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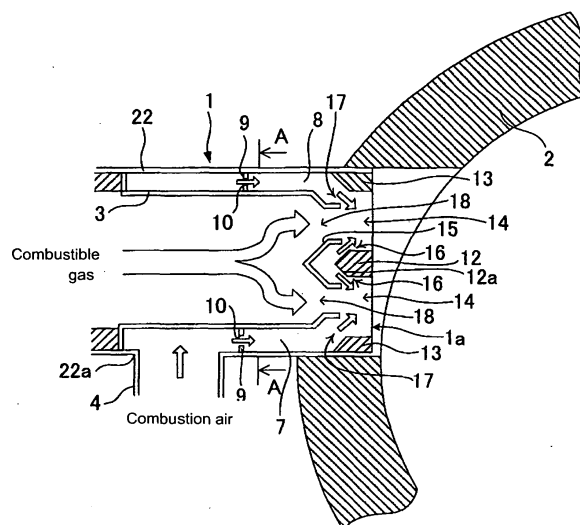
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(54) **COMBUSTION BURNER**

(57) A combustion burner capable of enhancing efficiency in mixing of combustible gas and combustion air is provided. A combustion burner (1) mixes combustible gas generated by gasification of a waste product and combustion air together, and supplies the combustible gas and the combustion air to a combustion chamber. The combustion burner (1) includes: a gas duct (3) forming a gas flow path along which the combustible gas moves; an air duct (22) disposed along the external surface of the gas duct, the air duct forming an air flow path along which the combustion air taken in from outside moves, the air flow path being formed between the air duct and the gas duct; and a branching post (15) connected to the gas duct in the gas flow path, the branching post discharging the combustible gas from the gas duct while dividing the gas flow path into a plurality of flow paths. The combustion air in the air flow path is guided to the branching post, and is discharged from the branching post toward the branched flow paths of the combustible gas. The combustion air is also discharged from the gas duct toward the branched flow paths of the combustible gas.

FIG.2



Description

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TECHNICAL FIELD

[0001] The present invention relates to a combustion burner for burning combustible gas generated by gasification of a waste product.

BACKGROUND ART

[0002] A waste disposal furnace such as a waste melting furnace is used for disposal of waste products including general waste products and industrial waste products. Combustible dusts and combustible gas generated in the waste disposal furnace are burned with a combustion burner in a combustion chamber to recover heat.

[0003] The combustion burner includes a partially premixed combustion burner that is known for its ability to enhance combustion characteristics with a simple structure (see Patent Literature 1).

[0004] Fig. 11, and Figs. 12A to 12C show the structure disclosed in Patent Literature 1. Fig. 11 is a horizontal sectional view of a combustion burner attached to a combustion chamber. Fig. 12A is a sectional view taken along F-F in Fig. 11, Fig. 12B is a sectional view taken along E-E in Fig. 11, and Fig. 12C is a sectional view taken along D-D in Fig. 11.

[0005] A combustion burner 100 is attached to a combustion chamber 200. Combustible gas generated in a waste disposal furnace is mixed with combustion air, and is burned in the combustion chamber 200. The combustible gas is guided through a duct 120 into the combustion chamber 200. The combustion air is guided through a duct 121 into a wind box 122. A straightening plate 126 is disposed along a path of the combustion air in the wind box 122. As shown in Fig. 12A, a plurality of openings 127 through which the combustion air passes are formed in the straightening plate 126.

[0006] The combustible gas and the combustion air are partially premixed in a gas mixing chamber 125. The gas mixing chamber 125 is a space formed between a burner tile 123 positioned at an end portion of the wind box 122 and an outlet of the duct 120. The combustible gas passes through a plurality of discharge ports formed in a plate 128 of the duct 120 to reach the gas mixing chamber 125. The combustible gas and the combustion air mixed in the gas mixing chamber 125 are jetted into the combustion chamber 200 through a plurality of mixed gas jet ports 124, thereby forming a flame in the combustion chamber 200.

CITATION-LIST

PATENT LITERATURES

[0007]

[Patent Literature 1] Japanese Patent Application

SUMMARY OF INVENTION

5 PROBLEMS TO BE SOLVED BY INVENTION

[0008] The combustion burner 100 disclosed in Patent Literature 1 guides the combustion air only through the periphery of the duct 120 for the combustible gas. This makes it difficult to mix the combustible gas and the combustion air uniformly. Mixing of the combustible gas and the combustion air is made more difficult especially if the size of the combustion burner 100 is increased to increase the inner diameter of the duct 120 for the combustible gas.

[0009] Accordingly, it is an object of the present invention to provide a combustion burner capable of mixing combustible gas and combustion air easily.

20 MEANS FOR SOLVING PROBLEMS

[0010] The present invention is a combustion burner configured to mix combustible gas generated by gasification of a waste product and combustion air together, and supply the combustible gas and the combustion air to a combustion chamber. The combustion burner includes: a gas duct forming a gas flow path along which the combustible gas moves; an air duct disposed along an external surface of the gas duct, the air duct forming an air flow path along which the combustion air taken in from outside moves, the air flow path being formed between the air duct and the gas duct; and a branching post connected to the gas duct in the gas flow path, the branching post discharging the combustible gas from the gas duct while dividing the gas flow path into a plurality of flow paths. The combustion air in the air flow path is guided to the branching post, and is discharged from the branching post toward the branched flow paths of the combustible gas. The combustion air is also discharged from the gas duct toward the branched flow paths of the combustible gas.

[0011] The branched flow paths of the combustible gas can be positioned between portions of the gas duct through which the combustion air is discharged and portions of the branching post through which the combustion air is discharged. This allows supply of the combustion air from positions where the branched flow paths are interposed, so that the combustion air can be mixed with the combustible gas with enhanced efficiency.

[0012] A straightening plate with an opening to control an amount of the combustion air passing through the opening may be disposed in the air flow path. This suppresses nonuniformity of the amount of movement of the combustion air through the air flow path.

[0013] The air flow path can have a region defined downstream of the combustion air with respect to the straightening plate, and the region is constructed of an upper air chamber, a lower air chamber, a left air cham-

ber, and a right air chamber separated from each other and positioned above and below the gas flow path, and on the left and right sides of the gas flow path, respectively. The combustion air in the upper air chamber and the lower air chamber can be guided to the branching post. The combustion air in the left air chamber and the right air chamber can be discharged from end portions of the gas duct toward the branched flow paths of the combustible gas.

[0014] The branching post can include a plurality of branching posts. In this case, the branching posts can be disposed such that the branching posts each extending vertically are disposed in juxtaposition as viewed in a horizontal plane.

[0015] A burner tile can be disposed along the branching post. Further, a space through which the combustion air moves, and a slit through which the combustion air is discharged toward the branched flow paths of the combustible gas can be formed between the branching post and the burner tile. The branching post may be formed into a cylinder, and the slit through which the combustion air is discharged may be provided to the branching post.

[0016] The gas duct can be circular in cross section perpendicular to a direction in which the combustible gas moves. The combustion burner of the present invention is attached to the combustion chamber in which the combustible gas and the combustion air are burned.

ADVANTAGEOUS EFFECTS OF INVENTION

[0017] According to the present invention, the branching post divides the gas flow path into a plurality of flow paths, and in this state the combustion air can be supplied from mutual different directions with respect to the respective branched flow paths. More specifically, the combustion air can be supplied from the branching post and from the gas duct into the branched flow paths of the combustible gas. This allows the combustion air to be supplied efficiently to the combustible gas moving in the gas flow path, so that the combustible gas and the combustion air can be mixed easily.

BRIEF DESCRIPTION OF DRAWINGS

[0018]

Fig. 1 is a vertical sectional view showing the configuration of a combustion chamber with a combustion burner in a first embodiment of the present invention.

Fig. 2 is horizontal sectional view of the combustion burner attached to the combustion chamber in the first embodiment.

Fig. 3 is a vertical sectional view of the combustion burner attached to the combustion chamber in the first embodiment.

Fig. 4 is a sectional view taken along A-A of Fig. 2.

Fig. 5 is a diagram of the outer appearance of the

combustion burner as the first embodiment.

Fig. 6 is a horizontal sectional view of a combustion burner attached to a combustion chamber in a second embodiment of the present invention.

Fig. 7 is a vertical sectional view of the combustion burner attached to the combustion chamber in the second embodiment.

Fig. 8 is a diagram of the combustion burner as viewed in a direction indicated by an arrow B of Fig. 6.

Fig. 9 is a sectional view taken along C-C of Fig. 6.

Fig. 10 is horizontal sectional view of a combustion burner attached to a combustion chamber in a third embodiment of the present invention.

Fig. 11 is a horizontal sectional view of a conventional configuration in which a combustion burner is attached to a combustion chamber.

Fig. 12A is a sectional view taken along F-F of Fig. 11.

Fig. 12B is a sectional view taken along E-E of Fig. 11.

Fig. 12C is a sectional view taken along D-D of Fig. 11.

EMBODIMENT(S) FOR CARRYING OUT INVENTION

[0019] Embodiments of the present invention will be described next with reference to the drawings.

[First Embodiment]

[0020] A combustion burner being a first embodiment of the present invention will be described by using Figs. 1 to 5. Fig. 1 is a vertical sectional view of a combustion chamber to which the combustion burner is attached. Fig. 2 is a horizontal sectional view of the combustion burner attached to the combustion chamber. Fig. 3 is a vertical sectional view of the combustion burner. Fig. 4 is a sectional view taken along A-A of Fig. 2. Fig. 5 is a perspective view of the outer appearance of the combustion burner.

[0021] As shown in Fig. 1, a combustion burner 1 of the present embodiment is attached to a combustion chamber 2, and supplies combustible gas and combustion air mixed with each other to the combustion chamber 2. The combustible gas is generated by gasification in a waste disposal furnace, and is supplied to the combustion burner 1. The combustion air is supplied, for example, from the atmosphere into the combustion burner 1. The combustible gas and the combustion air supplied from the combustion burner 1 into the combustion chamber 2 form a flame that moves along the inner circumference of the combustion chamber 2.

[0022] As shown in Fig. 2, the combustion burner 1 includes a gas duct 3 that forms a gas flow path along which the combustible gas moves. The gas duct 3 is formed into a rectangle in cross section perpendicular to a direction in which the combustible gas moves.

A wind box (air duct) 22 is formed to surround the gas

duct 3. An air flow path along which the combustion air moves is formed between the outer wall surface of the gas duct 3 and the inner wall surface of the wind box 22. A supply duct 4 through which the combustion air is supplied is connected to the wind box 22.

[0023] A straightening plate 9 is disposed in the air flow path formed by the wind box 22. The straightening plate 9 is positioned downstream of the combustion air with respect to a point 22a at which the supply duct 4 is connected to the wind box 22. The straightening plate 9 has a plurality of openings 10 through which the combustion air passes. In other words, part of the straightening plate 9 except that in which the openings 10 are formed prevents movement of the combustion air. The plurality of openings 10 are disposed around the gas duct 3 as shown in Fig. 4.

[0024] The combustion air having passed through the openings 10 of the straightening plate 9 enters four separated air chambers 5 to 8. Parts of the straightening plate 9 corresponding to the air chambers 5 to 8 are each given three openings 10. Accordingly, the combustion air in a predetermined amount responsive to the opening area of the three openings 10 (total area thereof) enters each of the air chambers 5 to 8. In the present embodiment, each of the air chambers 5 to 8 is provided with three openings 10. However, this is not the only number of openings 10, but the number of openings 10 may arbitrarily be determined. Further, the air chambers 5 to 8 may have the same number of openings 10, or different numbers of openings 10.

[0025] The upper air chamber 5 is an air flow path positioned above the gas duct 3. The lower air chamber 6 is an air flowpath positioned below the gas duct 3. The left air chamber 7 is an air flow path positioned on the left side of the gas duct 3 when the combustion burner 1 is viewed from inside the combustion chamber 2 (see Fig. 4). The right air chamber 8 is an air flow path positioned on the right side of the gas duct 3 when the combustion burner 1 is viewed from inside the combustion chamber 2. As shown in Fig. 4, the gas duct 3 is surrounded by the air chambers 5 to 8, and the air chambers 5 and 6 are arranged above and below the air chambers 7 and 8, respectively.

[0026] Burner tiles 12 and 13 to form two mixed gas jet ports 14 are provided to an end 1a of the combustion burner 1. The mixed gas jet ports 14 are provided to guide the combustible gas and the combustion air mixed with each other to the combustion chamber 2. The burner tile 13 is disposed along the inner wall surface of the wind box 22 as shown in Fig. 5.

[0027] The burner tile 12 is disposed at a position at which an opening formed by the burner tile 13 is divided into two. The two openings divided by the burner tile 12 become the mixed gas jet ports 14, and the two mixed gas jet ports 14 are disposed in juxtaposition as viewed in a horizontal plane. The burner tile 12 has a pair of tilted surfaces 12a, so that the width of the burner tile 12 defined in the horizontal section (see Fig. 2) becomes small-

er with a longer distance from the end 1a of the combustion burner 1.

[0028] Two mixed gas jet ports 14 are provided in the present embodiment. However, this is not the only number of mixed gas jet ports 14. The number of mixed gas jet ports 14 may arbitrarily be determined as long as the mixed gas jet ports 14 are disposed in juxtaposition in a horizontal direction.

[0029] A branching post 15 is disposed upstream of the flow path of the combustible gas with respect to the burner tile 12. The branching post 15 extends vertically, and which is formed into a shape conforming to the shapes of the tilted surfaces 12a of the burner tile 12. Provision of the branching post 15 in the gas duct 3 divides the flow path of the combustible gas into two, so that the combustible gas can move toward the two mixed gas jet ports 14.

[0030] As shown in Fig. 3, the upper end portion of the branching post 15 is connected to the upper air chamber 5 (gas duct 3). The combustion air from the upper air chamber 5 is guided into a space formed between the branching post 15 and the burner tile 12. The lower end portion of the branching post 15 is connected to the lower air chamber 6 (gas duct 3). The combustion air from the lower air chamber 6 is guided into a space formed between the branching post 15 and the burner tile 12.

[0031] Two discharge nozzles 16 through which the combustion air is discharged are formed between the branching post 15 and the burner tile 12 as viewed in a horizontal plane as shown in Fig. 2. The discharge nozzles 16 are each an opening in the form of slit defined by part of the branching post 15 and part of the burner tile 12. The combustion air guided from the air chambers 5 and 6 is discharged through the corresponding discharge nozzles 16. The combustion air discharged through the discharge nozzles 16 moves toward the mixed gas jet ports 14.

[0032] As shown in Fig. 2, discharge nozzles 17 through which the combustion air is discharged are formed between the gas duct 3 and the burner tile 13 as viewed in a horizontal plane. The discharge nozzles 17 are openings in the form of slits defined by end portions of the gas duct 3 and the burner tile 13, and are provided for the corresponding air chambers 7 and 8. The combustion air in the left air chamber 7 is discharged through one of the discharge nozzles 17, and then moves toward one of the mixed gas jet ports 14. The combustion air in the right air chamber 8 is discharged through the other of the discharge nozzles 17, and then moves toward the other of the mixed gas jet ports 14.

[0033] Two discharge nozzles 18 through which the combustible gas is discharged are formed between the gas duct 3 and the branching post 15 as viewed in a horizontal plane. The discharge nozzles 18 are openings in the form of slits defined by end portions of the gas duct 3 and parts of the branching post 15, and discharge the combustible gas to the mixed gas jet ports 14 there-through. The discharge nozzles 18 are positioned be-

tween the discharge nozzles 16 and 17 as viewed in a horizontal plane.

[0034] The operation of the combustion burner 1 will be described next.

[0035] The combustion air having passed through the supply duct 4 enters the wind box 22, and thereafter, moves into the four air chambers 5 to 8 through the openings 10 of the straightening plate 9. The combustion air having reached the upper air chamber 5 and the lower air chamber 6 enters the spaces formed between the branching post 15 and the burner tile 12, and is thereafter discharged through the discharge nozzles 16 to the mixed gas jet ports 14. The combustion air having reached the left air chamber 7 and the right air chamber 8 is discharged through the discharge nozzles 17 to the mixed gas jet ports 14. Meanwhile, the combustible gas is discharged through the discharge nozzles 18 to the mixed gas jet ports 14.

[0036] The combustible gas having been discharged through the discharge nozzles 18 is mixed with the combustion air discharged through each of the discharge nozzles 16 and 17, and is then jetted through the mixed gas jet ports 14 into the combustion chamber 2.

[0037] In the present embodiment, the discharge nozzles 16 and 17 are disposed such that the discharge nozzles 18 are interposed between the discharge nozzles 16 and 17. Accordingly, the combustion air discharged through the discharge nozzles 16 and 17 can be mixed easily with the combustible gas discharged through the discharge nozzles 18. This allows the combustion characteristics of gas to be maintained at a stable level, with the gas being generated in a melting furnace for gasification of a waste product, and changing largely in calorie depending on waste characteristics. Enhanced efficiency in mixing of the combustible gas and the combustion air can enhance the combustion efficiency of the mixed gas in the combustion chamber 2.

[0038] The external surface of the gas duct 3 is in contact with the combustion air supplied through the supply duct 4, so that temperature increase of the gas duct 3 to be caused by the combustible gas can be suppressed. Further, contact between the branching post 15 and the combustion air can suppress temperature increase of the branching post 15 to be caused by the combustible gas. This eliminates the need for the combustion burner 1 to have a particular heat-resistant structure, so that the combustion burner 1 (especially the gas duct 3 and the branching post 15) can be made of metal. The position of the branching post at a tip end portion of the burner allows a temperature to be maintained at an appropriate degree (from 300 °C to 350 °C), thereby preventing dust blockage to be generated by the condensation of tar contained in generated gas.

[Second Embodiment]

[0039] A combustion burner being a second embodiment of the present invention will be described by using Figs.

6 to 9. Fig. 6 is a horizontal sectional view of the combustion burner attached to a combustion chamber. Fig. 7 is a vertical sectional view of the combustion burner. Fig. 8 shows the combustion burner as viewed in a direction indicated by an arrow B of Fig. 6. Fig. 9 is a sectional view taken along C-C of Fig. 6. Members having the same functions as those of the members described in the first embodiment are identified by the same reference numerals. The description below is intended mainly for differences from the first embodiment.

[0040] A combustion burner 1 of the present embodiment is circular in cross section perpendicular to a longitudinal direction as shown in Fig. 8. To be specific, a gas duct 3 and a wind box 22 constructing the combustion burner 1 have cylindrical shapes, and the wind box 22 is disposed to be concentric with the gas duct 3. A flow path along which combustion air moves is formed by the outer circumference of the gas duct 3 and the inner circumference of the wind box 22.

[0041] Like in the first embodiment, a straightening plate 9 is disposed in the wind box 22, and the straightening plate 9 is formed into an annular shape as shown in Fig. 9. Four air chambers 5 to 8 are provided downstream of the flow path of the combustion air with respect to the straightening plate 9. The four air chambers 5 to 8 are separated from each other by the wind box 22, and are disposed in juxtaposition in the circumferential direction of the wind box 22. The upper air chamber 5 forms an air flow path positioned above the gas duct 3. The lower air chamber 6 forms an air flow path positioned below the gas duct 3. The left air chamber 7 forms an air flow path positioned on the left side of the gas duct 3 when the combustion burner 1 is viewed from inside a combustion chamber 2. The right air chamber 8 forms an air flow path positioned on the right side of the gas duct 3.

[0042] The straightening plate 9 has a plurality of openings 10, and the plurality of openings 10 are disposed in juxtaposition in the circumferential direction of the wind box 22 as shown in Fig. 9. Accordingly, the combustion air supplied through the supply duct 4 passes through the openings 10 to move into each of the air chambers 5 to 8. The air chambers 5 to 8 have the same number of openings 10. The flow rate of the combustion air guided into each of the air chambers 5 to 8 depends on the sectional area of the openings 10. The numbers of openings 10 may be changed depending on the air chambers 5 to 8.

[0043] A vertically extending branching post 15 in the form of a cylinder is disposed in the gas duct 3. The branching post 15 disposed in the gas duct 3 divides the flow path of combustible gas into two as viewed in a horizontal plane as shown in Fig. 6. The branching post 15 of the present embodiment is cylindrical in cross section perpendicular to the longitudinal direction thereof. However, this is not the only shape of the cross section of the branching post 15. The cross section of the branching post 15 may arbitrarily be determined as long as the flow path of the combustible gas is divided by the branching post 15 vertically extending in the gas duct 3.

[0044] As shown in Fig. 7, the upper end portion of the branching post 15 is connected to the upper air chamber 5 (gas duct 3 and the wind box 22). The combustion air in the upper air chamber 5 is guided into the branching post 15. The lower end portion of the branching post 15 is connected to the lower air chamber 6 (gas duct 3 and the wind box 22). The combustion air in the lower air chamber 6 is guided into the branching post 15. The branching post 15 may be made, for example, of metal.

[0045] The branching post 15 has four discharge nozzles 16 through which the combustion air is discharged. Two of the discharge nozzles 16 are disposed in juxtaposition in the circumferential direction of the branching post 15 (in other words, in a horizontal plane). The discharge nozzles 16 in pairs are disposed in juxtaposition at upper and lower parts of the branching post 15 (namely, in a vertical direction) (see Fig. 8). The discharge nozzles 16 are configured as openings in the form of slits extending vertically as shown in Fig. 8. The shape or the number of the discharge nozzles 16 may arbitrarily be determined as long as the discharge nozzles 16 allow discharge of the combustion air in the branching post 15.

[0046] The two discharge nozzles 16 disposed in juxtaposition as viewed in a horizontal plane are provided in a region of the branching post 15 closer to an end portion 1a of the combustion burner 1. The combustion air guided into the branching post 15 is discharged through the four discharge nozzles 16 to the outside of the branching post 15. The combustion air discharged through each of the discharge nozzles 16 moves toward mixed gas jet ports 14.

[0047] A burner tile 13 extending along the outer circumference of the wind box 22 is disposed at the end portion 1a of the combustion burner 1 (see Fig. 8). Two discharge nozzles 17 through which the combustion air in the corresponding air chambers 7 and 8 is discharged are provided between the gas duct 3 and the burner tile 13. The discharge nozzles 17 are constructed of parts of the gas duct 3 that extend vertically as shown in Fig. 8.

[0048] Discharge nozzles 18 through which the combustible gas is discharged are formed between the gas duct 3 and the branching post 15 as viewed in a horizontal plane. The discharge nozzles 18 are openings in the form of slits configured by parts of the branching post 15 and end portions of the gas duct 3. The discharge nozzles 18 are positioned between the discharge nozzles 17 and the discharge nozzles 16 as viewed in a horizontal plane.

[0049] The operation of the combustion burner 1 of the present embodiment will be described next.

[0050] The combustion air having passed through the supply duct 4 enters the wind box 22, and thereafter, moves into the four air chambers 5 to 8 through the openings 10 of the straightening plate 9. The combustion air having reached the upper air chamber 5 and the lower air chamber 6 is guided into the branching post 15, and is thereafter discharged through the discharge nozzles 16. The combustion air having reached the left air chamber 7 and the right air chamber 8 is discharged through

the discharge nozzles 17.

[0051] The combustible gas discharged through the discharge nozzles 18 is mixed with the combustion air discharged through each of the discharge nozzles 16 and 17, and is thereafter jetted through the mixed gas jet ports 14 into the combustion chamber 2.

[0052] In the present embodiment, the discharge nozzles 16 and 17 are disposed such that the discharge nozzles 18 are positioned between the discharge nozzles 16 and 17. Accordingly, the combustion air discharged through the discharge nozzles 16 and 17 can be mixed easily with the combustible gas discharged through the discharge nozzles 18. Enhanced efficiency in mixing of the combustible gas and the combustion air can enhance the combustion efficiency of the mixed gas in the combustion chamber 2.

[0053] The external surface of the gas duct 3 is allowed to be in contact with the combustion air lower in temperature than the combustible gas, so that temperature increase of the gas duct 3 to be caused by the combustible gas can be suppressed. Further, contact between the inner circumference of the branching post 15 and the combustion air can suppress temperature increase of the branching post 15 to be caused by the combustible gas. This eliminates the need for the combustion burner 1 to have a particular heat-resistant structure, so that the combustion burner 1 (especially the gas duct 3 and the branching post 15) can be made of metal.

[Third Embodiment]

[0054] A combustion burner being a third embodiment of the invention will be described by using Fig. 10. Fig. 10 is a horizontal sectional view of a combustion burner attached to a combustion chamber. In the present embodiment, members having the same functions as those of the members described in the first embodiment are identified by the same reference numerals, and are not particularly described. The description below is intended mainly for differences from the first embodiment.

[0055] In the present embodiment, a burner tile 13 disposed along the outer-edge of a combustion burner 1 (wind box 22), and three vertically extending burner tiles 12 connected to the burner tile 13 are disposed at an end portion 1a of the combustion burner 1. As a result, four mixed gas jet ports 14 are formed at the end portion 1a of the combustion burner 1.

[0056] Branching posts 15 are disposed upstream of the flow path of combustible gas with respect to the corresponding ones of the burner tiles 12. Further, like in the first embodiment, combustion air from the upper air chamber 5 and the lower air chamber 6 is guided into spaces formed between the branching posts 15 and the burner tiles 12, and is then discharged through discharge nozzles 16 to the mixed gas jet ports 14. Discharge nozzles 17 through which the combustion air from the right air chamber 7 and the left air chamber 8 is discharged are provided between the gas duct 3 and the burner tile

13.

[0057] In the combustion burner 1 of the present embodiment, the three branching posts 15 divide the flow path of the combustible gas into four flow paths R1 to R4.

[0058] The combustible gas guided into the respective branched flow paths R1 and R4 passes through corresponding discharge nozzles 18. These discharge nozzles 18 are positioned between the discharge nozzles 17 and 16. Accordingly, the combustible gas discharged through these discharge nozzles 18 is mixed with the combustion air discharged through the discharge nozzles 17 and 16, and is then jetted through the mixed gas jet ports 14 into the combustion chamber 2.

[0059] The combustible gas guided into the respective branched flow paths R2 and R3 passes through corresponding discharge nozzles 18. These discharge nozzles 18 are positioned between two of the discharge nozzles 16. Accordingly, the combustible gas discharged through these discharge nozzles 18 is mixed with the combustion air discharged through the discharge nozzles 16, and is then jetted through the mixed gas jet ports 14 into the combustion chamber 2.

[0060] The present embodiment achieves the same effect as that of the first embodiment. In addition, a larger number of mixed gas jet ports 14 of the present embodiment makes it possible to mix the combustible gas and the combustion air more easily than in the first embodiment. The number of mixed gas jet ports 14 in the combustion burner 1, namely the number of branching posts 15 may arbitrarily be determined, for example, on the basis of the size of the combustion burner 1. Air can be supplied easily to the branching posts 15 by dividing the upper air chamber 5 and the lower air chamber 6 shown in Fig. 3 into a number corresponding to the number of branching posts 15.

[0061] The present embodiment includes a plurality of the branching posts 15 described in the first embodiment. The present embodiment may also include a plurality of the branching posts 15 described in the second embodiment.

DESCRIPTION OF REFERENCE NUMERALS

[0062]

- 1: combustion burner
- 2: combustion chamber
- 3: gas duct
- 4: supply duct
- 5: upper air chamber (air duct)
- 6: lower air chamber (air duct)
- 7: left air chamber (air duct)
- 8: right air chamber (air duct)
- 9: straightening plate
- 10: opening
- 12, 13: burner tile
- 14: mixed gas jet port
- 15: branching post

- 16, 17, 18: discharge nozzle
- 22: wind box (air duct)

5 Claims

1. A combustion burner configured to mix combustible gas generated by gasification of a waste product and combustion air together, and supply the combustible gas and the combustion air to a combustion chamber, the combustion burner comprising:

a gas duct forming a gas flow path along which the combustible gas moves;

an air duct disposed along an external surface of the gas duct, the air duct forming an air flow path along which the combustion air taken in from outside moves, the air flow path being formed between the air duct and the gas duct; and

a branching post connected to the gas duct in the gas flow path, the branching post discharging the combustible gas from the gas duct while dividing the gas flow path into a plurality of flow paths, wherein

the combustion air in the air flow path is guided to the branching post, and is discharged from the branching post toward the branched flow paths of the combustible gas, and is also discharged from the gas duct toward the branched flow paths of the combustible gas.

2. The combustion burner according to claim 1, wherein the branched flow paths of the combustible gas are positioned between portions of the gas duct through which the combustion air is discharged and portions of the branching post through which the combustion air is discharged.

3. The combustion burner according to claim 1 or 2, further comprising a straightening plate disposed in the air flow path and having an opening that controls an amount of the combustion air passing through the opening.

4. The combustion burner according to claim 3, wherein the air flow path has a region defined downstream of the combustion air with respect to the straightening plate, the region being constructed of an upper air chamber, a lower air chamber, a left air chamber, and a right air chamber separated from each other and positioned above and below the gas flow path, and on the left and right sides of the gas flow path, respectively, the combustion air in the upper air chamber and the lower air chamber is guided to the branching post, and the combustion air in the left air chamber and the

right air chamber is discharged from end portions of the gas duct toward the branched flow paths of the combustible gas.

5. The combustion burner according to any one of claims 1 to 4, wherein the branching post includes a plurality of branching posts, and the branching posts are disposed such that the branching posts each extending vertically are disposed in juxtaposition as viewed in a horizontal plane. 5
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6. The combustion burner according to any one of claims 1 to 5, further comprising a burner tile disposed along the branching post, and wherein a space through which the combustion air moves, and a slit through which the combustion air is discharged toward the branched flow paths of the combustible gas are formed between the branching post and the burner tile. 15
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7. The combustion burner according to any one of claims 1 to 6, wherein the gas duct is circular in cross section perpendicular to a direction in which the combustible gas moves. 25
8. A combustion chamber comprising the combustion burner according to any one of claims 1 to 7, and allowing the combustible gas and the combustion air supplied from the combustion burner to be burned therein. 30

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FIG.1

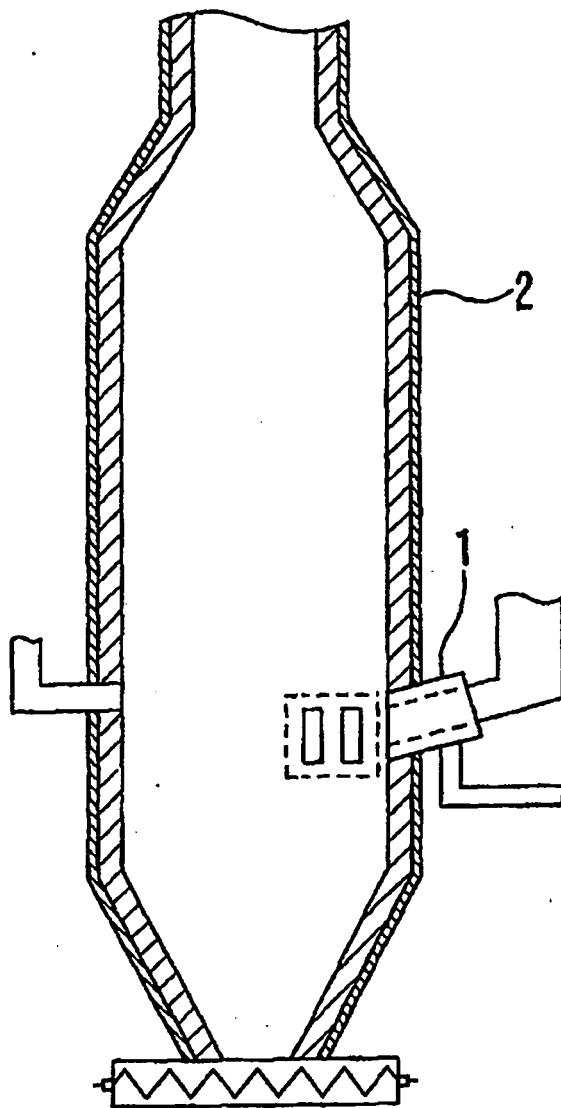


FIG.2

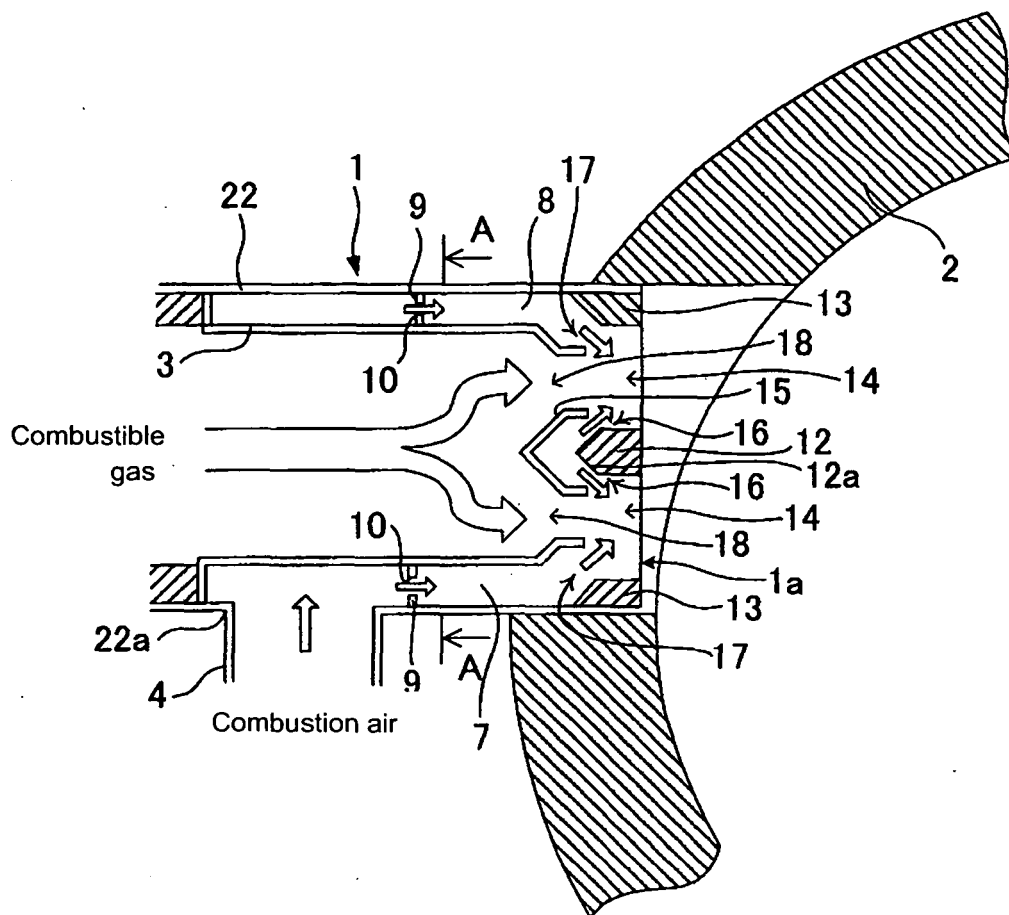


FIG.3

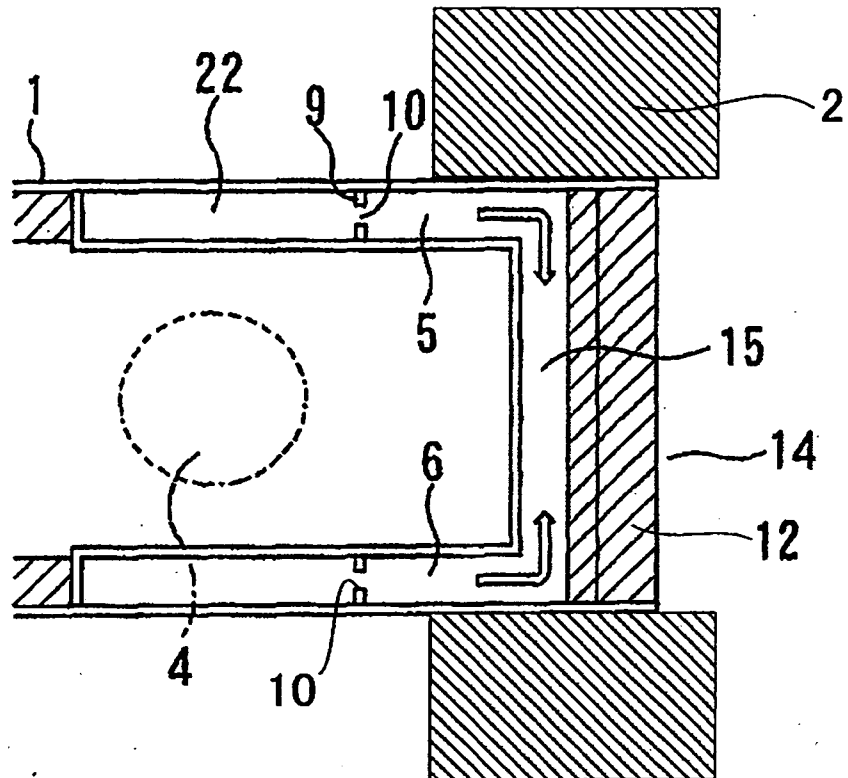


FIG.4

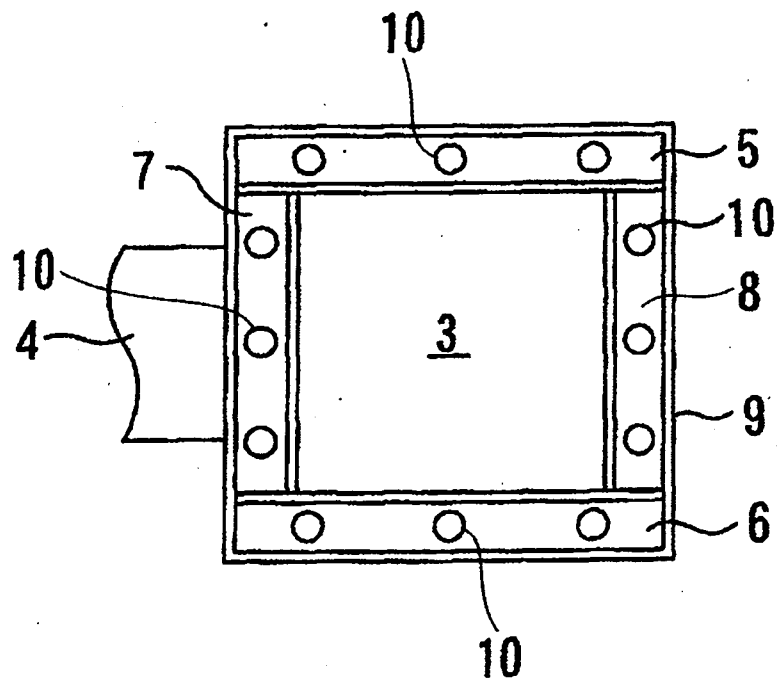


FIG.5

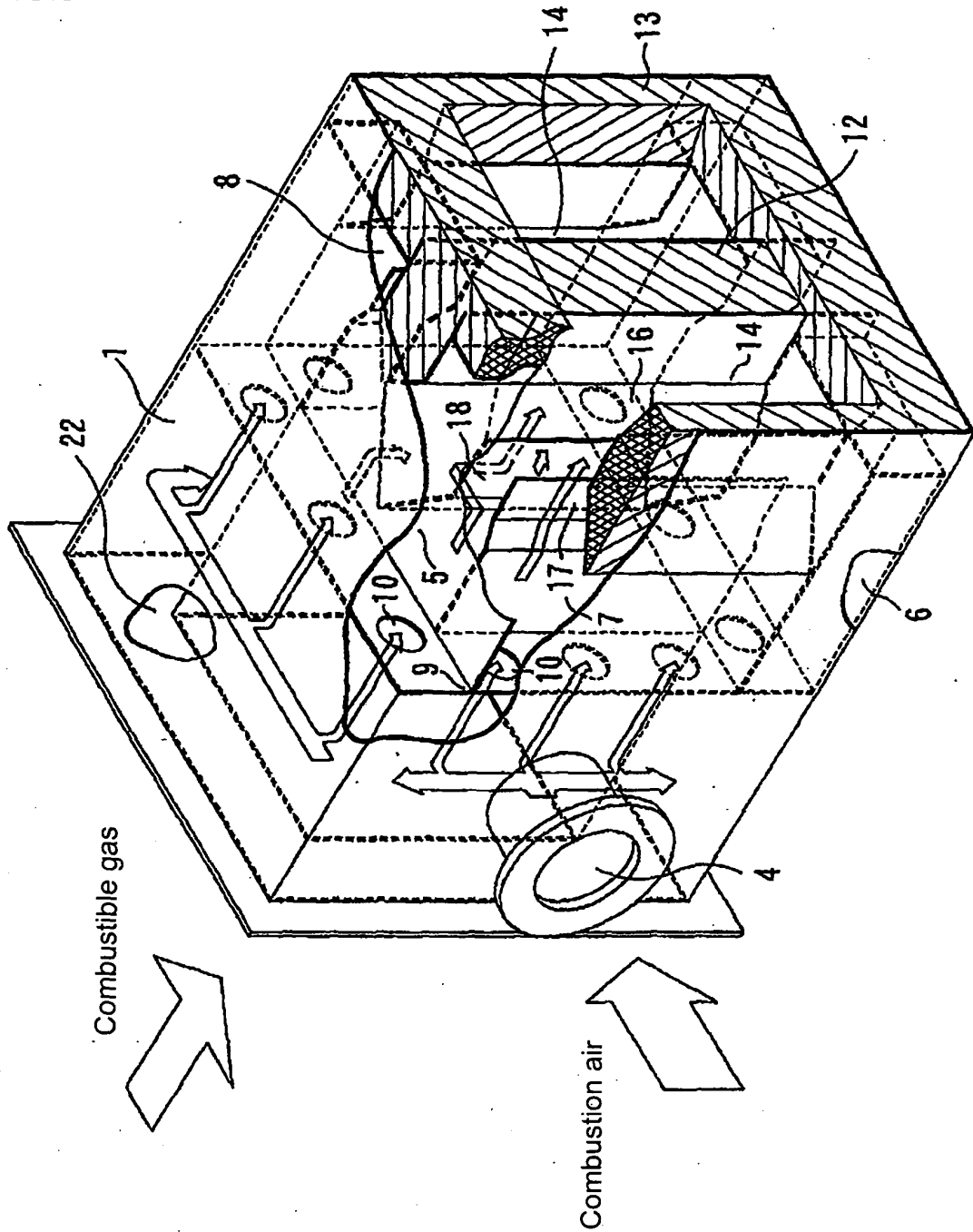


FIG.6

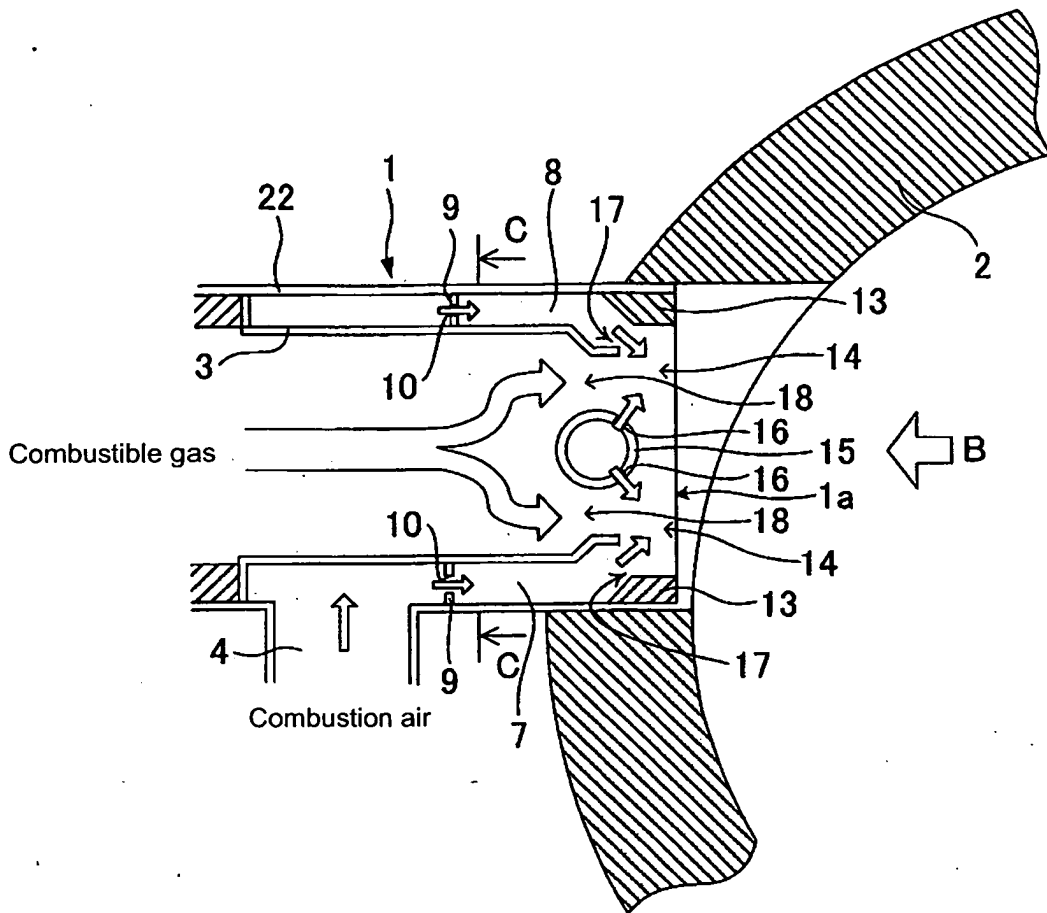


FIG.7

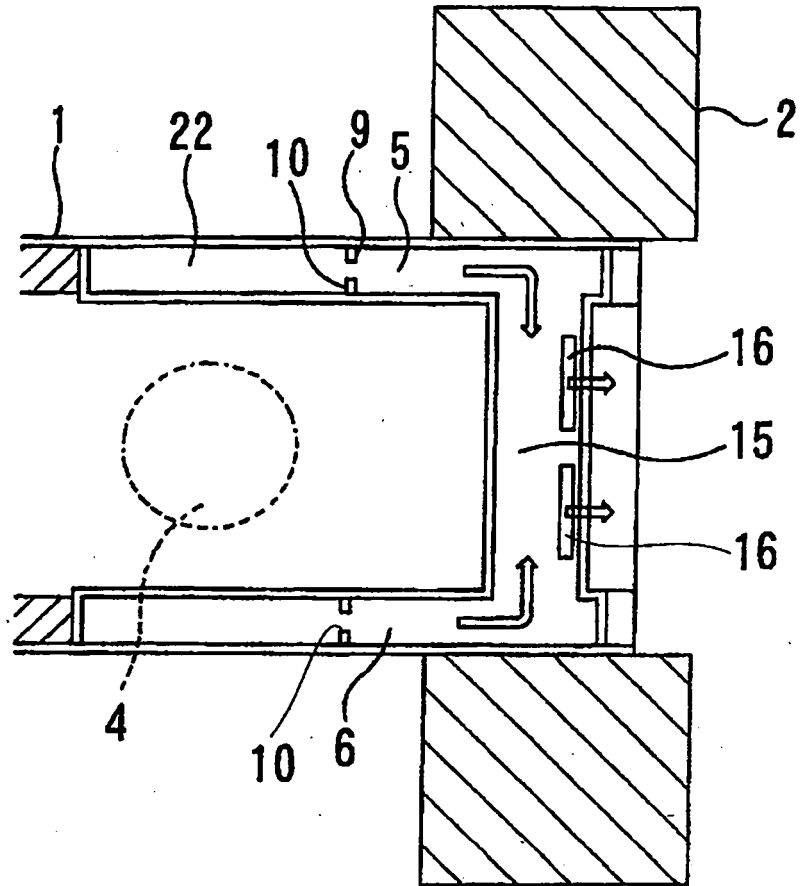


FIG.8

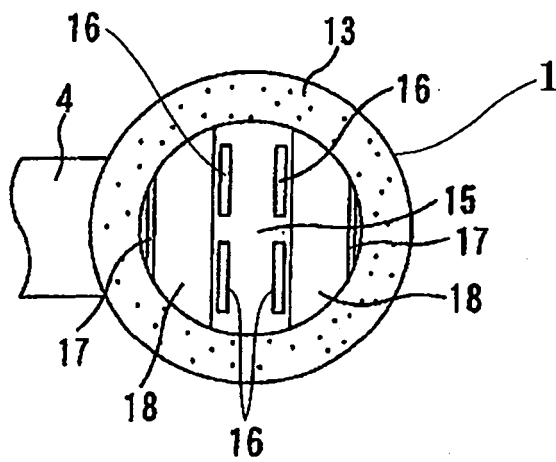


FIG.9

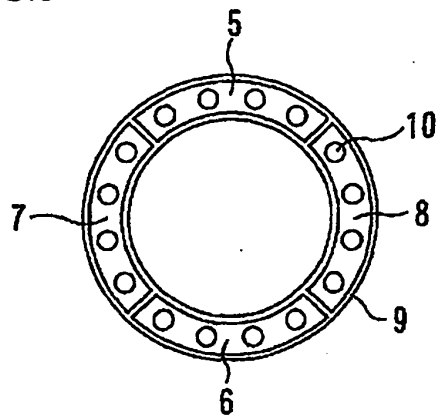


FIG.10

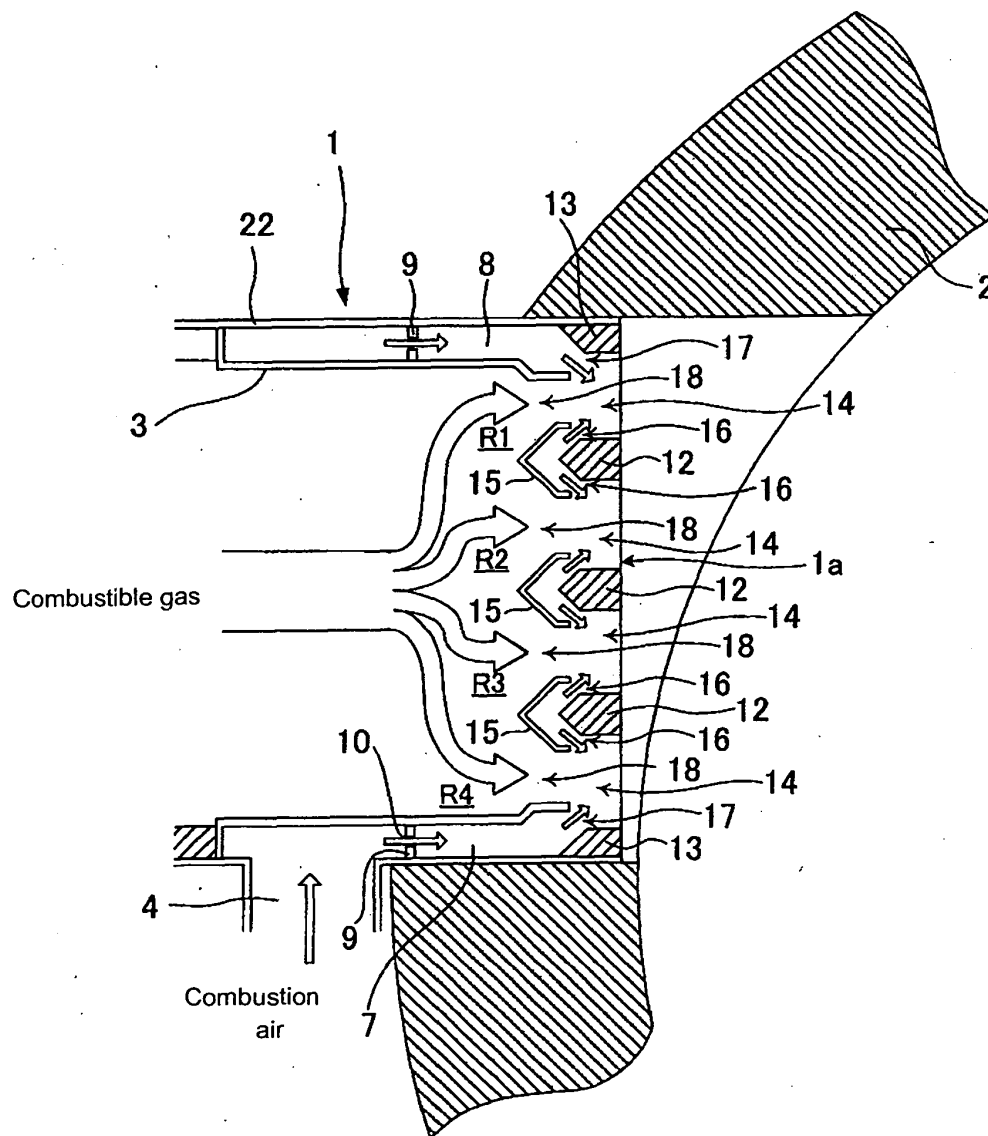


FIG.11

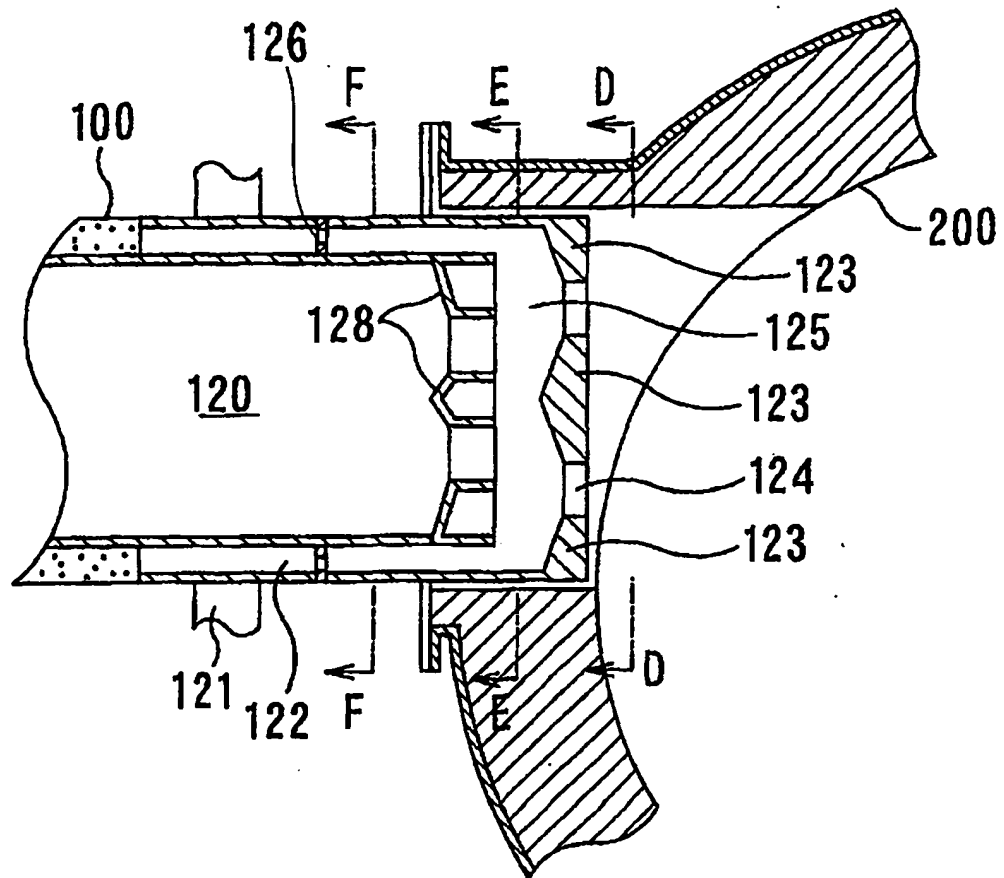


FIG.12A

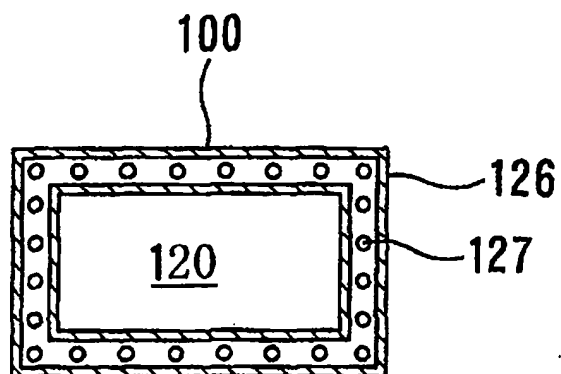


FIG.12B

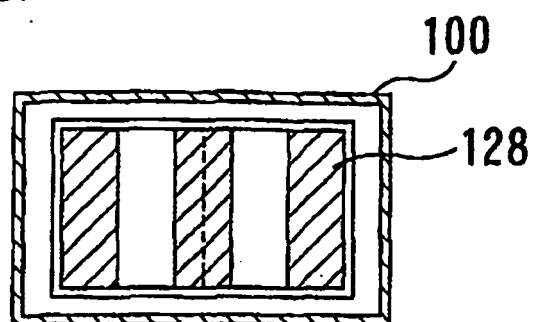
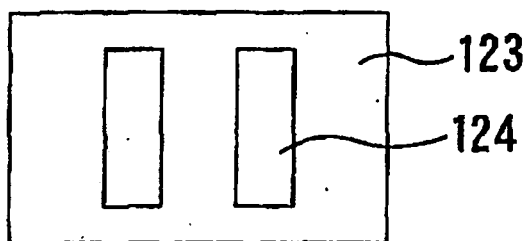


FIG.12C



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2009/002944

A. CLASSIFICATION OF SUBJECT MATTER

F23G7/06 (2006.01) i, F23D14/02 (2006.01) i, F23G5/027 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F23G7/06, F23D14/02, F23G5/027

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2009
Kokai Jitsuyo Shinan Koho	1971-2009	Toroku Jitsuyo Shinan Koho	1994-2009

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2008-116077 A (Takuma Co., Ltd.), 22 May, 2008 (22.05.08), Par. Nos. [0015] to [0030]; Fig. 1 (Family: none)	1, 3, 6-8 2, 4, 5
Y A	JP 10-339406 A (Osaka Gas Co., Ltd.), 22 December, 1998 (22.12.98), Par. Nos. [0005] to [0007]; Figs. 1 to 3 (Family: none)	1, 3, 6-8 2, 4, 5

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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Date of the actual completion of the international search
01 September, 2009 (01.09.09)Date of mailing of the international search report
08 September, 2009 (08.09.09)Name and mailing address of the ISA/
Japanese Patent Office

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Patent documents cited in the description

- JP 2006266619 A [0007]