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(54) **BURNER DEVICE AND METHOD FOR INJECTING A MIXTURE OF FUEL AND OXIDANT INTO A COMBUSTION SPACE**

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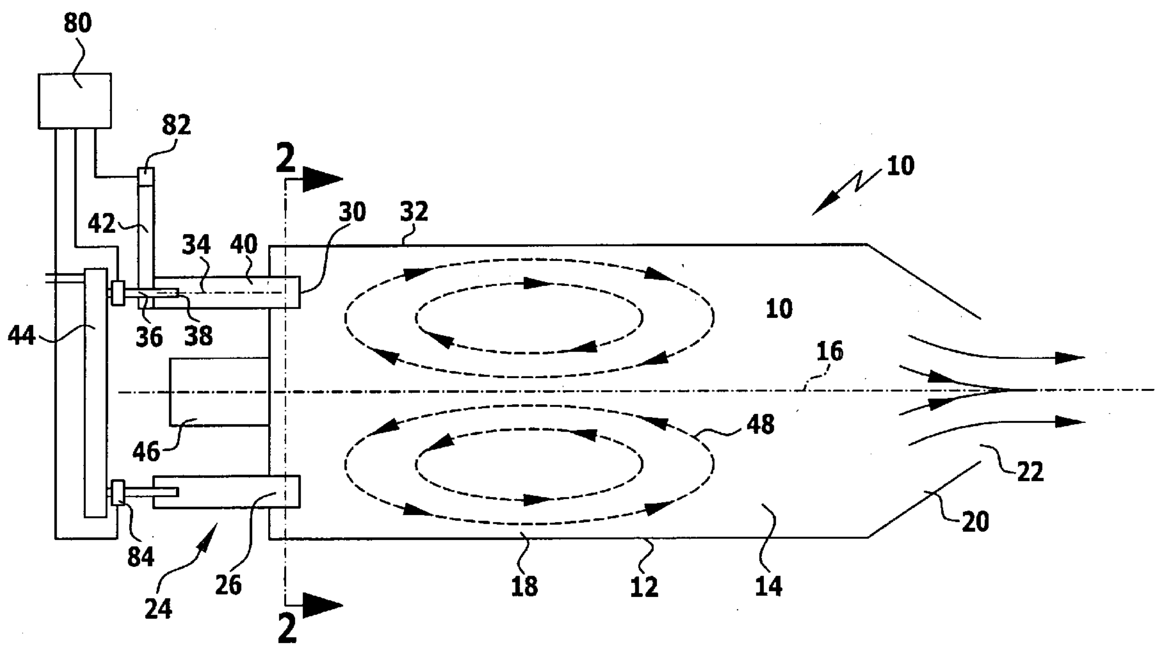
(57) **ABSTRACT**

A burner device is made available, comprising a combustion chamber with a combustion space and an injection device for injecting a mixture of fuel and oxidant into the combustion space, wherein the injection device has a plurality of nozzles arranged on a circular line, the nozzles each have a nozzle chamber, fuel nozzles or fuel pipes for the coupling in of fuel open into the nozzle chambers, oxidant can be coupled into the nozzle chambers via a feed device for generating a mixture and wherein nozzle apertures of the nozzles in the combustion space are designed as elongated holes.



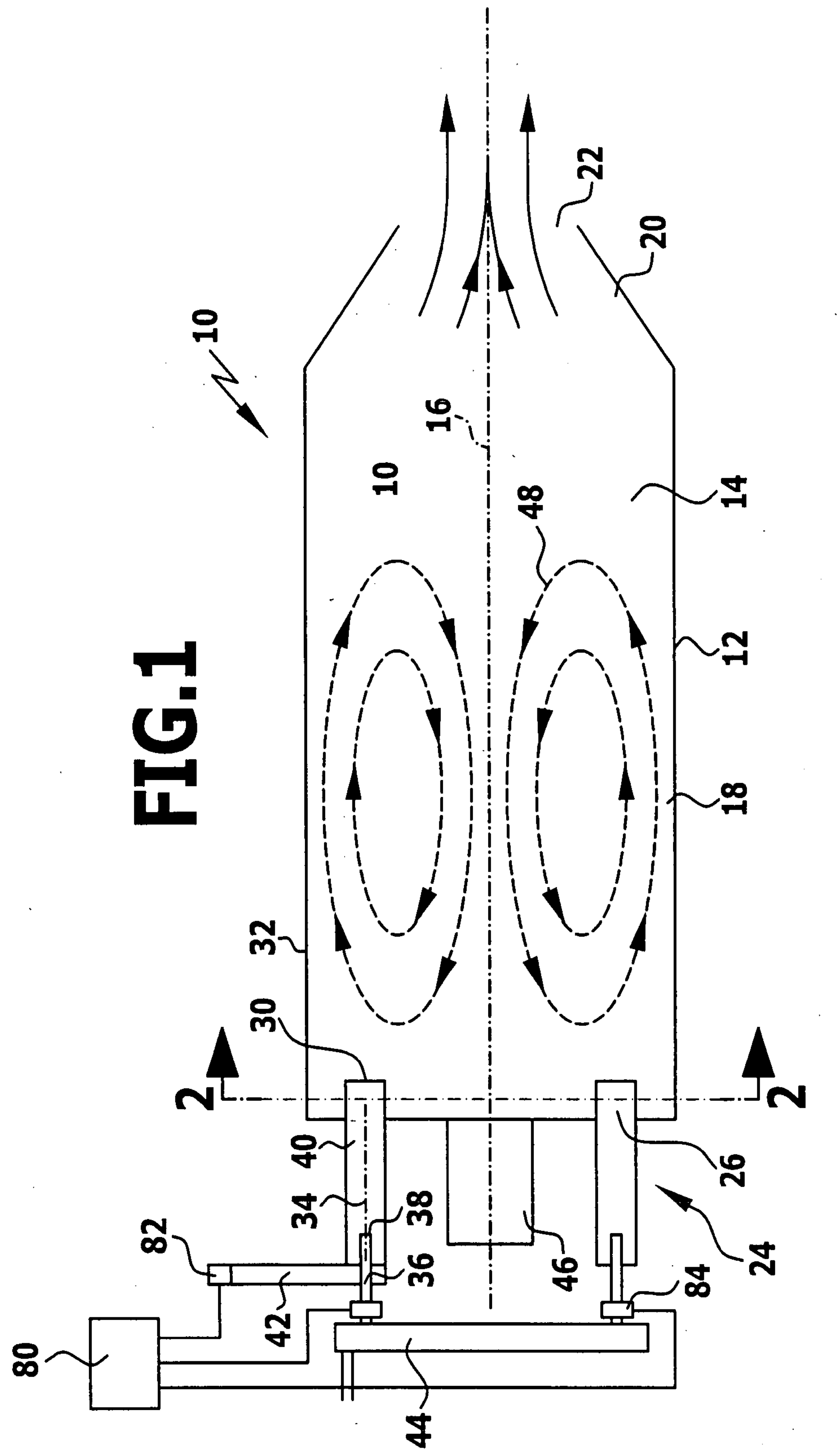


FIG.1

FIG.2

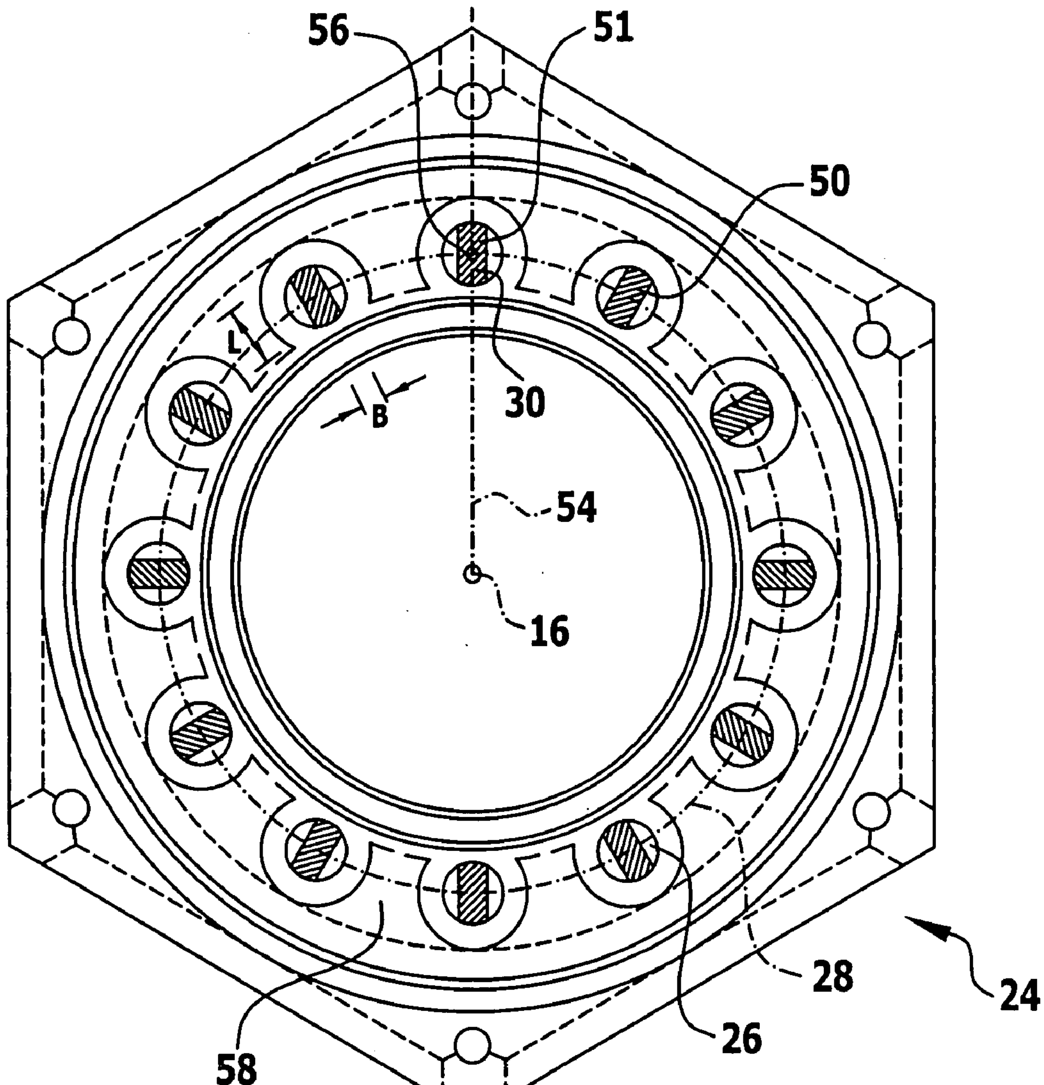
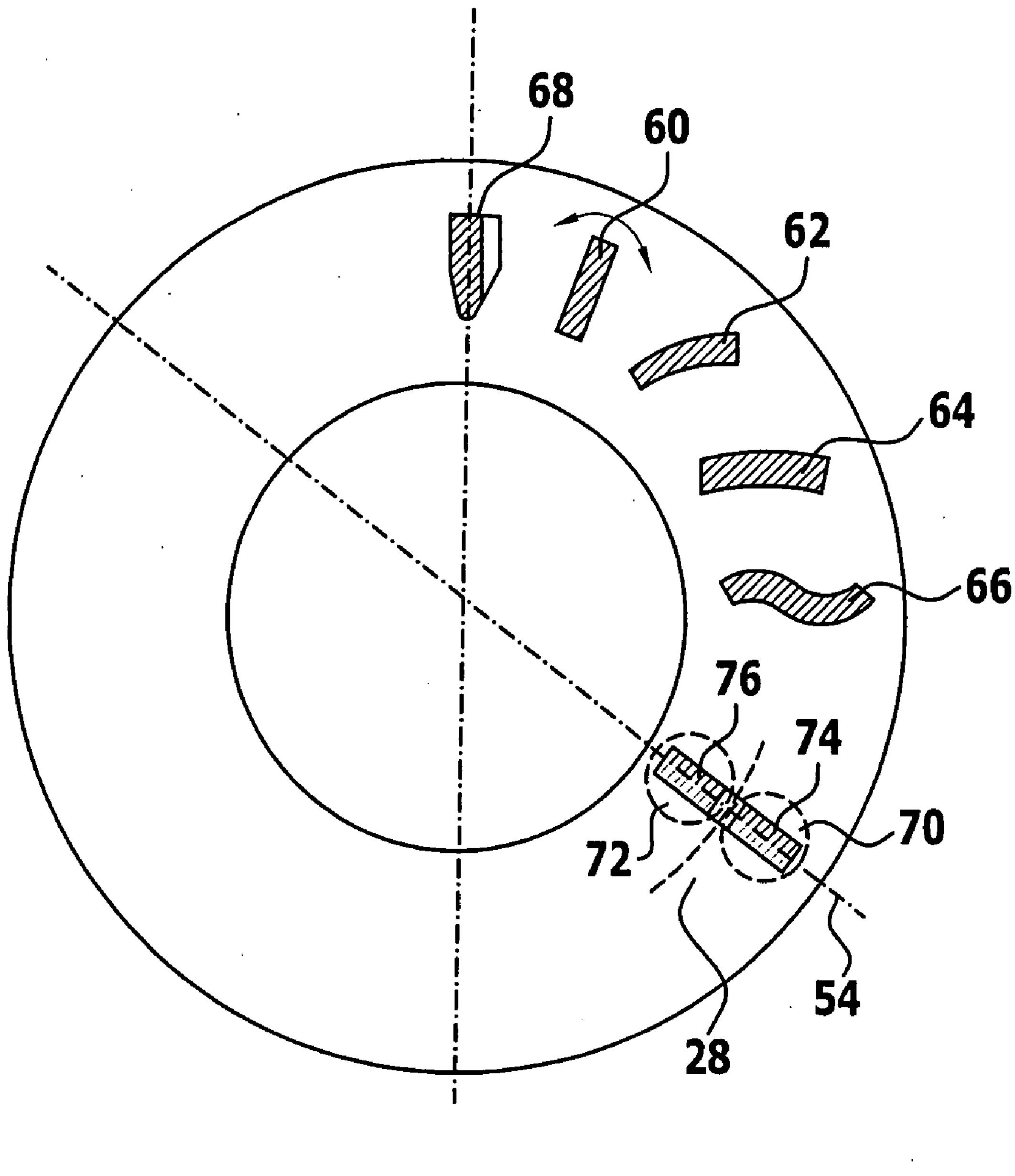


FIG.3



BURNER DEVICE AND METHOD FOR INJECTING A MIXTURE OF FUEL AND OXIDANT INTO A COMBUSTION SPACE

[0001] The present disclosure relates to the subject matter disclosed in German application number 10 2006 051 286.3 of Oct. 26, 2006, which is incorporated herein by reference in its entirety and for all purposes.

BACKGROUND OF THE INVENTION

[0002] The invention relates to a burner device, comprising a combustion chamber with a combustion space and an injection device for injecting a mixture of fuel and oxidant into the combustion space, wherein the injection device has a plurality of nozzles arranged on a circular line.

[0003] The invention relates, in addition, to a method for injecting a mixture of fuel and oxidant into a combustion space.

[0004] A recirculation of exhaust gas may be brought about in the combustion space as a result of such a burner device. The mixture of fuel and oxidant, which is injected into the combustion space via corresponding nozzle jets, can mix with the recirculating exhaust gas. As a result, homogeneous combustion ratios are obtained in the combustion space and these counteract the formation of hot spots. As a result, good exhaust gas values with respect to CO and NOx are, on the other hand, obtained.

[0005] A burner system which comprises a combustion chamber and a distributor which has at least one intake for fuel is known from US 2006/0029894 A1. Fuel can be directed into the combustion chamber from a first end in the direction of a second end via the distributor.

[0006] U.S. Pat. No. 3,834,627 discloses a fuel injector which has a fuel distribution device. DE 25 28 671 A1 discloses a combustion chamber for liquid fuels and gas fuels which has essentially cylindrical walls and a cover plate arranged at the end. The cover plate has a fuel supply nozzle arranged centrally and several feed apertures for gaseous media which are arranged so as to be inclined at an angle in a tangential direction in relation to the central axis of the combustion chamber.

[0007] DE 1 800 612 discloses a combustion chamber with apertures which serve the purpose of admixing cooling air to hot combustion gases. The entry apertures for the cooling air have slit-like cross sections.

[0008] WO 2005/080878 A1 discloses a premix burner for the combustion of a lean combustible gas which has a premix air duct which extends along a burner axis and via which combustion air can be supplied.

[0009] A lance with guides for the mixing of gases is known from U.S. Pat. No. 3,043,577. EP 0 856 128 B1 discloses a gas appliance for bringing about a transfer of heat to a fluid comprising at least one gas burner with premixing.

SUMMARY OF THE INVENTION

[0010] In accordance with the present invention, a burner device is provided, with which a good intermixing of gases in the combustion chamber is obtained even with an increase in the power density.

[0011] In accordance with the invention, the nozzles each have a nozzle chamber, fuel nozzles or fuel pipes for the coupling in of fuel open into the nozzle chambers, and oxidant can be coupled into the nozzle chambers via a feed device for generating a mixture and nozzle apertures of the nozzles in the combustion space are designed as elongated holes.

[0012] In order to increase the power density of a burner device of the type specified at the outset, the gas flow rate through the nozzles can be increased. This leads, however, to greater losses of pressure and, therefore, to a direct reduction in the degree of effectiveness. In order to reduce the losses of pressure, on the other hand, the diameter of the nozzle apertures can be increased. The increase in the diameter of the nozzle apertures does, however, impair the intermixing of gases in the combustion space because the gas jet is thicker.

[0013] In accordance with the invention, with elongated holes as nozzle apertures, the mixture of fuel and oxidant may be injected into the combustion space at the respective nozzles as a band-like jet. Such a band-like jet has a greater surface area in comparison with a jet with a round diameter and the same cross section. As a result, the incorporation into the recirculated exhaust gas is improved. As a result, on the other hand, smaller lambda gradients are obtained in the combustion chamber and the emission of NOx and CO may be reduced in comparison with nozzles with round nozzle apertures.

[0014] As a result, an improved intermixing of gases can be achieved even with an increase in the power density.

[0015] Fuel nozzles or fuel pipes are provided for coupling fuel into the nozzles. As a result, a mixture of fuel and oxidant may be generated which is injected into the combustion space through the nozzles. This mixture of fuel and oxidant is generated in a nozzle chamber of the nozzles. Emissions of NOx and CO are reduced further as a result of the mixing (in comparison with no preliminary mixing) since the lambda gradient is decreased.

[0016] The ratio of hole circumference to hole surface area is greater, in particular, in the case of the elongated holes than in the case of a circular hole with the same hole circumference or same hole surface area. As a result, the intermixing of gases can be improved relative to the same hole surface area. The nozzle apertures may be designed with a smaller surface area and, therefore, in a more space-saving manner relative to the same hole circumference.

[0017] The ratio is, in particular, greater by at least a factor of 1.2, preferably by a factor of 1.4 and, in one embodiment, by a factor of 1.5. As a result, an effective intermixing relative to the same cross-sectional surface area may be achieved in comparison with round nozzle apertures.

[0018] It is favorable when a length of a nozzle aperture is greater than a greatest width of the nozzle aperture. As a result, the ratio of hole circumference to hole surface area may be increased.

[0019] The length of the nozzle aperture is, in particular, at least 1.5 times greater than the greatest width in order to achieve a large hole circumference. A large hole circumference, on the other hand, brings about a large cross-sectional volume in an injected jet of fuel and oxidant.

[0020] It has proven to be favorable when the nozzle apertures are aligned with their center line radially or at an angle of less than 30° in relation to the radial direction. As a result, an optimized incorporation into the recirculated exhaust gas is obtained. The center line is, in this respect, located between the longer sides of the nozzle aperture.

[0021] It may be provided for the rotational orientation in relation to an axis of a nozzle aperture parallel to the axis of the combustion space to be adjustable at least in an angular range. As a result, this rotational position can be varied in order to obtain optimized mixture ratios and combustion ratios at a combustor device in the combustion space.

[0022] A nozzle aperture is, in particular, of a slit-like design in order to generate a band-like jet in the mixture of fuel and oxidant injected.

[0023] It is also possible for a nozzle aperture to be of a triangular design.

[0024] It is also possible for a nozzle aperture to have one or more curved boundary lines. The boundary lines can be curved once or several times.

[0025] It is favorable when the combustion space is of a rotationally symmetric design. As a result, mixture ratios and combustion ratios may be achieved in the combustion space with a high degree of symmetry. This, on the other hand, leads to an improved intermixing of recirculated exhaust gas and injected mixture of fuel and oxidant.

[0026] It is favorable when the combustion chamber has an outlet area which has a tapering inner cross section. As a result of this outlet area, a recirculation of exhaust gas may be brought about, as a result of which the injected mixture of fuel and oxidant may, on the other hand, be incorporated into hot recirculated exhaust gas.

[0027] It is particularly advantageous when the burner device is designed such that a recirculation of exhaust gas can be formed in the combustion space. As a result, homogeneous mixture and combustion ratios are obtained in the combustion space and hot spots avoided.

[0028] It is favorable when the hole surface area of an elongated hole is greater than or equal to a surface area of an outlet aperture of a fuel nozzle or fuel pipe into a nozzle chamber. As a result, the formation of any counterpressure is avoided. A preliminary mixture consisting of fuel and oxidant may thus be generated effectively in the nozzle chamber and this mixture may be coupled into the combustion space.

[0029] It is advantageous when a switching device is present, by means of which one or more nozzles can be switched to active or inactive with respect to the injection of a mixture of fuel and oxidant into the combustion space through the respective nozzles. It is possible for the switching device, for example, with the aid of a valve to regulate whether a mixture of fuel and oxidant is injected through a correspondingly activated nozzle or not. As a result, the mass flow of the mixture of fuel and oxidant into the combustion space may be reduced in the case of a variation in power without the ratio of fuel to oxidant in the mixture (lambda ratio) having to be readjusted. The exiting velocity of the mixture out of an active nozzle into the combustion space in the case of a reduced mass flow may be maintained by inactivating one or more nozzles, i.e., the momentum of the mixture of fuel and oxidant during entry into the combustion space need not be modified in the case of any variation in power. In particular, with the switching device it is possible to control the fact that, for example, every second or every third or every fourth etc. nozzle can be inactivated. As a result, symmetric ratios can also be achieved in the case of a reduction in the mass flow in the case of a decrease in power.

[0030] It is also possible for several nozzles to be arranged on the circular line one behind the other in a radial direction. At least two nozzles with corresponding nozzle apertures in an elongated form are then seated at a nozzle location on the circular line. Several nozzle apertures are then provided at the corresponding nozzle location instead of a single nozzle aperture. These apertures may be designed with a smaller length than if only one nozzle is present at a nozzle location. With a corresponding configuration, it is possible to obtain a greater ratio of the hole circumference to the hole surface area at the nozzle apertures relative to the overall number of nozzles at a nozzle location. As a result the incorporation into recirculating hot exhaust gas may, on the other hand, be improved. A nozzle at a nozzle location is, so to speak, divided into several nozzles.

[0031] In accordance with the invention, a method is provided, with which a good intermixing of gases in the combustion space can be achieved even with an increase in the power density.

[0032] In accordance with the invention, fuel and oxidant are coupled into nozzle chambers in order to produce a mixture of fuel and oxidant and the mixture of fuel and oxidant is injected into the combustion space via nozzle apertures adjoining the nozzle chambers, wherein the nozzle apertures are located on a circular line and are designed as elongated holes.

[0033] The method in accordance with the invention has the advantages already explained in conjunction with the burner device according to the invention.

[0034] Additional, advantageous developments have likewise already been explained in conjunction with the burner device according to the invention.

[0035] It is provided, in particular, for the mixture of fuel and oxidant to be injected into the combustion space with a higher velocity than the turbulent flame velocity in the combustion space. As a result, any flashback into the nozzle chamber is avoided.

[0036] It is favorable when one or more nozzles are inactivated in order to reduce the mass flow of a mixture of fuel and oxidant which is injected into the combustion space. As a result, the mass flow can be reduced in a simple manner in the case of a variation in power without the mixture in the nozzle chamber needing to be influenced. Furthermore, the exiting momentum at the nozzles in the case of a reduction in the mass flow need not be modified as a result.

[0037] The inactivated nozzles are, in particular, selected such that they are distributed symmetrically on the circular line. As a result, symmetric ratios are also obtained in the case of a reduction in the mass flow.

[0038] The following description of preferred embodiments serves to explain the invention in greater detail in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0039] FIG. **1** shows a schematic sectional illustration of one embodiment of a burner device according to the invention;

[0040] FIG. **2** shows a sectional view of the burner device according to FIG. **1**; and

[0041] FIG. **3** shows a schematic illustration of various possibilities for the configuration of nozzle apertures.

DETAILED DESCRIPTION OF THE INVENTION

[0042] One embodiment of a burner device in accordance with the invention, which is shown in FIG. **1** and designated as **10**, comprises a combustion chamber **12** with a combustion space **14**. The combustion space **14** is designed to be rotationally symmetric around an axis **16**.

[0043] The combustion space **14** comprises a combustion area **18** which is essentially cylindrical and an outlet area **20** with an outlet aperture **22**. The outlet area **20** tapers towards the outlet aperture **22**. The outlet area **20** is of a truncated design.

[0044] An injection device **24** is arranged at the combustion chamber **12** and a mixture of fuel and oxidant may be injected into the combustion space **14** via this injection device. A gaseous fuel is used as fuel. The oxidant is, in particular, atmospheric oxygen.

[0045] The injection device **24** comprises a plurality of nozzles **26** which are arranged on a circular line **28** (FIG. **2**). In the embodiment shown in FIG. **2**, the nozzles **26** are located on the circular line **28**. The nozzles **26** have nozzle apertures **30** which open into the combustion space **14**. The nozzle apertures **30** are located in the vicinity of a combustion chamber wall **32** which limits the combustion area **18** of the combustion space **14** and are spaced in relation to this combustion chamber wall **32**.

[0046] The nozzles **26** are essentially aligned parallel to the axis **16** so that the mixture of fuel and oxidant can be injected into the combustion space **14**, which is located essentially parallel to the axis **16**, with a main direction of inflow. Nozzle axes **34** are, accordingly, aligned parallel to the axis **16**.

[0047] Fuel can be injected into the nozzles **26** via a respectively associated fuel nozzle **36** or via a respective small fuel pipe **36**. Such a fuel nozzle or such a small fuel pipe **36** has an outlet aperture **38** which opens into a nozzle chamber **40** of the nozzles **26** or is positioned outside the nozzle chamber **40** such that fuel which exits from the respective outlet apertures **38** enters the respective nozzle chamber **40** completely. The diameter of the outlet apertures **38** is correspondingly smaller than the diameter of the nozzle chamber **40**.

[0048] Furthermore, oxidant and, in particular, air can be coupled into the nozzle chamber **40** via a feed device **42**.

[0049] Fuel can be supplied to the fuel nozzles **36** via a feed device **44**.

[0050] In one embodiment, twelve nozzles **26** are arranged on the circular line **28**. The diameter of the nozzles **26** at the nozzle chamber **40** is 4.5 mm. The diameter of the outlet apertures **38** of the fuel nozzles **36** is 1 mm. The outlet aperture **38** of the fuel nozzles **36** is, in particular, circular in shape.

[0051] An ignition device **46** is arranged at the combustion chamber **12** in order to be able to ignite the mixture of fuel and oxidant in the combustion space **14**.

[0052] The burner device **10** is designed such that exhaust gas can recirculate in the combustion space **14**. The recirculation of exhaust gas is indicated in FIG. **1** by the reference numeral **48**. As a result of the recirculation of exhaust gas, a temperature profile with a good degree of homogeneity may be achieved in the combustion space **14** and so hot spots are avoided. As a result, lower amounts of NOx and of CO are contained in the exhaust gas.

[0053] In this respect, it is provided, in particular, for the velocity of fuel in the fuel nozzles **36** to be greater than the turbulent flame velocity in the combustion space **14** in order to prevent any flashback of the flame into the injection device **24**.

[0054] In order to increase the power density in the case of a given combination **10** of gas turbine and combustor device, the throughput of the mixture of fuel and oxidant through the injection device **24** can be increased. This does, however, lead to increased losses of pressure which result in a reduction in the degree of efficiency. In order to keep the loss of pressure small, the cross-sectional surface areas of the nozzle apertures **30** of the nozzles **26** can be increased. As a result of the thicker gas jet which is caused by this and is coupled into the combustion space **14**, the intermixing with recirculated exhaust gas in the combustion space **14** will deteriorate.

[0055] In accordance with the invention, it is provided for the nozzle apertures **30** for the nozzles **26** to be designed as elongated holes **50** instead of circular nozzle apertures. In the case of the elongated holes **50**, the ratio of hole circumference to the hole surface area at the nozzle apertures **30** is greater than in the case of a circular aperture with the same hole surface area and, in particular, is greater by a factor of at least 1.2. It may be advantageous when this factor is at least 1.4 or even at least 1.5.

[0056] Furthermore, the elongated holes have a length L which is greater than the greatest width B. This length L is, in particular, greater than the width B by at least 1.5 times.

[0057] The elongated holes **50** for the nozzle apertures **30** are aligned parallel to a radial direction **54** with a center line **51** or are located at a small acute angle in relation to the radial direction **54**. This small acute angle is, in particular, smaller than 30°.

[0058] In this respect, it is, in principle, possible for the orientation of the nozzle aperture **30** in its rotary position relative to an axis of rotation **56** to be adjustable parallel to the axis **16**.

[0059] For example, the nozzles **26** or corresponding parts of the nozzles **26**, which bear the nozzle aperture **30**, can be screwed to a holder **58**. The position of the axis of rotation **56** is determined by the screw-in position and, with it, the alignment in relation to the radial direction **54**.

[0060] The mixture of fuel and oxidant may be injected into the combustion space **14** through the elongated hole nozzle apertures **50** in "thin strips". A high ratio is obtained for the cross-sectional circumference of an injected jet in comparison with its cross-sectional surface area (relative, in particular, to a circular nozzle aperture). As a result, the incorporation into the recirculated hot exhaust gas is improved and the incorporation also takes place more quickly. As a result, on the other hand, smaller lambda gradients occur and the emission of NOx and CO is reduced in comparison with round nozzle apertures with the same hole surface area.

[0061] The elongated holes **50** may be of a slit-like design, as indicated in FIG. **3** by the reference numeral **60**. Parallel boundary lines are provided for the elongated hole **60**.

[0062] It is also possible for elongated holes to have curved boundary lines, like the elongated holes **62**, **64** and **66** according to FIG. **3**. The elongated holes can, as mentioned above, be aligned in a radial direction **54** or be turned relative thereto.

[0063] The elongated holes **62** and **64** according to FIG. **3** have boundary lines with a single curvature. The elongated hole **66** has boundary lines which are curved several times.

[0064] It is, for example, also possible for an elongated hole to be of a triangular design like the elongated hole **68** according to FIG. **3**.

[0065] It is also possible for a plurality of nozzles **70**, **72** to be arranged on the circular line **28** on a corresponding sector of a circle. The nozzles **70**, **72** are located, in particular, radially to one another. They have corresponding nozzle apertures **74**, **76** which are elongated hole apertures. The nozzle apertures **74** and **76** are located one behind the other in a radial direction **54** and are aligned so as to be flush with one another.

[0066] With this embodiment, a nozzle aperture with a long length is subdivided into several nozzle apertures **74**, **76**. As a result, separate jets of fuel and oxidant can be coupled into the combustion space **14** at the nozzles **70**, **72** with an increased area when the distance between the nozzle apertures **74**, **76** is selected accordingly.

[0067] In one embodiment, the burner device **10** comprises a switching device **80**. This acts on the device **42** for feeding oxidant into the respective nozzle chambers **40**. The supply of oxidant for each nozzle or for selected nozzles **26** can be interrupted by this device. For this purpose, on-off valves **82** are, in particular, associated with the corresponding nozzles.

[0068] Furthermore, the switching device **80** activates on-off valves **84** which are seated on the small fuel pipes **36** or are seated on small fuel pipes **36** of selected nozzles **26**. The supply of fuel into the nozzle chamber **40** of a respective nozzle **26** can be interrupted.

[0069] In the case of a selected nozzle **26**, an on-off valve **82** is provided for the interruption of the supply of oxidant as well as an on-off valve **84** for the interruption of the supply of fuel; the activation of the corresponding on-off valves **82** and **84** is synchronized by the switching device **80**.

[0070] A selected nozzle **26** can be inactivated by the switching device **80**; no more oxidant and no more fuel are made available to the corresponding nozzle **26** due to the closure of the on-off valves **82** and **84** and also no more mixture of fuel and oxidant can then flow into the combustion space **14**.

[0071] The mass flow of the mixture of fuel and oxidant into the combustion space **14** may be reduced by the switching device **80** in that one or more nozzles **26** are inactivated. This may be required, for example, in the case of a variation in power. The mass flow may be reduced without any regulation or readjustment of the ratio of fuel to oxidant being necessary at the nozzle or the nozzles, via which a mixture of fuel and oxidant is still being injected. Furthermore, no reduction in the exiting velocity occurs at the nozzles, via which injection takes place, i.e., the exiting momentum is not altered.

[0072] In particular, the switching device **80** controls the nozzles **26** on the circular line symmetrically so that, for example, ever second, every third or every fourth etc. nozzle **26** is inactivated depending on the mass flow to be set.

[0073] As a result of the solution according to the invention with the provision of elongated holes **50**, the area of the jet which is coupled into the combustion space **14** may be increased in comparison with circular nozzle apertures with the same jet surface area. A band-like jet is made available, by means of which a better incorporation into recirculated exhaust gas is achieved.

[0074] The method in accordance with the invention functions as follows:

[0075] Fuel and oxidant are premixed in the nozzle chambers **40** of the nozzles **26**. Oxidant is coupled into the respective nozzle chambers **40** via the feed device **42** and fuel is coupled in via the small fuel pipes **36**. This mixture is then injected into the combustion space **14** via the respective elongated hole nozzle apertures **50**.

[0076] The injection velocity is adjusted such that it is higher than the turbulent flame velocity in the combustion space **14**. As a result, a flashback of the flame into the nozzle chambers **40** may be avoided.

[0077] The nozzle apertures **30** of the nozzles **26** are arranged on the circular line **28**.

[0078] The aperture surface area of the outlet apertures **38** into the nozzle chambers **40** is smaller than the respective surface areas of the elongated hole nozzle apertures **50** in order to avoid any counterpressure.

[0079] One or more nozzles **26** may be inactivated by the switching device **80**, i.e., the supply of oxidant and supply of fuel into the corresponding nozzle chamber **40** will be interrupted via the corresponding on-off valves **82** or **84**. As a result, the mass flow of the mixture of fuel and oxidant, which is injected into the combustion space **14**, may be reduced, wherein no reduction in the exiting velocity and, therefore, the exiting momentum of the mixture of fuel and oxidant at the nozzles **26**, via which injection is still taking place, occurs.

1. Burner device, comprising:
a combustion chamber with a combustion space; and
an injection device for injecting a mixture of fuel and oxidant into the combustion space;
wherein the injection device has a plurality of nozzles arranged on a circular line;
wherein the nozzles each have a nozzle chamber;
wherein fuel nozzles or fuel pipes for the coupling in of fuel open into the nozzle chambers;
wherein oxidant is able to be coupled into the nozzle chambers via a feed device for generating a mixture; and
wherein nozzle apertures of the nozzles in the combustion space are designed as elongated holes.

2. Burner device as defined in claim **1**, wherein the ratio of hole circumference to hole surface area is greater in the case of the elongated holes than in the case of a circular hole with the same hole circumference or same hole surface area.

3. Burner device as defined in claim **2**, wherein the ratio is greater by at least a factor of 1.2.

4. Burner device as defined in claim **2**, wherein the ratio is greater by at least a factor of 1.4.

5. Burner device as defined in claim **2**, wherein the ratio is greater by at least a factor of 1.5.

6. Burner device as defined in claim **1**, wherein a length of a nozzle aperture is greater than a greatest width of the nozzle aperture.

7. Burner device as defined in claim **6**, wherein the length of the nozzle aperture is at least 1.5 times greater than the greatest width.

8. Burner device as defined in claim **1**, wherein the nozzle apertures are aligned with their center line radially or at an angle of less than 30° in relation to the radial direction.

9. Burner device as defined in claim **1**, wherein the rotational orientation in relation to an axis of a nozzle aperture parallel to the axis of the combustion space is adjustable at least in an angular range.

10. Burner device as defined in claim **1**, wherein a nozzle aperture is of a slit-like design.

11. Burner device as defined in claim **1**, wherein a nozzle aperture is of a triangular design.

12. Burner device as defined in claim **1**, wherein a nozzle aperture has one or more curved boundary lines.

13. Burner device as defined in claim **1**, wherein the combustion space is of a rotationally symmetric design.

14. Burner device as defined in claim **1**, wherein the combustion chamber has an outlet area with a narrowing inner cross section.

15. Burner device as defined in claim **1**, wherein its design is such that a recirculation of exhaust gas is able to be formed in the combustion space.

16. Burner device as defined in claim **1**, wherein several nozzles are arranged one behind the other in a radial direction on the circular line.

17. Burner device as defined in claim **1**, wherein a hole surface area of an elongated hole is greater than or equal to a surface area of an outlet aperture of a fuel nozzle or a fuel pipe into a nozzle chamber.

18. Burner device as defined in claim **1**, comprising a switching device for switching one or more nozzles to active or inactive with respect to the injection of a mixture of fuel and oxidant through the respective nozzles.

19. Method for injecting a mixture of fuel and oxidant into a combustion space, comprising:

bringing fuel and oxidant into nozzle chambers in order to produce a mixture of fuel and oxidant; and

injecting the mixture of fuel and oxidant into the combustion space via nozzle apertures adjoining the nozzle chambers;

wherein the nozzle apertures are arranged so as to be distributed on a circular line and are designed as elongated holes.

20. Method as defined in claim **19**, wherein the mixture of fuel and oxidant is injected into the combustion space with a higher velocity than the turbulent flame velocity in the combustion space.

21. Method as defined in claim **19**, wherein one or more nozzles are inactivated for the purpose of reducing the mass flow of the mixture of fuel and oxidant injected into the combustion space.

22. Method as defined in claim **21**, wherein the inactivated nozzles are selected such that they are distributed symmetrically on the circular line.

* * * * *