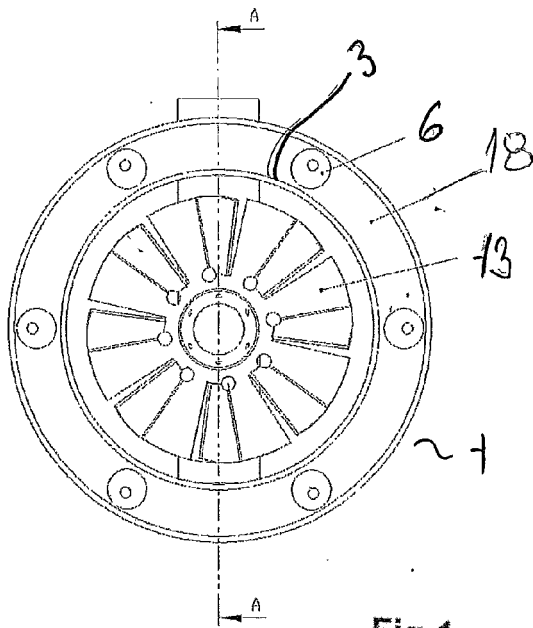


Fig.1

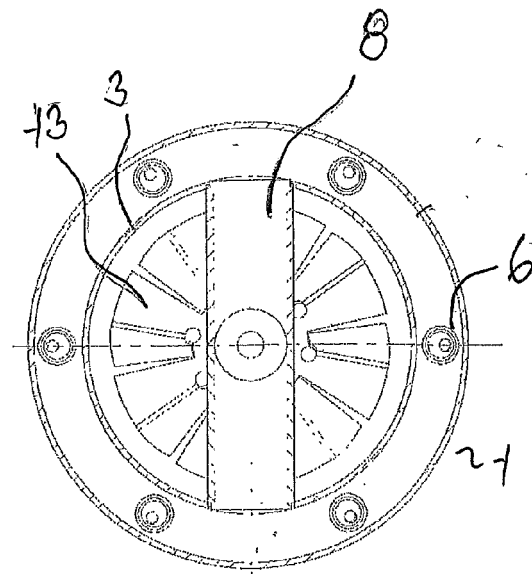


Fig.3

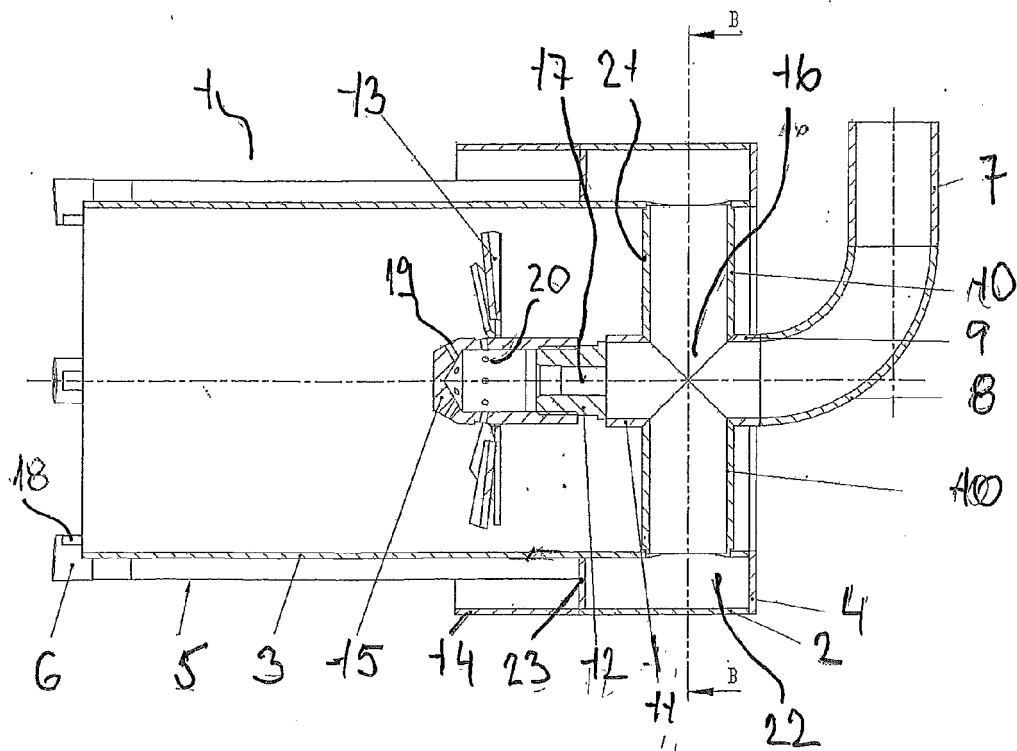


Fig.2



EUROPEAN SEARCH REPORT

Application Number
EP 15 16 2738

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 0 076 036 A1 (ZINK CO JOHN [US]) 6 April 1983 (1983-04-06) * page 3, lines 34-36 * * page 4, line 27 - page 5, line 4 * * figures 1, 5, 8 *	1	INV. F23D14/02 F23D14/24
Y	W0 2007/017056 A1 (ELSTER GMBH) 15 February 2007 (2007-02-15) * paragraphs [0021], [0022] * * figure unique *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			F23C F23D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 September 2015	Examiner Vogl, Paul
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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EPO FORM 1503 03.82 (P04C01)

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

EP 15 16 2738

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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- US 4505666 A [0003]