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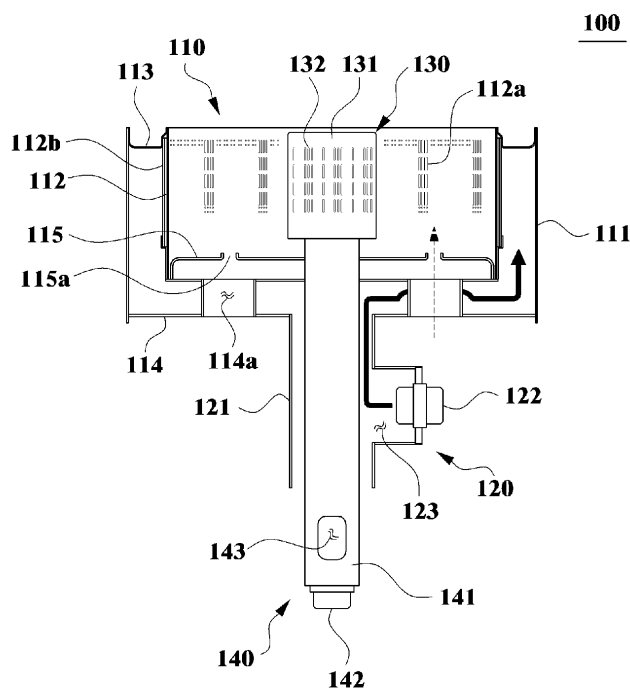
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(54) INNER AND OUTER FLAME COMPOUND TYPE MULTISTAGE BURNER

(57) The present invention relates to an inner and outer frame compound type multistage burner using an outer burner and an inner burner arranged in a center of the inside of the outer burner, and in particular, to an inner and outer frame compound type multistage burner which improves a turn-down ratio and a proportional con-

control characteristic and enables safe ignition and complete combustion by providing a compound flame using the inner flame generated from the outer burner to the inside and the outer flame generated from the inner burner to the outside.

[Fig. 2]



Description

[Technical Field]

[0001] The present invention relates to an inner and outer frame compound type multistage burner using an outer burner and an inner burner arranged in a center of the inside of the outer burner, and more particularly, to an inner and outer frame compound type multistage burner which improves a turn-down ratio and a proportional control characteristic and enables safe ignition and complete combustion by providing a compound flame using the inner flame generated from the outer burner to the inside and the outer flame generated from the inner burner to the outside.

[Background Art]

[0002] In general, the burners used in gas boilers are classified into a cylindrical burner and a planar burner. The cylindrical burner disclosed in Korean patent NO. 681345 realizes stable heat absorbing distribution to optimize and stabilize the combustion

[0003] Meanwhile, TDR (Turn-Down Ratio) of such a gas boiler is set according to a heating load required for a commercial boiler. The turn-down ratio is 'a ratio of the maximum amount of consumed gas to the minimum amount of consumed consumption' of a gas burner in which an amount of gas is variably controlled.

[0004] For example, when the maximum amount of consumed gas is 30,000 kcal/h and the minimum amount of consumed gas is 6,000 kcal/h, the TDR is 5:1. The TDR is limited according to how much the minimum amount of consumed gas for maintaining a stable flame is reduced.

[0005] In case of a gas boiler, as the TDR is larger, it is more convenient to control the gas boiler. That is, although the combustion is performed at the maximum fire-power at the early stage of combustion to reach the target heating temperature during a short time, the combustion is performed by gradually reducing the amount of gas supplied to the burner as the temperature approaches to the target heating temperature.

[0006] Thus, according to a combustion apparatus including a multistage structure cylindrical burner of Korean patent NO. 851226, a gas boiler having a cylindrical burner includes a distribution plate formed in a multistage structure to uniformly distribute mixed gas into combustion chambers, and independently provides the mixed gas to the distribution plate of the multistage structure. Therefore, the gas boiler proposes a technique of improving the TDR of the burner.

[0007] However, although the boiler according to the related art includes the boiler having the distribution plate of the multistage structure, since the TDR of the boiler is increased by using a single burner, it is essentially limited to increase the TDR and it is difficult to perform a precise proportional control.

[0008] That is, since there is a limitation in providing the minimum amount of consumed gas and the maximum amount of consumed gas, it is essentially limited to increase the TDR by using a single burner. In addition, it is difficult to perform a precise proportional control through a scheme of independently controlling a mixer connected to the single distribution plate having a multistage structure.

[0009] Further, since fuel gas is supplied to the single burner and is ignited to be burned, as in the related art, a problem of incomplete combustion continuously exists so that ignition burst due to the abrupt combustion continuously exists.

[Disclosure]

[Technical Problem]

[0010] To solve the problems described above, the present invention provides an inner and outer frame compound type multistage burner having an outer burner and an inner burner which can improve a turn-down ratio and a proportional control characteristic and enable safe ignition and complete combustion by providing a compound flame using the inner flame generated from the outer burner to the inside and the outer flame generated from the inner burner to the outside.

[Technical Solution]

[0011] In order to accomplish the objects, according to the present invention, there is provided an inner and outer frame compound type multistage burner. The inner and outer frame compound type multistage burner includes: an outer burner disposed at an outside to generate a flame toward an inside; a first fuel supply to mix primary air with a fuel to supply the mixed primary air and fuel to the outer burner; an inner burner disposed at an inner central portion of the outer burner to generate a flame toward the outside; a second fuel supply to mix primary air and a fuel to supply the mixed primary air and fuel to the inner burner; and an ignition apparatus to ignite the supplied fuel.

[0012] In this case, the outer burner includes: an outer wall having a cylindrical shape with opened upper and lower portions; an inner wall having a diameter less than a diameter of the outer wall and a cylindrical shape, the inner wall being spaced apart from an inside of the outer wall by a predetermined interval and having a plurality of inner flame holes to generate a flame toward the inside, wherein the inner burner is disposed at an inside central portion; an upper plate covering a space formed between an upper end of the outer wall and an upper end of the inner wall; and a lower finishing plate covering an entire lower end of the outer burner, the lower finishing plate being formed at a center thereof with an installation hole through which a second fuel supply connected to the inner burner is installed, a secondary air hole being formed

around the installation hole to supply secondary air for supplementing combustion between the inner and outer burners.

[0013] In addition, preferably, the inner and outer frame compound type multistage burner further includes an air dispersion plate installed over the lower finishing plate and spaced apart from the lower finishing plate by a predetermined distance, wherein the air dispersion plate has a plurality of air dispersion holes which disperse air raised after the air passes through the secondary air hole.

[0014] In addition, preferably, the inner burner includes: a burner body disposed at an inner central portion of the inner wall, the burner body having a closed upper portion, a lower portion connected to the second fuel supply, and a flowing path formed therein; and a plurality of outer flame holes formed on a side surface of the burner body to belch a flame toward the outside facing the outer burner.

[0015] In addition, preferably, the first fuel supply is connected to a side portion of the outer burner, and the second fuel supply is connected to the inner burner through a lower portion of the outer burner.

[0016] In addition, preferably, the first fuel supply is connected to a lower portion of the outer burner, and the second fuel supply is connected to the inner burner by passing through the first fuel supply.

[0017] In addition, preferably, the ignition apparatus is installed in a combustion chamber between the inner and outer burners to ignite one of the inner burner and the outer burner.

[0018] In addition, preferably, the inner and outer frame compound type multistage burner further includes a control unit controlling the first and second fuel supplies, wherein the control unit independently controls the first and second fuel supplies, such that fuel is supplied through one of the first and second fuel supplies or all of the first and second fuel supplies.

[0019] In addition, preferably, the control unit controls an amount of fuel (TDR: Turn-Down Ratio) supplied through the first and second fuel supplies.

[0020] In addition, preferably, the control unit controls to supply fuel through the first fuel supply after the fuel is supplied through the second fuel supply so that the outer burner is ignited by using a flame generated from the inner burner as the ignition apparatus is operated.

[0021] In addition, preferably, the ignition apparatus is installed closely to the inner burner in order to ignite only the inner burner and the outer burner is ignited by using an outer flame generated from the inner burner upon ignition.

[Advantageous Effects]

[0022] As described above, according to the inner and outer frame compound type multistage burner including an outer burner and an inner burner which is capable of providing a compound flame using the inner flame generated from the outer burner to the inside and the outer

flame generated from the inner burner to the outside.

[0023] Therefore, the minimum thermal power (the minimum amount of gas consumption) can be more reduced and the maximum thermal power (the maximum amount of gas consumption) can be more increased so that the turn down ratio is increased, and in addition, the proportional control can be easily performed by selectively operating the inner and outer burners. Further, the inner and outer flames are contributed to the burning actions for each other so that the complete combustion can be achieved. In addition, after the inner burner of a small capacity is first ignited, the outer burner of a large capacity is then ignited through the inner burner so that ignition burst can be prevented.

[Description of Drawings]

[0024]

FIG. 1 is a perspective view showing an inner and outer frame compound type multistage burner according to the first embodiment of the present invention.

FIG. 2 is a sectional view showing an inner and outer frame compound type multistage burner according to the first embodiment of the present invention.

FIG. 3 is a sectional view showing an inner and outer frame compound type multistage burner according to the second embodiment of the present invention.

FIG. 4 is a sectional view showing an inner and outer frame compound type multistage burner according to the third embodiment of the present invention.

FIG. 5 is a sectional view showing an inner and outer frame compound type multistage burner according to the fourth embodiment of the present invention.

[Best Mode]

[Mode for Invention]

[0025] Hereinafter, an inner and outer frame compound type multistage burner according to a preferable embodiment of the present invention will be described in detail with reference to accompanying drawing.

[0026] As shown in FIGS. 1 and 2, an inner and outer frame compound type multistage burner 100 according to the present invention includes an outer burner 110 for generating a flame toward an inside thereof, a first fuel supply 120 for supplying a mixed gas which serves as a fuel to the outer burner 110, an inner burner 130 disposed at an inner central portion of the outer burner 110 for generating a flame toward an outside thereof, and a second fuel supply 140 for supplying the mixed gas as the fuel to the inner burner 130.

[0027] Further, an ignition apparatus (not shown) is included for igniting the mixed gas supplied from the first or second fuel supply 120 or 140 as described above. When the outer burner 110 is ignited by the ignition ap-

paratus, the outer burner 110 generates an 'inner flame' which is toward to the inside and the inner burner 130 generates an 'outer flame' which is toward the outside.

[0028] The definition of the 'inner flame' and the 'outer flame' is based on an initial forwarding direction of the flame when the mixed gas is burned. It is obvious that the inner and outer flames are raised after starting to be belched.

[0029] Further, a control unit 150 is included for controlling the ignitions of the inner and outer burners 130 and 110, whether the mixed gas is supplied, and an amount of mixed gas to be supplied. The control unit 150 may adaptively control the inner and outer flame compound type multistage burner 100 of the present invention according to a load.

[0030] In more detail, the outer burner 110 is disposed at an outside of the burner formed in a multistage and has a relative large output power as compared with the inner burner 130. The outer burner 110 belches the inner flame toward the inner burner 130.

[0031] The outer burner 110 includes an outer wall 111 having opened upper and lower portions and a cylindrical shape, an inner wall 112 spaced apart from the outer wall 111 in an inside direction by a predetermined distance, an upper end plate 113 interposed between upper ends of the outer wall 111 and the inner wall 112, and a lower finishing plate 114 covering an entire lower end of the outer burner 110.

[0032] Since the inner wall 112 is formed in a cylindrical shape having a diameter less than that of the outer wall 111, a space in which the mixed gas provided from the first fuel supply 120 flows is formed between the inner and outer walls 112 and 111.

[0033] It is preferable to scatter more uniformly the mixed gas supplied through the flowing path between the outer and inner walls 111 and 112 by sequentially stacking a mesh and a perforated plate 112b of FIG. 2 on an outer surface of the inner wall 112.

[0034] Since a plurality of small holes are formed at the mesh and a plurality of through-holes are formed at the perforated plate, the perforated plate may be used to fix the mesh. The mesh and the perforated plate are described in more detail in Korean patent NO. 681345 applied by the applicant of the present invention.

[0035] The upper end plate 113 is fixed to seal a gap formed between upper end portions of the outer and inner walls 111 and 112 and a mounting groove having a predetermined depth is formed on the upper end plate 113. Thus, the upper end plate 113 serves as a support into which a heat exchanger having a cylindrical shape is directly inserted. Accordingly, a heat source feeder or a heat exchanger mounting structure is not unnecessary, so a structure of a boiler is simplified.

[0036] The lower finishing plate 114 is configured to close the entire lower end of the outer burner 110 as well as a gap between the lower ends of the outer and inner walls 111 and 112 and an installation hole H is formed at the central portion of the lower finishing plate 114. Sec-

ondary air holes 114a are formed around the installation hole H along the periphery of the installation hole H.

[0037] The second fuel supply 140 passes through the installation hole H to be connected to the inner burner 130. Secondary air for supplementing combustion may be supplied between the inner and outer burners 130 and 110 through the secondary air holes 114a.

[0038] By supplying a proper amount of the secondary air necessary to completely burn the mixed gas (gas + primary air for a fuel) serving as a fuel, the complete combustion is supplemented. The secondary air reaches the combustion chamber between the inner and outer burners 130 and 140 after the secondary air rises through the secondary air holes 114a.

[0039] The reason that the lower finishing plate 114 is configured to close the entire lower end of the outer burner 110 is because it is preferable that a proper amount of secondary air is supplied only through the secondary air holes 114a and the second fuel supply 140 is installed through the installation hole H. If not taking consideration into this regard, any other structures may be employed.

[0040] Further, an air scattering plate 115 having a plurality of air scattering holes 115a is installed over the lower finishing plate 114 so that the air rising through the secondary air holes 114a is more scattered through the air scattering holes 115a, so air may be uniformly supplied to the entire combustion chamber.

[0041] To this end, the number of air scattering holes 115a is greater than that of the secondary air holes 114a and sizes of each air scattering hole 115a is formed to be relatively smaller than those of the secondary air holes 114a.

[0042] The first fuel supply 120 supplies the mixed gas of the primary air and the gas for the fuel to the outer burner 110. For example, the first fuel supply 120 includes a first venturi tube 121, a first nozzle coupled to the first venture tube 121 and a first air hole 123 passing through a side of the first venture tube 121.

[0043] The first venturi tube 121 is connected to a lower portion (that is, lower surface) of the outer burner 110 and an opened end of the first venturi tube 121 communicates with a flow path which is empty between the outer and inner walls 111 and 112.

[0044] Therefore, as designated as an arrow (full line) in FIG. 2, after the mixed gas supplied through a lower portion of the outer burner 110 flows to a side of the outer burner 110, the mixed gas sequentially passes through the perforated plate, the mesh and the inner flame holes 112a to be exhausted. Since the secondary air holes 114a are formed at a portion of the lower finishing plate 114, the mixed gas flows to an upper side through the remaining portion in which no secondary air hole 114a is formed.

[0045] The first nozzle 122 is installed in a branch pipe provided at a side of the first venturi tube 121 to supply a gas. The first air hole 123 extends through the branch pipe so that the primary air for fuel flows therein, so the mixed gas generated by mixing the primary air and a gas

is supplied to the outer burner 110.

[0046] The inner burner 130 is disposed at an inner central portion of the outer burner 110 (exactly, an inner central portion of the inner wall 112), so that the outer flame is generated toward an outside facing the outer burner 110. The inner burner 130 includes a body 131 and an outer flame hole 132 formed on the side surface of the body 131.

[0047] For example, as depicted in the drawings, the body 131 has a hollow cylindrical shape, a closed upper portion and a lower portion connected to the second fuel supply 140. Thus, the mixed gas supplied from the second fuel supply 140 is exhausted through the outer flame holes 132 after passing through the flowing path in the body 131.

[0048] The mixed gas is uniformly supplied on the whole through the outer flame holes 132 along a circumferential direction of the body 131. Since the inner burner 130 is relatively smaller than the outer burner 110, the number of the outer flame holes 132 formed on the body 131 is less than that of the inner flame holes 112a of the outer burner 110. Thus, the inner burner 130 having an output (capacity or amount of flame belch) less than that of the outer burner 110 may be used.

[0049] The second fuel supply 140 supplies the mixed gas of the primary air and the gas for fuel to the inner burner 130. For example, the second fuel supply 140 includes a second venturi tube 141, a second nozzle 142 coupled to the second venturi tube 141 and a second air hole 143 formed to pass through a side of the second venturi tube 141.

[0050] The second venturi tube 141 is installed through a lower portion (that is, lower surface) of the outer burner 110 and an opened end of the second venturi tube 141 is connected to the body 131 of the inner burner 130, so that the mixed gas is supplied to the inner burner 130.

[0051] Specifically, since the second venturi tube 141 has a diameter less than that of the first venturi tube 121, the second venturi tube 141 is connected to the inner burner 130 while being inserted into the first venturi tube 121. As described above, if the first and second venturi tubes 121 and 141 are implemented with double pipes, the size of the burner is more reduced as compared with a case that the first venturi tube 121 is installed at the side of the outer burner 110 and the second venturi tube 141 is installed at the lower portion of the outer burner 110.

[0052] The second nozzle 142 is installed on an end of the second venturi tube 141 to supply a gas. Since the second air hole 143 is formed at the side portion of the second venturi tube 141 so that the primary air is input through the second air hole 143, the mixed gas of the primary air and the gas is supplied to the inner burner 130.

[0053] Although the first and second fuel supplies 120 and 140 including the venturi tubes 121 and 141, the nozzles 122 and 142, and the air holes 123 and 143, respectively, are described above as examples, as generally known in the art, since the fuel supplies may be

implemented in various structures, it is possible to apply any other modifications of the fuel supplies to the present invention except for the fact that the second venturi tube 141 is disposed in the first venturi tube 121.

[0054] For example, even when the first and second air holes 123 and 143 are not separately formed, the mixed gas obtained by preliminarily mixing the primary air and gas may be directly supplied through the first and second nozzles 122 and 142. In addition, instead of installing the first nozzle 122 to the branch pipe of the first venturi tube 121, the first nozzle 122 may be fitted between the inner surface of the first venturi tube 121 and the outer surface of the second venturi tube 141. In this case, the branch pipe may be omitted.

[0055] A scheme of generating a spark by using electric power through an igniter is used for an ignition apparatus (not shown) which ignites the mixed gas discharged through the inner flame hole 112a of the outer burner 110 or the outer flame hole 132 of the inner burner 130 to burn the mixed gas.

[0056] Preferably, such an ignition apparatus is installed in an empty space of a combustion chamber between the outer and inner burners 110 and 130. Although the ignition apparatus is not depicted in the embodiment of the present invention, as generally known in the art, the ignition apparatus is described in detail in various documents including Korean Registered Patent No. 681345.

[0057] The control unit 150, which controls the ignitions of the inner and outer burners 130 and 110, whether the mixed gas is supplied, and an amount of mixed gas to be supplied, may adaptively control the inner and outer flame compound type multistage burner 100 of the present invention according to a capacity of a load.

[0058] For example, the control unit 150 independently controls the first and second fuel supplies 120 and 140, such that fuel is supplied through one of the first and second fuel supplies 120 and 140 or all of the first and second fuel supplies 120 and 140, so the control 150 performs a proportional control according to a capacity of a load.

[0059] Further, the control unit 150 performs a fine control to increase or reduce an amount of fuel supplied through the first and second fuel supplier 120 and 140, thereby controlling the TDRs of the inner and outer burners 130 and 110, individually or entirely.

[0060] Further, the control unit 150 controls the first and second fuel supplies 140 and 120 such that the fuel is supplied through the first fuel supply 120 after the fuel is supplied through the second fuel supply 140. Thus, the control unit 150 may first ignite the inner burner 130 of a small capacity by using the ignition apparatus and then, may ignite the outer burner 110 of a large capacity by using the outer flame uniformly belched from the inner burner 130 in all directions.

[0061] As described above, according to the present invention, one of the outer and inner burners 110 and 130 (preferably the inner burner which has a relatively

smaller capacity than that of the outer burner) is operated by the control unit 150, so that the minimum thermal power (the minimum amount of gas consumption) may be more reduced.

[0062] Further, when a multistage burner including two burners is used by operating all of the outer and inner burners 110 and 130, since both thermal powers of the outer and inner burners 110 and 130 are combined, the maximum thermal power (the maximum amount of gas consumption) may be more increased as compared with the related art.

[0063] That is, according to the inner and outer frame compound type multistage burner of the present invention, the TDR, which is 'a ratio of the maximum amount of gas consumption to the minimum amount of gas consumption', may be increased.

[0064] Further, since the control unit 150 may control the amounts of mixed gas supplied to each of the outer and inner burners 110 and 130 so that it is possible to freely control the TDR of the outer or inner burner 110 or 130, or the TDR of the multistage burner which is constituted by the outer burner 110 and the inner burner 130, the proportional control characteristic may be improved.

[0065] For example, if the ratio of the area of the inner flame hole 112a is 70% and the ratio of the area of the outer flame hole 132 is 30% with respect to the entire flame hole area of 100% (any other ratio of 65% to 35% is also possible), the burner may be operated at the ratio of 70% by using only the outer burner 110, 30% by using only the inner burner 130, or 100% by using all of the outer and inner burners 110 and 130. In this case, if each amount of the mixed gas supplied to the burners 110 and 130 is controlled, it is possible to achieve the precise proportional control while TDR is increased.

[0066] While the entire size of the burner is not changed, the multistage burner may be configured by installing the inner burner 130 in the empty space in the outer burner 110. In addition, since the secondary air is supplied between the outer and inner burners 110 and 130 through the single secondary air hole 114a, the entire size of the burner may be prevented from being increased.

[0067] Further, since the second venturi tube 141 of the second fuel supply 140 is inserted into the first venturi tube 121 of the first fuel supply 120, compared with the case that the first venturi tube 121 is installed at the side of the outer burner 110 and the second venturi tube 141 is installed at the lower portion of the outer burner 110, the entire width of the burner may be prevented from being larger.

[0068] When the inner flame of the outer burner 110 is incompletely burned, complete consumption is achieved through the outer flame of the inner burner 130. To the contrary, when the outer flame of the inner burner 130 is incompletely burned, complete consumption is achieved through the inner flame of the outer burner 110. Thus, the incomplete consumption is substantially prevented.

[0069] Further, since the inner burner 130 of a relatively small capacity is first ignited by using the ignition apparatus and the fuel which is being discharged from the outer burner 110 is ignited with the outer flame which is being uniformly belched from the inner burner 130, an explosion ignition is prevented so that the fuel may be smoothly ignited.

[0070] For this ignition, if the control unit 150 allows the mixed gas to be first supplied to the inner burner 130 and then, to be supplied to the outer burner 110 after a predetermined time is elapsed, the scheme of igniting the inner burner 130 with the outer flame belched by the early consumption of the inner burner 130 may be utilized.

[0071] Of course, although the scheme of igniting the outer burner 110 with the outer flame generated from the inner burner 130 may be utilized by installing the corresponding ignition apparatus near the inner burner 130 to allow the ignition apparatus to ignite only the inner burner 130, there is a defect that cannot ignite only the outer burner 110.

[0072] Hereinafter, an inner and outer frame compound type multistage burner according to the second embodiment of the present invention will be described with reference to accompanying drawings.

[0073] When compared with the third embodiment, the fourth embodiment of the present invention includes the inner burner having a body shape different from that of the third embodiment.

[0074] As shown in FIG. 3, the inner and outer frame compound type multistage burner 100 according to the second embodiment of the present invention includes an outer burner 110, a first fuel supply 120, an inner burner 130, a second fuel supply 140 and an ignition apparatus, as described above.

[0075] However, the body 131' of the inner burner 130 according to the second embodiment of the present invention has a tapered cylindrical shape such that a diameter of the body 131' is gradually reduced toward an upper portion of the body 130.

[0076] Thus, since the body 131' having the tapered cylindrical shape has a surface area less than that of a general cylindrical shape, if the inner burner 130 is only operated, the minimum amount of consumed gas is more reduced, so that a control for reducing the output of the burner is more conveniently performed.

[0077] That is, for example, when the outer flame hole 132 is formed on the body 131 of FIG. 2 having the general cylindrical shape, the flame hole area ratio is 30%. Compared with the general cylindrical shape, when the outer flame hole 132' is formed on the body 131' having the tapered cylindrical shape, the flame hole area ratio is reduced to 20%, so that the minimum amount of consumed gas may be more reduced.

[0078] Hereinafter, an inner and outer frame compound type multistage burner according to the third embodiment of the present invention will be described with reference to accompanying drawings

[0079] Differently from the first embodiment, in the third embodiment of the present invention, a second air plate substitutes for a portion of the lower finishing plate closing the entire lower portion of the outer burner and the first fuel supply is connected through a side portion of the outer burner.

[0080] As shown in FIG. 4, the inner and outer frame compound type multistage burner according to the third embodiment of the present invention includes an outer burner 210, a first fuel supply 220, an inner burner 230, a second fuel supply 240 and an ignition apparatus, as described above.

[0081] However, the lower finishing plate 214 according to the third embodiment closes only a lower end between the outer wall 211 and the inner wall 212 of the outer burner 210 of the entire lower portion of the outer burner 210 and the remaining end is closed by a secondary air plate 215 in which a secondary air hole 2154a is formed.

[0082] If the lower finishing plate 214 is integrated with the secondary air plate 215, as in the first embodiment, it may be substantially the same as the case that the entire lower portion of the outer burner 110 of FIG. 2 is closed by a single lower finishing plate 114 of FIG. 2.

[0083] Further, in the third embodiment, the first fuel supply 220 is connected to a side of the outer burner 210. To this end, the first venturi tube 221 is installed to communicate with a flowing path between the outer and inner walls 211 and 212 and in addition, the first venturi tube 221 includes a second nozzle 222 and a second air hole 223 to supply mixed gas.

[0084] However, in this case, there is a disadvantage that a width of the burner is widened corresponding to the length of the first fuel supply 220.

[0085] Further, since dispersion is lowered when the mixed gas supplied through the first venturi tube 221 flows in a horizontal direction (based on the drawing), a baffle 216 is installed in perpendicular to the moving direction of the mixed gas.

[0086] Therefore, it is preferable to uniformly supply the mixed gas to the entire inner flame hole 212a by increasing the length of the flowing path of the mixed gas to facilitate the mixing of the primary air with gas and by allowing the mixed gas to ascend be supplied to the inner flame hole 212a.

[0087] Hereinafter, an inner and outer frame compound type multistage burner according to the fourth embodiment of the present invention will be described with reference to accompanying drawings.

[0088] When compared with the third embodiment, the fourth embodiment of the present invention includes the inner burner having a body shape different from that of the third embodiment.

[0089] As shown in FIG. 5, the inner and outer frame compound type multistage burner according to the fourth embodiment of the present invention includes an outer burner 210, a first fuel supply 220, an inner burner 230, a second fuel supply 240 and an ignition apparatus, as

described above.

[0090] However, the body 231' of the inner burner 230 according to the fourth embodiment of the present invention has a tapered cylindrical shape such that a diameter of the body 231' is gradually reduced toward an upper portion of the body 231'.

[0091] Therefore, the minimum gas consumption may be more reduced due to the body 231' having the tapered cylindrical shape as compared with a general cylindrical shape, which has already been described above, so the detailed description thereof will be omitted.

[Industrial Applicability]

[0092] Although the exemplary embodiments of the present invention have been described, it is understood that the present invention should not be limited to these exemplary embodiments but various changes and modifications can be made by one ordinary skilled in the art within the spirit and scope of the present invention as hereinafter claimed.

[0093] Therefore, since the embodiments are provided for the purpose of completely explaining the scope of the present invention to those skilled in the art, it is understood that the present invention should not be limited to these exemplary embodiments and should be defined within the scope of the claims claimed hereinafter.

Claims

1. An inner and outer frame compound type multistage burner comprising:

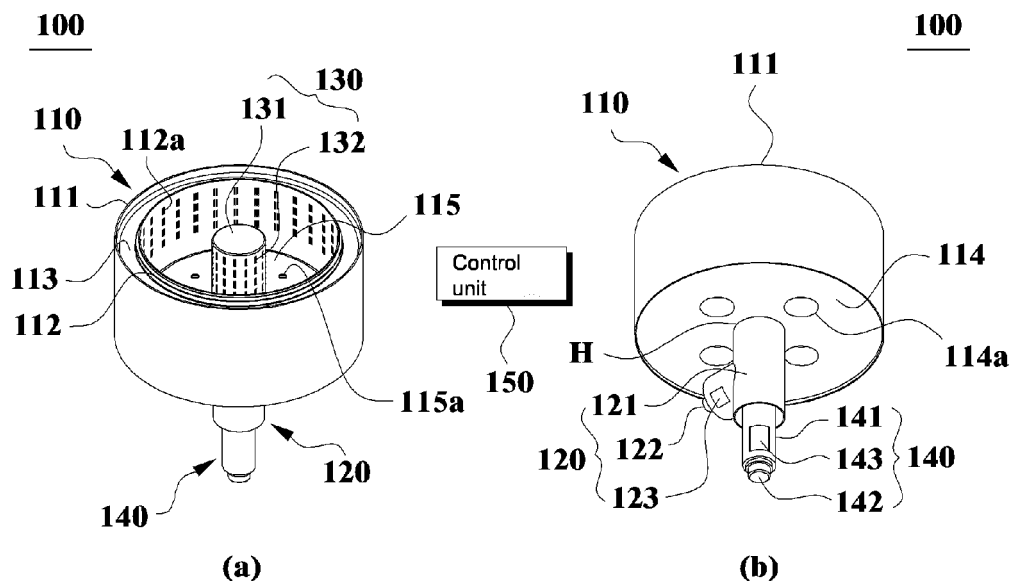
an outer burner disposed at an outside to generate a flame toward an inside;
a first fuel supply to mix primary air with a fuel to supply the mixed primary air and fuel to the outer burner;
an inner burner disposed at an inner central portion of the outer burner to generate a flame toward the outside;
a second fuel supply to mix primary air and a fuel to supply the mixed primary air and fuel to the inner burner; and
an ignition apparatus to ignite the supplied fuel.

2. The inner and outer frame compound type multistage burner of claim 1, wherein the outer burner includes:

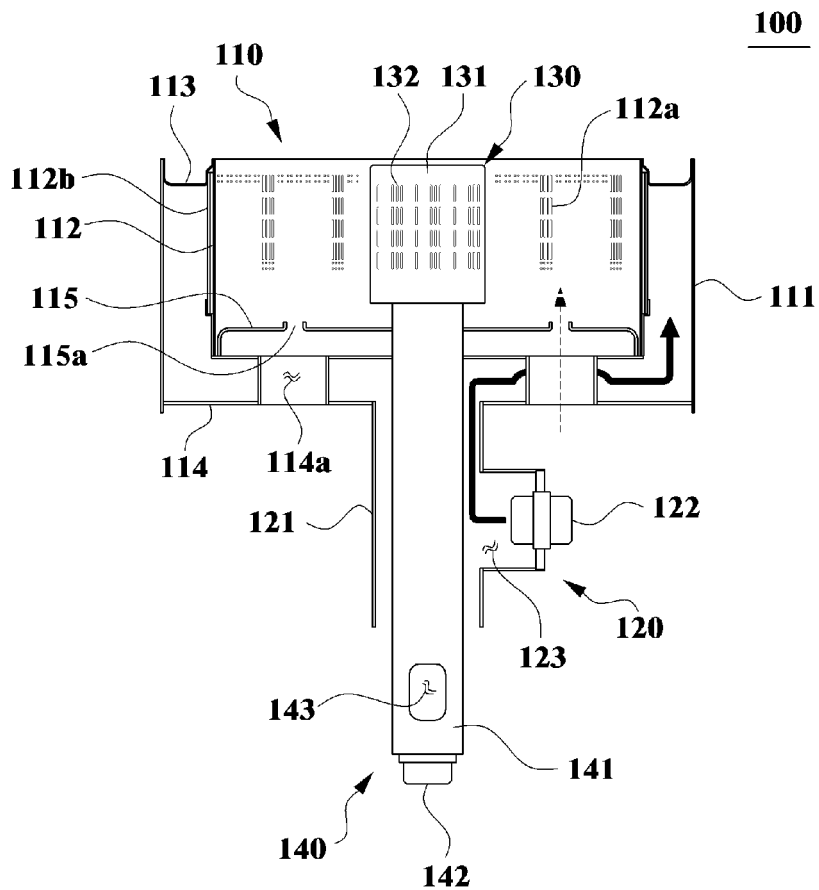
an outer wall having a cylindrical shape with opened upper and lower portions;
an inner wall having a diameter less than a diameter of the outer wall and a cylindrical shape, the inner wall being spaced apart from an inside of the outer wall by a predetermined interval and having a plurality of inner flame holes to generate a flame toward the inside, wherein the inner

- burner is disposed at an inside central portion;
 an upper plate covering a space formed between an upper end of the outer wall and an upper end of the inner wall; and
 a lower finishing plate covering an entire lower end of the outer burner, the lower finishing plate being formed at a center thereof with an installation hole through which a second fuel supply connected to the inner burner is installed, a secondary air hole being formed around the installation hole to supply secondary air for supplementing combustion between the inner and outer burners.
3. The inner and outer frame compound type multistage burner of claim 2, further comprising an air dispersion plate installed over the lower finishing plate and spaced apart from the lower finishing plate by a predetermined distance,
 wherein the air dispersion plate has a plurality of air dispersion holes which disperse air raised after the air passes through the secondary air hole.
 4. The inner and outer frame compound type multistage burner of claim 2, wherein the inner burner includes:
 a burner body disposed at an inner central portion of the inner wall, the burner body having a closed upper portion, a lower portion connected to the second fuel supply, and a flowing path formed therein; and
 a plurality of outer flame holes formed on a side surface of the burner body to belch a flame toward the outside facing the outer burner.
 5. The inner and outer frame compound type multistage burner of claim 1, wherein the first fuel supply is connected to a side portion of the outer burner, and the second fuel supply is connected to the inner burner through a lower portion of the outer burner.
 6. The inner and outer frame compound type multistage burner of claim 1, wherein the first fuel supply is connected to a lower portion of the outer burner, and the second fuel supply is connected to the inner burner by passing through the first fuel supply.
 7. The inner and outer frame compound type multistage burner of claim 1, wherein the ignition apparatus is installed in a combustion chamber between the inner and outer burners to ignite one of the inner burner and the outer burner.
 8. The inner and outer frame compound type multistage burner of one of claims 1 to 7, further comprising a control unit controlling the first and second fuel supplies,
 wherein the control unit independently controls the first and second fuel supplies, such that fuel is supplied through one of the first and second fuel supplies or all of the first and second fuel supplies.
 9. The inner and outer frame compound type multistage burner of claim 8, wherein the control unit controls an amount of fuel (TDR: Turn-Down Ratio) supplied through the first and second fuel supplies.
 10. The inner and outer frame compound type multistage burner of claim 8, wherein the control unit controls to supply fuel through the first fuel supply after the fuel is supplied through the second fuel supply so that the outer burner is ignited by using a flame generated from the inner burner as the ignition apparatus is operated.
 11. The inner and outer frame compound type multistage burner of one of claims 1 to 7, wherein the ignition apparatus is installed closely to the inner burner in order to ignite only the inner burner and the outer burner is ignited by using an outer flame generated from the inner burner upon ignition.

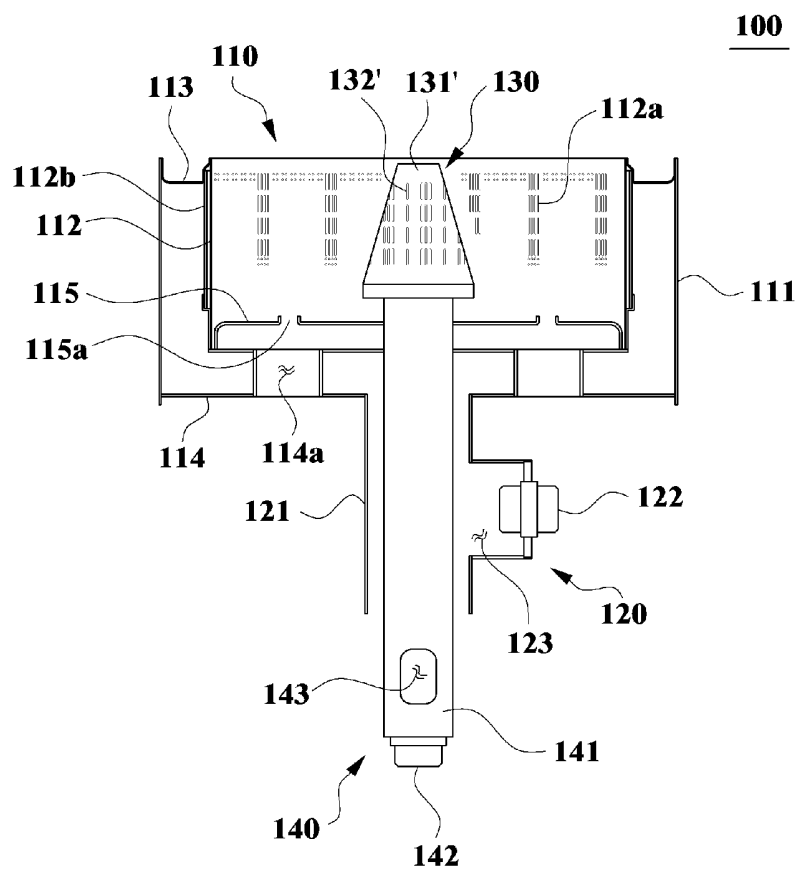
[Fig. 1]



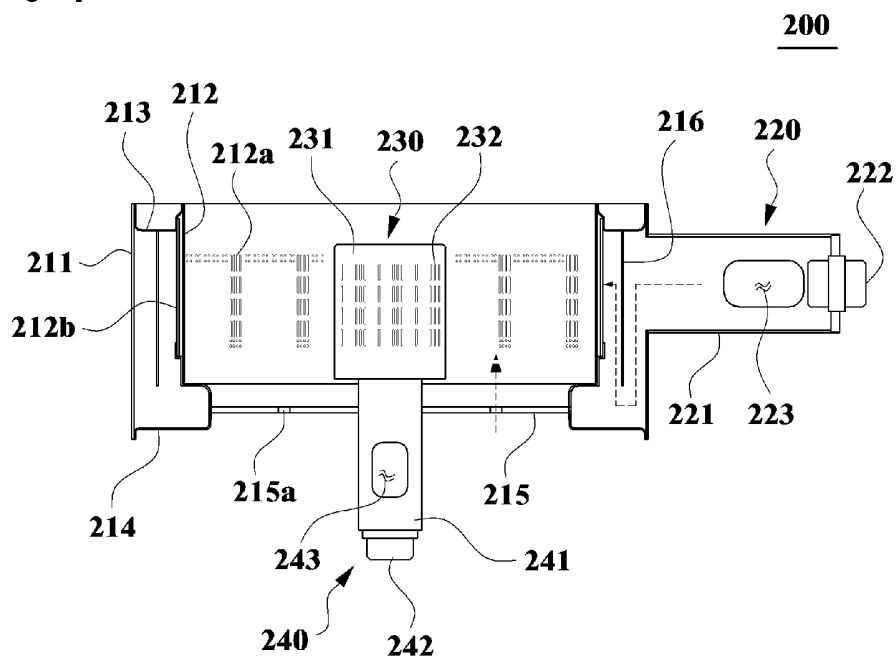
[Fig. 2]



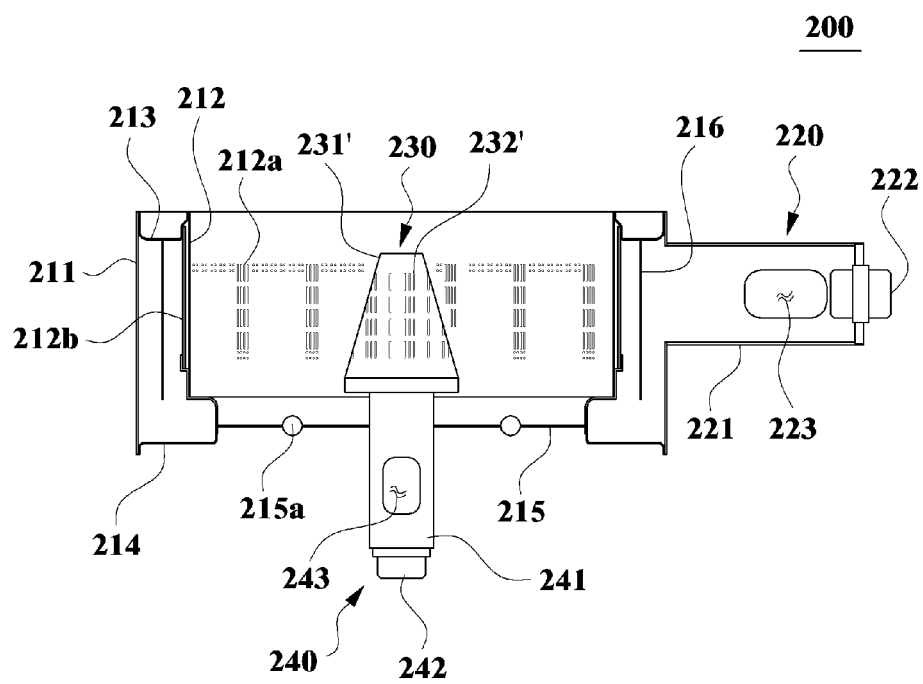
[Fig. 3]



[Fig. 4]



[Fig. 5]



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2012/007396

A. CLASSIFICATION OF SUBJECT MATTER

F23D 14/04(2006.01)i, F23D 14/28(2006.01)i, F23N 1/00(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)

F23D 14/04; F23C 11/00; F23D 23/00; F23D 14/06

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

Korean Utility models and applications for Utility models: IPC as above

Japanese Utility models and applications for Utility models: IPC as above

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

eKOMPASS (KIPO internal) & Keywords: turndown, burner, boiler, inner flame, outer flame, sub, secondary, inner side

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 10-220715 A (TOHO GAS CO LTD et al.) 21 August 1998 See abstract; paragraphs [0022]-[0032]; figures 1, 3	1,2,4,5,7-11 3,6
Y A	KR 20-0210405 Y1 (DOWOO PRECISION INDUSTRIAL CO., LTD. et al.) 15 January 2001 See abstract; page 6, lines 9-38; figures 1, 4, 6	1,2,4,5,7-11 3,6
A	KR 10-2006-0088981 A (CHOI, JIN MIN) 08 August 2006 See abstract; page 4; figures 1, 2	1,2
A	JP 10-160126 A (TOKYO GAS CO LTD et al.) 19 June 1998 See abstract; page 2; figure 1	1-3

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT
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JP 10-220715 A	21.08.1998	NONE	
KR 20-0210405 Y1	15.01.2001	NONE	
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JP 10-160126 A	19.06.1998	NONE	

Form PCT/ISA/210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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