(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 219 893 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
18.01.2006 Bulletin 2006/03

(21) Application number: **02006378.0**

(22) Date of filing: **29.07.1998**

(51) Int Cl.:
F23C 5/32 *(2006.01)* ***F23D 1/00*** *(2006.01)*

(54) Pulverized coal burner

Kohlenstaubbrenner

Brûleur à charbon pulvérisé

(84) Designated Contracting States:
BE NL

(43) Date of publication of application:
03.07.2002 Bulletin 2002/27

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
98114219.3 / 0 976 977

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a pulverized coal burning boiler or furnace according to the preamble portion of Claim 1 for generating a steam for a power plant, a factory and the like.

Description of the Prior Art

[0002] A conventional boiler of this kind will be described below with reference to Figs. 7 to 10.

[0003] Reference numeral 01 denotes a boiler furnace main body, and a plurality of burner main bodies 02 are disposed in a vertical direction at each of four corners therein. The burner main body 02 is constituted by a combustion air nozzle 03. an auxiliary air nozzle 04. a pulverized coal mixture nozzle 05. etc. and a pulverized coal mixture 10. a combustion air 11, a main burner air 12 and an additional air 13 are supplied thereto through a pulverized coal mixture feeding pipe 06, an air feeding duct 07, a main burner air duct 08 and an additional air duct 09.

[0004] Reference numeral 14 denotes an additional air nozzle disposed at an upper position, reference numeral 15 denotes a furnace, and a pulverized coal flame 16 is formed in the furnace 15. Reference numeral 17 denotes an air adjusting damper assembled in each of the burner main bodies 02. reference numeral 18 denotes an imaginary circle imagined in the furnace 15 for explanation purpose, and reference numeral 19 denotes a fire vortex formed in the furnace 15.

[0005] In the conventional pulverized coal burning boiler provided with the means mentioned above, a coal fed to a coal pulverizing apparatus (not shown) is finely pulverized, is mixed with a carrying air (a hot air) simultaneously fed so as to form the pulverized coal mixture 10, and is fed to the pulverized coal mixture nozzle 05 provided in the burner main body 02 through the pulverized coal mixture feeding pipe 06.

[0006] The burner main bodies 02 are provided.at four corners of the boiler furnace main body 01. and plural sets of burners, each burner comprising the combustion air nozzle 03, the pulverized coal mixture nozzle 05 provided in a center portion thereof and the auxiliary air nozzle 04 provided above and below the combustion air nozzle 03, are installed within each of the burner main bodies 02. (Here, there is a case that the burner main bodies 02 are provided not only at four corners of the boiler furnace main body 01, but also on a wall surface as shown in Fig. 9.)

[0007] Each set of these nozzles, that is, the combustion air nozzle 03, the auxiliary air nozzle 04 and the pulverized coal mixture nozzle 05, is installed in such a manner as to blow the pulverized coal mixture 10 and the main burner air 12 in a tangential direction of an imaginary circle 18 which is set at a center portion on a horizontal cross section of the boiler furnace main body 01. A construction drawing of the conventional pulverized coal mixture nozzle 05 will be shown in Fig. 10.

[0008] The additional air nozzles 14 are provided at four corners above the burner main bodies 02 in the boiler furnace main body 01. The additional air nozzle 14 is installed in such a manner as to blow the additional air 13 in a tangential direction of an imaginary circle 18 which has a same diameter as that of the imaginary circle 18 with respect to the respective nozzles 03, 04 and 05 of the burner main body 02 and is set at a center portion on a horizontal cross section of the boiler furnace main body 01.

[0009] The pulverized coal mixture 10 supplied to the pulverized coal mixture nozzle 05 provided in the burner main body 02 is blown into the furnace 15 from the nozzle 05. On the other hand, the combustion air 11 is fed through the air feeding duct 07 by a feeding apparatus (not shown), and is branched into the main burner air 12 and the additional air 13 before entering the burner main body 02.

[0010] The main burner air 12 is fed to the burner main body 02 through the main burner air duct 08, and is blown into the furnace 15 from the combustion air nozzle 03 and the auxiliary air nozzle 04.

[0011] An amount of the main burner air 12 is generally set to be equal to or less than a stoichiometric mixture ratio of an amount of the pulverized coal blown as the pulverized coal mixture 10 so as to hold a portion of the furnace 15 below the additional air nozzle 14 in a reducing atmosphere, thereby reducing a nitrogen oxide (hereinafter referred to as to NOx for short) generated by burning the pulverized coal.

[0012] The main burner air 12 and the branched additional air 13 are fed to the additional air nozzle 14, and blown into the furnace 15 so as to be used for completing a burning of a combustible portion left in the combustion gas due to the reduction combustion.

[0013] The pulverized coal mixture 10 blown into the furnace 15 from the four corners of the boiler furnace main body 01 is ignited by an ignition source (not shown), and forms the pulverized coal flame 16. The pulverized coal flame 16 becomes a swirling flow so as to form the fire vortex 19, and ascend in the furnace 15 with swirling, thereby performing a swirling combustion.

[0014] As mentioned above, the amount of the main burner air 12 blown from the burner main body 02 is equal to or less than the stoichiometric mixture ratio of the amount of the pulverized coal blown as the pulverized coal mixture 10 from the pulverized coal mixture nozzle 05, so that the portion of the furnace 15 below the additional air nozzle 14 portion becomes a reducing atmosphere.

[0015] Accordingly, a combustion exhaust gas generated by burning the pulverized coal becomes to contain a combustible portion, however, NOx in the combustion exhaust gas generated by burning the pulverized coal is

reduced so that an intermediate product such as NH3 and HCN is generated in place thereof.

[0016] In the reduction of NOx in this reducing area, it is important to efficiently diffuse and mix the main burner air 12 and the pulverized coal mixture 10 so as to burn, and the more completely an oxygen supplied by the main burner air 12 is consumed, the higher a rate of NOx reduction becomes.

[0017] The combustion exhaust gas containing the combustible portion is blown with the additional air 13 in the additional air nozzle 14 portion, and the combustion thereof is completed till an outlet of the furnace.

[0018] In the conventional pulverized coal combustion mentioned above, in the case that a diameter of the imaginary circle 18 set in the center portion on the horizontal cross section of the boiler furnace main body 01 is excessively small, the pulverized coal flames 16 collide with each other, so that a formation of the fire vortex 19 becomes insufficient and the combustion is deteriorated. On the contrary, in the case that the diameter of the imaginary circle 18 is excessively large, the pulverized coal flames 16 collide with a side wall of the furnace 15 so that a phenomenon that a slagging occurs violently and a combustion is deteriorated is generated.

[0019] Accordingly, a determination of the diameter of the imaginary circle 18 has so far been carefully performed by taking actual results into consideration. Nevertheless, a negative pressure is generated between the side wall of the furnace 15 and the pulverized coal flame 16 by the main burner air 12 blown at a high speed, so that the fire vortex 19 formed by the pulverized coal flames 16 becomes a hollow doughnut-shaped fire vortex 19 having a diameter significantly larger than the diameter of the imaginary circle 18 and flows in the furnace 15 due to a so-called Coanda effect in which the pulverized coal flame 16 is drawn near the side wall. Therefore, the slagging occurs violently.

[0020] Since a blowing momentum of the pulverized coal mixture 10 blown from the pulverized coal mixture nozzle 05 becomes large when a capacity of the burner becomes large, a degree of collision of the pulverized coal flame 16 with side wall of the furnace 15 is increased, and in addition thereto, it becomes difficult to secure a stable ignitability. As a result, the conventional pulverized coal burner has a disadvantage that it is hard to increase the capacity.

[0021] In the case of intending to increase the capacity of the boiler, an combustion rate is necessarily increased, however, in order to deal with this, it is necessary (1) to increase a number of the burners attached to the boiler and (2) to increase the capacity of each of the burners.

[0022] Among them, the increase of the number of the burners is performed by increasing a number of stages of the burners since the number of the burners on the horizontal cross section of the boiler furnace main body 01 is fixed, however, in this manner, a height of the boiler is increased, so that a cost for constructing the boiler is increased.

[0023] Accordingly, in order to increase the capacity of the boiler, it is necessary to increase the capacity of each of the burners, however, when the combustion forming the fire vortex 19 is performed by the conventional burner, the blowing momentum of the pulverized coal mixture 10 blown from the pulverized coal mixture nozzle 05 is increased, together with an increase of the capacity of the burner, so that a degree of collision of the pulverized coal flame 16 with the side wall of the furnace 15 is increased. Therefore, there are problems that an amount of slagging is increased and it becomes difficult to secure the stability of ignition of the pulverized coal flame 16.

[0024] US-A-5 593 298 discloses a furnace including a pulverized coal burner with the features of the preamble portion of claim 1. In the pulverized coal burner of this furnace a fuel nozzle is arranged so as to be surrounded by an air passage for discharging a fuel stream and a surrounding air stream. In order to change the distribution of air in relation to the fuel stream this prior art teaches to use restricting blades to create an eccentric distribution of air by partially restricting or blocking the flow. The central coal mixture nozzle itself is symmetrically arranged with respect to the surrounding air nozzles.

SUMMARY OF THE INVENTION

[0025] It is the object of the present invention to provide a furnace including a pulverized coal burner which is improved so as to avoid the attaching of molten ash on the furnace walls.

[0026] In order to solve this object the present invention provides a furnace including a pulverized coal burner as defined in claim 1. Preferred embodiments are defined in the dependent claims.

[0027] The invention provides a furnace with a pulverized coal burner for supplying a pulverized coal mixture in a tangential direction of an imaginary circle in a horizontal plane of the furnace so as to be burned, wherein a pulverized coal mixture nozzle is made eccentric with respect to an air nozzle so that the pulverized coal mixture becomes rich on a central side of the imaginary circle. Accordingly, an axis of the pulverized coal mixture nozzle and an axis of the air nozzle are moved and shifted to be eccentric with each other so that a concentration of the pulverized coal of the pulverized coal mixture blown to an outer peripheral side of a fire vortex (near the wall surface of the furnace) formed in the furnace from the pulverized coal mixture nozzle is reduced and a concentration of the pulverized coal blown to an inner portion side of the fire vortex becomes rich, thereby the pulverized coal flame is prevented from colliding with the furnace wall and an amount of an air near the inner wall surface of the furnace is increased to form an oxidation atmosphere. Therefore, the molten ash is prevented from attaching by increasing an ash melting point.

[0028] Furthermore, the invention provides a pulverized coal burner with a means for applying a swirl to a

combustion air supplied from an outer periphery of the pulverized coal mixture nozzle. Accordingly, an ignition stability with an increased capacity of a burner, a flame stability at a time of load changes, a short flame and a lowness of soot and dust can be secured by applying a swirl to the combustion air and by using, for example, a combined flame stabilizer, if necessary.

[0029] Moreover, the invention provides a pulverized coal burner with a means for directing a front end portion of the burner in vertical and lateral directions. Accordingly, a position of the fire vortex can be changed by making the structure capable of changing the nozzle direction in the vertical and lateral directions, so that a distribution of the thermal load in the furnace can be adjusted.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030]

Fig. 1 is an explanatory view as seen from a cross section along a line I-I in Fig. 2, which shows a system of a boiler in accordance with a first embodiment of the invention;

Fig. 2 is a cross sectional view along a line II-II in Fig. 1, which shows a horizontal cross section of the boiler in Fig. 1;

Figs. 3(a), 3(b) and 3(c) show a summary of a pulverized coal mixture nozzle in the boiler shown in Figs. 1 and 2, in which Fig. 3(a) is a schematic view showing a cross section along a line a-a in Fig. 3(b), Fig. 3(b) is a schematic view showing a cross section along a line b-b in Fig. 3(a) and Fig. 3(c) is a schematic view showing a cross section along a line c-c in Fig. 3(a);

Fig. 4 is a front elevational view of a burner in accordance with a second embodiment of the invention;

Fig. 5 is a vertically cross sectional view of the burner shown in Fig. 4;

Figs. 6(a), 6(b). 6(c) and 6(d) show a summary of a pulverized coal burner in accordance with a third embodiment of the invention, in which Fig. 6(a) is a schematic view showing a cross section of a boiler. Fig. 6(b) is a schematic view showing a burner windbox arranged at four corners of Fig. 6(a) and a separately provided additional port arranged above the burner windbox, Fig. 6(c) is a schematic view showing a front surface of one of fuel nozzles of Fig. 6(b) and Fig. 6(d) is a schematic view showing a pulverized fuel pipe for supplying a fuel to a fuel nozzle of Fig. 6(c);

Fig. 7 is a schematic view as seen from a cross section along a line VI-VI in Fig. 8, which shows a system of a conventional boiler;

Fig. 8 is a cross sectional view along a line VII-VII of a boiler shown in Fig. 7;

Figs. 9(a), 9(b), 9(c) and 9(d) are schematic views which respectively show different aspects of an arrangement of a burner in the conventional boiler; and

Figs. 10(a) and 10(b) show a pulverized coal mixture nozzle in the conventional boiler, in which Fig. 10(a) is a cross sectional view and Fig. 10(b) is a cross sectional view along a line B-B of fig. 10(a).

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] A first embodiment of the invention will be described below with reference to Figs. 1 to 3. In this case, in correspondence to the conventional ones mentioned above, reference numerals obtained by adding 100 to the reference numerals in the conventional ones will be attached to the same parts so that a mutual relation can be easily understood, and an overlapping description will be omitted as much as possible.

[0032] Accordingly, since reference numerals 101 to 119 correspond to the reference numerals 01 to 19 in the conventional structure, a description will be simplified as much as possible, and an ignition promoting air hole 120 provided in a pulverized coal mixture nozzle 105, an ignition promoting air chamber 121, an ignition promoting air chamber inlet port 122, a guiding plate 123. a rich/lean separating body 124, etc. will be described in detail.

[0033] A coal fed to a coal pulverizing apparatus (not shown) is pulverized there, is mixed with a carrying air (a hot air) simultaneously fed so as to form a pulverized coal mixture 110. and is fed to a pulverized coal mixture nozzle 105 provided in a burner main body 102 through a pulverized coal mixture transporting pipe 106.

[0034] The pulverized coal mixture nozzle 105 is constituted by a pulverized coal mixture pipe connected to the pulverized coal mixture transporting pipe 106, and a mixture injecting nozzle attached to a front end thereof. The rich/lean separating body 124 is provided within the pulverized coal mixture pipe near an inlet of the mixture injecting nozzle.

[0035] An injecting port of the mixture injecting nozzle is branched into upper and lower directions with an optional angle, for example, an angle of 10 degrees to 30 degrees in one direction with respect to a horizontal axis, and the ignition promoting air chamber 121 is provided between the upper and lower injecting ports.

[0036] The combustion air nozzle 103 is provided on an outer periphery of the mixture injecting nozzle, and blows the main burner air 112 into the furnace 114 from a blowing port constituted by the mixture injecting nozzle and the combustion air nozzle 103.

[0037] The pulverized coal mixture 110 fed to the pulverized coal mixture nozzle 105 flows in a biased manner at the pulverized coal mixture pipe outlet portion by the rich/lean separating body 124. As a result, the pulverized coal mixture 110 is structured such that a concentration of the pulverized coal becomes lean on the rich/lean separating body 124 attaching side at the mixture injecting nozzle outlet port due to a force of inertia and a concentration of the pulverized coal on the opposite side not attaching the same becomes rich.

[0038] A blowing port of the main burner air 112 formed by the mixture injecting nozzle and the combustion air nozzle 103 is formed wider on the lean pulverized coal side of the pulverized coal mixture 110 and narrower on the rich pulverized coal side.

[0039] In a swirling combustion performed by forming the fire vortex 119 in a center portion of the furnace 115, a portion, blown into a central side of the fire vortex 119, of the pulverized coal mixture 110 injected from the mixture injecting nozzle becomes to an upstream side of the swirling combustion flow, so that said portion is in a state of easily igniting having a large radiant heat from the adjacent pulverized coal flame 116. Accordingly, the pulverized coal mixture 110 is set such that the rich pulverized coal side is blown to the central side of the fire vortex 119.

[0040] In the main burner air 112 blown from the main burner air 112 blowing port formed by the mixture injecting nozzle and the combustion air nozzle 103. since an area of of the main burner air 112 blowing port is set such that a blowing amount to the central side of the fire vortex 119 becomes less and a blowing amount to the outer peripheral side (a wall surface side of the furnace) of the fire vortex 119 becomes more, the pulverized coal flame 116 is prevented from colliding with the wall surface of the furnace 115. thereby restricting a generation of slagging and unburned component.

[0041] In addition to the structure mentioned above, in accordance with this embodiment, a new device is further added to the mixture injecting nozzle in order to improve an ignition stability of the pulverized coal flame 116.

[0042] That is, as mentioned above, the mixture injecting nozzle is structured such that the injecting port thereof is branched to the upper and lower directions with an optional angle, the ignition promoting air chamber 121 is provided between the upper and lower injecting ports, and the guiding plate 123 and the ignition promoting air chamber inlet hole 122 are provided in the inlet of said air chamber 121.

[0043] The ignition promoting air chamber 121 is formed by disposing a plate on a side facing to the the furnace 115. and the ignition promoting air hole 120 is bored on the plate so as to blow the main burner air 112. which has flown to the ignition promoting air chamber 121 through the ignition promoting air chamber inlet hole 122, between two pulverized coal mixtures 110 injected from the mixture injecting nozzle.

[0044] The main burner air 112 blown from the ignition promoting air hole 120 prevents flows of the pulverized coal mixture 110 blown from two injection ports of the mixture injecting nozzle from joining together earlier, and since a temperature of the main burner air 112 is high to be about 300 °C in comparison that a temperature of the pulverized coal mixture 110 is generally 100 °C or less (in many cases, about 80 °C), an effect that a generation of a volatile matter between the pulverized coal mixtures 110 is promoted can be obtained, so that an igniting stability of the pulverized coal flame 116 can be secured.

[0045] Next, a second embodiment in accordance with the invention will be described below with reference to Figs. 4 and 5. Here, in this embodiment, an explanation will be given with respect to a representative burner main body, and it will be easily understood that this respresentative burner main body is one that is picked up and shown from the burners arranged in the first embodiment.

[0046] Reference numeral 201 denotes a pulverized coal mixture nozzle, and a secondary air nozzle 202 and a tertiary air nozzle 203 are arranged in a periphery thereof.

[0047] Reference numeral 204 denotes a swirler, arranged at an upstream position of an outlet of the tertiary air nozzle 203. Reference numeral 205 denotes a hollow core provided at an upstream position of an outlet of the pulverized coal mixture nozzle 201.

[0048] Reference numeral 206 denotes a tilt bar connected to a spherical connecting portion 210 at a front end portion of each of the nozzles 201, 202 and 203. and each of the nozzles 201, 202 and 203 can be directed in a vertical direction around the connecting portion 210 by moving the tilt bar 206 laterally as shown by arrows in the drawing.

[0049] In this case, a tilt bar 206 connected to the tertiary air nozzle 203 operates a motion in the vertical direction of the tertiary air nozzle 203, and the pulverized coal mixture nozzle 201 and the secondary air nozzle 202 are interlocked by a supporting rod 207 and the tilt bar 206 is connected to the secondary air nozzle 202, thereby the pulverized coal mixture nozzle 201 together with the secondary air nozzle 202 change the direction in the vertical direction.

[0050] Further, it can be easily understood that another tilt bar (not shown) is connected to a position substantially 90 degrees rotated in the spherical connecting portion 210. so that the front end of each of the nozzles 201, 202 and 203 can change the direction in the lateral direction. Further, reference numeral 208 denotes a flame stabilizer, arranged at the front end of each of the nozzles 201. 202 and 203, for serving a flame stabilizing effect.

[0051] Accordingly, in accordance with this embodiment, by the hollow core 205 within the pulverized coal mixture nozzle 201, a concentration distribution of the pulverized coal in the pulverized coal mixture injecting flow is made rich on the peripheral side, and by the flame stabilizer 208, an ignition stability is increased.

[0052] Further, the injecting direction of the pulverized coal mixture, the secondary air and the tertiary air can be changed in the vertical and lateral directions by moving the tilt bar 206 in the front and rear direction. In this case, since the pulverized coal mixture nozzle and the secondary air nozzle are interlocked to be fixed together by the supporting rod 107, the injecting flow therefrom is directed in the same direction.

[0053] A third embodiment in accordance with the invention will be described below with reference to Fig. 6. In this case, Fig. 6(a) shows a cross section of a boiler, Fig. 6(b) shows a burner windbox arranged at each of

four corners of Fig. 6(a) and a separately provided additional air port arranged above the burner windbox. Fig. 6(c) shows a front of one of fuel nozzles of Fig. 6(b) and Fig. 6(d) shows a pulverized fuel pipe for supplying a fuel to the fuel nozzle of Fig. 6(c).

[0054] In Fig. 6(a), reference numeral 301 denotes a cross section of a furnace, a periphery of which is surrounded by a wall of the furnace in a square shape, and a burner windbox 302 is arranged at each of four corners thereof. Reference numeral 303 denotes a flame and reference numeral 304 denotes a section close to the furnace wall.

[0055] Fig. 6(b) shows a detail of the burner windbox 302 structured in five stages. That is, auxiliary air portions 305b and 305a are arranged at upper and lower ends, a first stage fuel nozzle portion 306a is placed on the lower end auxiliary air portion 305a. a second stage fuel nozzle portion 306b is placed thereon via an oil nozzle portion 307a. and a third stage fuel nozzle portion 306c. a fourth stage fuel nozzle portion 306d and a fifth stage fuel nozzle portion 306e are likewise placed via an oil nozzle portion 307b, an oil nozzle portion 307c and an oil nozzle portion 307d, respectively, up to the upper end auxiliary air portion 305b overlappedly with no gap being placed between each of them.

[0056] Then, among the elements in this overlapped body, paying attention to the hatched fifth stage fuel nozzle portion 306e, the front shape thereof is shown in Fig. 6(c). Then, the fifth stage fuel nozzle portion 306e is constituted by a fuel injecting port 308, disposed in a central portion, for injecting a pulverized fuel and a carrying air, and a combustion secondary air injecting port 309, surrounding a periphery thereof, for injecting a secondary air.

[0057] As a matter of course, the other fuel nozzle portions 306a to 306d are also constituted in the same manner as that of the fifth stage fuel nozzle portion 306e. Further, the pulverized fuel and the carrying air to be injected from the fuel injecting port 308 are carried through the pulverized fuel pipe 310 shown in Fig. 6(d) and reach the fuel injecting port 308.

[0058] It is to be noted that a basic construction part has been described above, however, as will be understood from the description in Fig. 6, various kinds of devices are further added to the invention. That is, the furnace cross section 301, the periphery of which is surrounded by the furnace wall in a square shape, is provided with the burner windbox 302 at each of four corners, however, the first to fifth stage fuel nozzle portions 306a to 306e, which constitute a main portion of the burner disposed here, and the respective oil nozzle portions 307a to 307d disposed therebetween are structured with an elongated horizontal width and a reduced height.

[0059] For example, in the conventional general fuel nozzle portion, the horizontal width is made to be 1 to 1.5 times the height, however, in this embodiment, the shape is formed such that the horizontal width is made to be about three times the height, and the height is reduced corresponding to the horizontal width, so elongated, so that the total height of the five stages is made lower.

[0060] Then, an additional air port 314 is provided above the burner windbox 302 constructed in five stages overlappedly, and the position of the additional air port 314 is set to be substantially same as the height at which the uppermost element of the conventional general fuel nozzle portions is arranged.

[0061] Further, the hatched fifth stage fuel nozzle portion 306e in the overlapped body is structured such that the front shape is constituted, as shown in Fig. 1(c), by the fuel injecting port 308. arranged on the inner side, for injecting the pulverized fuel and the carrying air, and the combustion secondary air injecting port 309. surrounding the fuel injecting port 308, for injecting the secondary air, however, the fuel injecting port 308 on the inner side is biased rightward as seen in the drawing in the fuel secondary air injecting port 309. surrounding the fuel injecting port 308.

[0062] That is, the structure is such that an opening portion of the fuel secondary air injecting port 309 is broader in a portion close to the furnace wall and a portion close to the center is narrower by that degree, so that the combustion secondary air is injected more to the portion close to the furnace wall by increasing an air flow area in the portion close to the furnace wall, and a lean fuel flame 311 is formed within the section 304 close to the furnace wall on the furnace wall side of the flame 303 around the center.

[0063] Further, in the interior of the pulverized fuel pipe 310 for supplying the pulverized fuel and the carrying air to the fuel injecting port 308, a block 313 is disposed at a portion at which a flow of the pulverized fuel and the carrying air curves, so that the pulverized fuel etc. is biased outwardly of the curved portion above the block by a centrifugal force and then, by use of a twist plate 312 which is arranged so as to twist a flow 90 degrees, the rich pulverized fuel etc. is biased to the inner side of the furnace and the concentration thereof in the portion close to the furnace wall is reduced.

[0064] Since the embodiment is structured in the manner mentioned above, the pulverized fuel flows with an increased area for receiving a radiation heat from the flame so as to promote the ignition by expanding the width of the so-called burner portion comprising the first to fifth stage fuel nozzle portions 306a to 306e and by reducing the height of the burner, and a combustion is done in a narrow area, thereby elevating an atmospheric temperature and improving a combustibility.

[0065] Further, the additional air port 314 installed separately from the burner portion is provided at the height position substantially corresponding to the uppermost stage of the conventional general burners and a sufficient amount of air corresponding to about 30 to 40 % of all the combustion air is supplied there, thereby making the burner portion a reducing area with a shortage of air, and further, reduction of the height of the entire burner portion secures a residence time for the pulverized fuel and the

combustion gas moving from the burner portion to the additional air port 314, so that the NOx reducing area is further strengthened in addition to the promotion of ignition and the increase of the atmospheric temperature.

[0066] Further, the twist plate 312 and the block 313 disposed inside the pulverized fuel pipe 310 first bias the pulverized fuel within the cross section of the pulverized fuel pipe 310 by a centrifugal force due to the block 313 and the curve of the pulverized fuel pipe 310, and next the twist plate 312 twists the pulverized fuel in the rich area to be injected to the inner side of the furnace, and reduces the pulverized fuel amount near the furnace wall, so that amount of ash content is reduced also.

[0067] Still further, in case that an iron is contained in the ash, a compound having a low melting temperature is formed in a state that the peripheral atmosphere is short of air and a bonding force is increased, so that an air amount close to the furnace wall where the opening area is broad is increased, and such component is prevented from occurring with the sufficient air.

[0068] Still further, in accordance with the invention as recited in Claim 1, the axis of the pulverized coal mixture nozzle and the axis of the air nozzle are shifted to be eccentric with each other so that the concentration of the pulverized coal in the pulverized coal mixture blown from the pulverized coal mixture nozzle to the portion on the outer peripheral side of the fire vortex formed in the furnace, that is, the portion close to the wall surface of the furnace is made lean and the concentration of the pulverized coal blown to the portion the inner side of the fire vortex is made rich, thereby the pulverized coal flame is prevented from colliding with the furnace wall and the air amount near the furnace wall is increased so as to form an oxidation atmosphere and increase the ash melting point, and the molten slag is prevented from attaching.

[0069] Furthermore, in accordance with the invention as recited in Claim 2, since the means for swirling the combustion air is provided so as to inject the swirling air, even in the case of enlarging the capacity of the burner, a stability of ignition, a load following ability, a shortening of flame, a lowness of soot and dust and a prevention of molten slag attachment can be achieved.

[0070] Moreover, in accordance with the invention as recited in Claim 3, the structure for freely changing the direction of the front end portion of the burner in the vertical and lateral directions is employed, the optimum position of the nozzle opening is selected in accordance with the condition, the position of the fire vortex can be changed and the distribution of the thermal load within the furnace can be adjusted.

Claims

1. A furnace including a pulverized coal burner (102) arranged to supply a pulverized coal mixture (110) in a tangential direction of an imaginary circle (118) in a horizontal plane of the furnace (115;301) so as to be burned,
said pulverized coal burner (102) including a pulverized coal mixture nozzle (105;201;308) and an air nozzle (103;203;309) surrounding said pulverized coal mixture nozzle (105;201;308) at the outer periphery thereof,
characterized in that said pulverized coal mixture nozzle (105;201;308) is arranged eccentric with respect to said air nozzle (103;203;309).

2. The pulverized coal burner as recited in claim 1, **characterized in that** there is provided a means (204) for applying a swirl to a combustion air supplied from an outer periphery of said pulverized coal mixture nozzle (201).

3. The pulverized coal burner as recited in claim 1 or 2, **characterized in that** there is provided a means (206) for directing a front end portion of the pulverized coal burner in vertical and lateral directions.

4. The pulverized coal burner as recited in claim 1 or 2, **characterized in that** there is provided a means (206) for independently directing the pulverized coal mixture nozzle (201) and the air nozzle (203) in vertical and lateral directions.

5. The pulverized coal burner as recited in claims 3 or 4, **characterized in that** said means for directing comprises a tilt bar (206) connected to a spherical connecting portion (210) at a front end of each of said nozzles (201,203).

Patentansprüche

1. Ofen mit einem Kohlestaubbrenner (102), der so angeordnet ist, dass er ein Kohlestaubgemisch (110) in einer Tangentialrichtung eines imaginären Kreises (118) in einer Horizontalebene des Ofens (115;301) zuführt, um es zu verbrennen,
wobei der Kohlestaubbrenner (102) eine Kohlestaub-Gemischdüse (105;201;308) und eine die Kohlestaub-Gemischdüse (105;201;308) an deren Außenumfang umgebende Luftdüse (103;203;309) aufweist,
dadurch gekennzeichnet, dass die Kohlestaub-Gemischdüse (105;201;308) exzentrisch in bezug auf die Luftdüse (103;203;309) angeordnet ist.

2. Kohlestaubbrenner nach Anspruch 1, **dadurch gekennzeichnet, dass** ein Mittel (204) zum Anlegen eines Wirbelstroms an eine von einem Außenumfang der Kohlestaub-Gemischdüse (201) zugeführte Verbrennungsluft vorgesehen ist.

3. Kohlestaubbrenner nach Anspruch 1 oder 2, **da-**

durch gekennzeichnet, dass ein Mittel (206) zum Ausrichten eines Vorderendabschnitts des Kohlestaubbrenners in Vertikal- und Lateralrichtungen vorgesehen ist.

4. Kohlestaubbrenner nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** ein Mittel (206) zum unabhängigen Ausrichten der Kohlestaub-Gemischdüse (201) und der Luftdüse (203) in Vertikal- und Lateralrichtungen vorgesehen ist.

5. Kohlestaubbrenner nach Anspruch 3 oder 4, **dadurch gekennzeichnet, dass** das Mittel zum Ausrichten eine Schwenk- bzw. Kippstange (206) umfasst, die mit einem kugelförmigen Verbindungsabschnitt (210) an einem Vorderende jeder der Düsen (201;203) verbunden ist.

Revendications

1. Foyer comprenant un brûleur à charbon pulvérisé (102) disposé de façon à fournir un mélange de charbon pulvérisé (110) dans une direction tangentielle à un cercle imaginaire (118) dans un plan horizontal du foyer (115; 301) pour qu'il soit brûlé,
ledit brûleur à charbon pulvérisé (102) comprenant une tuyère à mélange de charbon pulvérisé (105; 201; 308) et une tuyère à air (103; 203; 309) entourant ladite tuyère à mélange de charbon pulvérisé (105; 201; 308) à sa périphérie extérieure,
caractérisé en ce que ladite tuyère à mélange de charbon pulvérisé (105; 201; 308) est disposée de manière excentrique par rapport à ladite tuyère à air (103; 203; 309).

2. Brûleur à charbon pulvérisé suivant la revendication 1, **caractérisé en ce qu'**un moyen (204) est prévu pour appliquer un tourbillon à de l'air de combustion fourni par une périphérie extérieure de ladite tuyère à mélange de charbon pulvérisé (201).

3. Brûleur à charbon pulvérisé suivant la revendication 1 ou 2, **caractérisé en ce qu'**un moyen (206) est prévu pour diriger une partie d'extrémité avant du brûleur à charbon pulvérisé dans les directions verticale et latérale.

4. Brûleur à charbon pulvérisé suivant la revendication 1 ou 2, **caractérisé en ce qu'**un moyen (206) est prévu pour diriger indépendamment la tuyère à mélange de charbon pulvérisé (201) et la tuyère à air (203) dans les directions verticale et latérale.

5. Brûleur à charbon pulvérisé suivant la revendication 3 ou 4, **caractérisé en ce que** ledit moyen d'orientation comprend une barre d'inclinaison (206) connectée à la partie de connexion sphérique (210) à une extrémité avant de chacune desdites tuyères (201,203).

Fig. 1

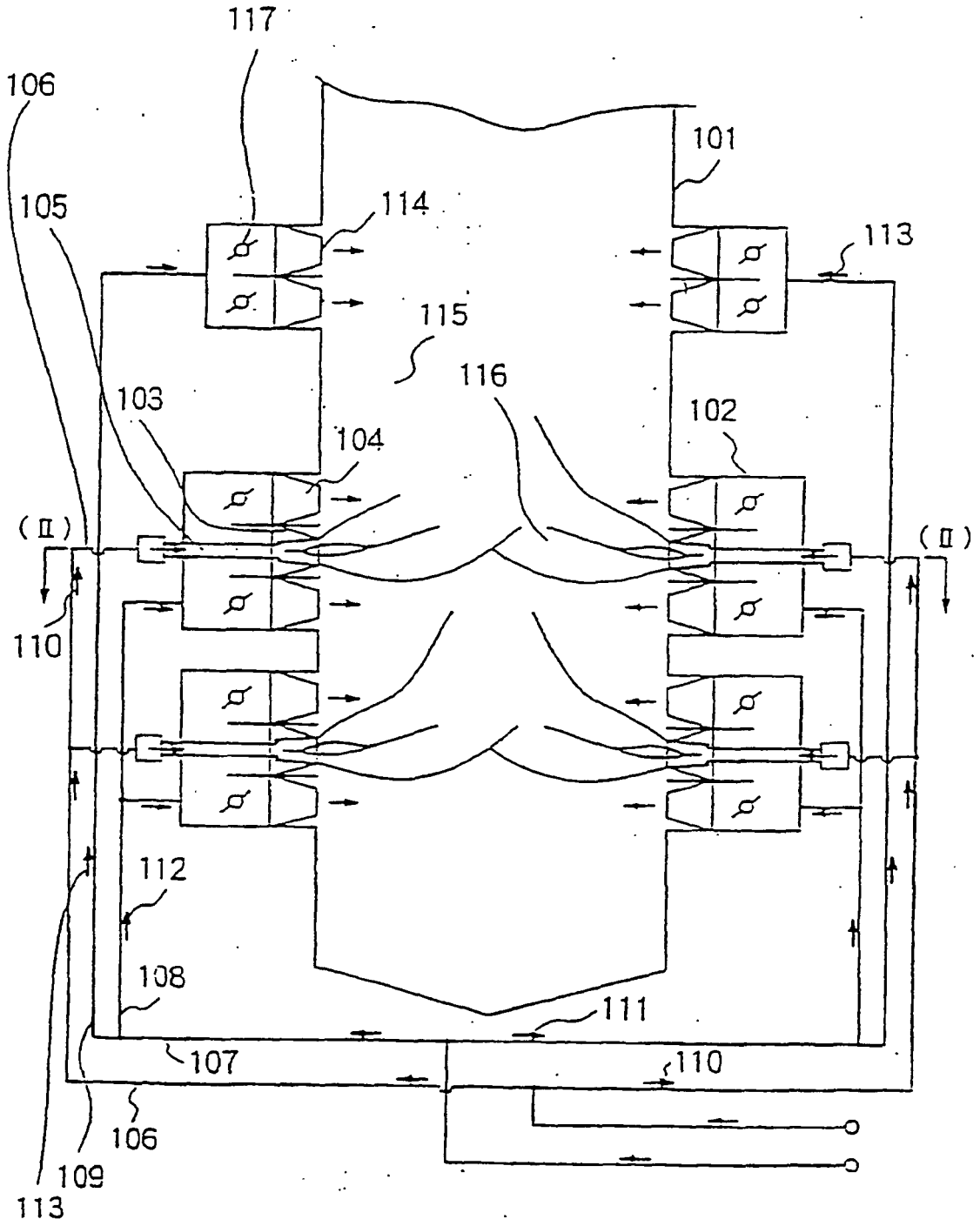
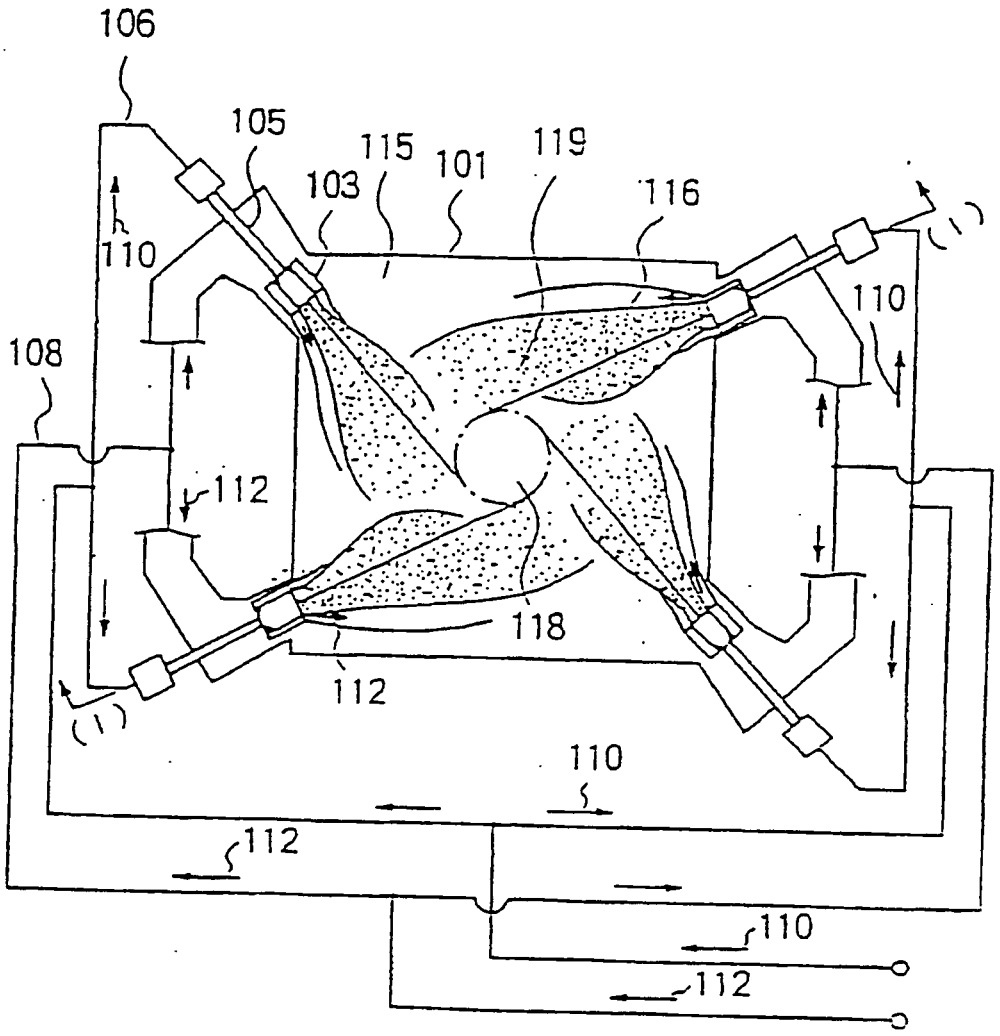

117
106
101
105
114
113
115
116
103
102
104
(II)
(II)
110
112
108
111
107
110
106
109
113

Fig. 2


106
105
115
101
119
103
116
110
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108
112
118
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110
112

Fig. 3(a)

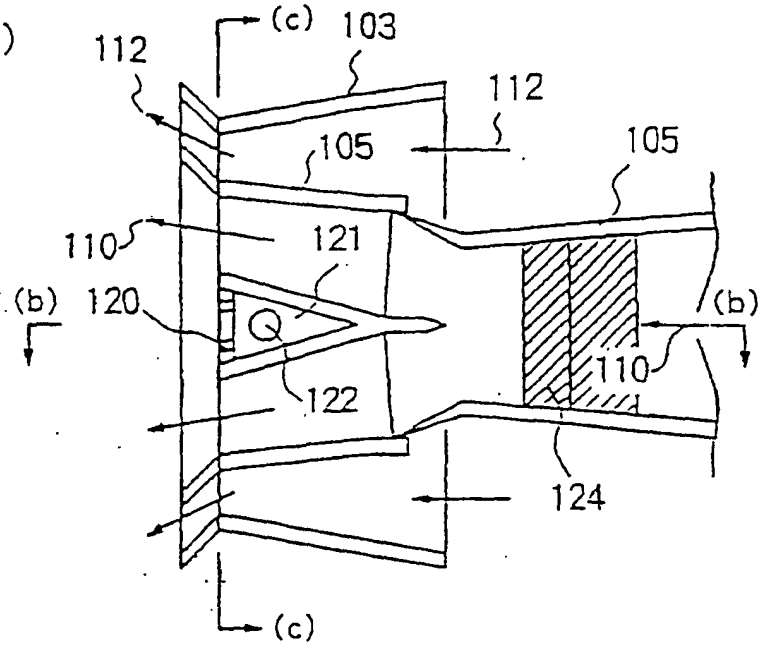


Fig. 3(b)

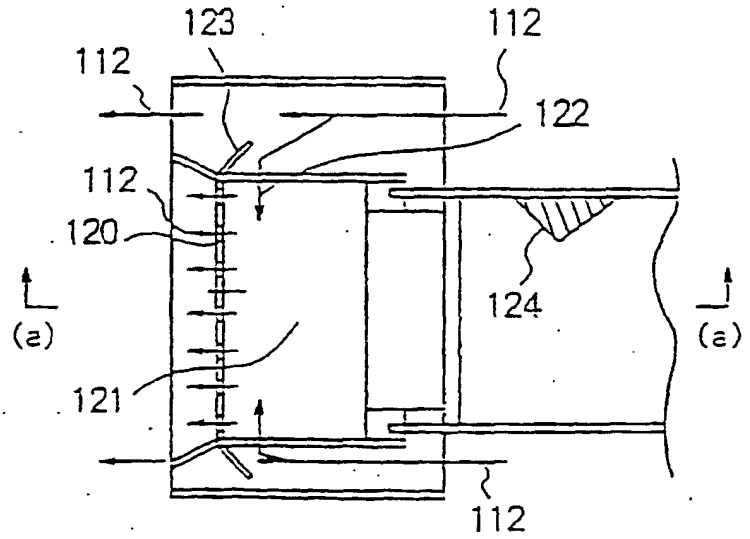
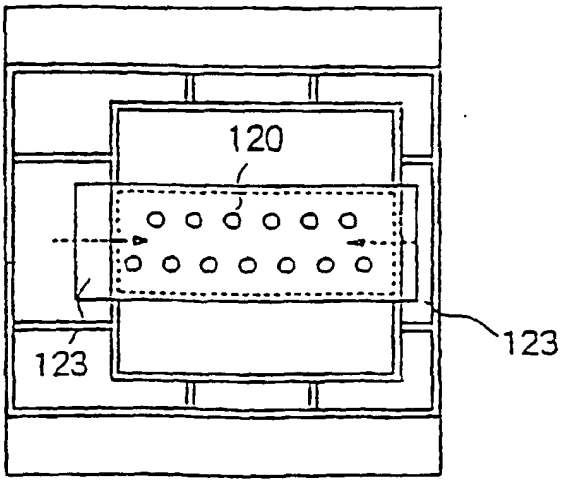


Fig. 3(c)



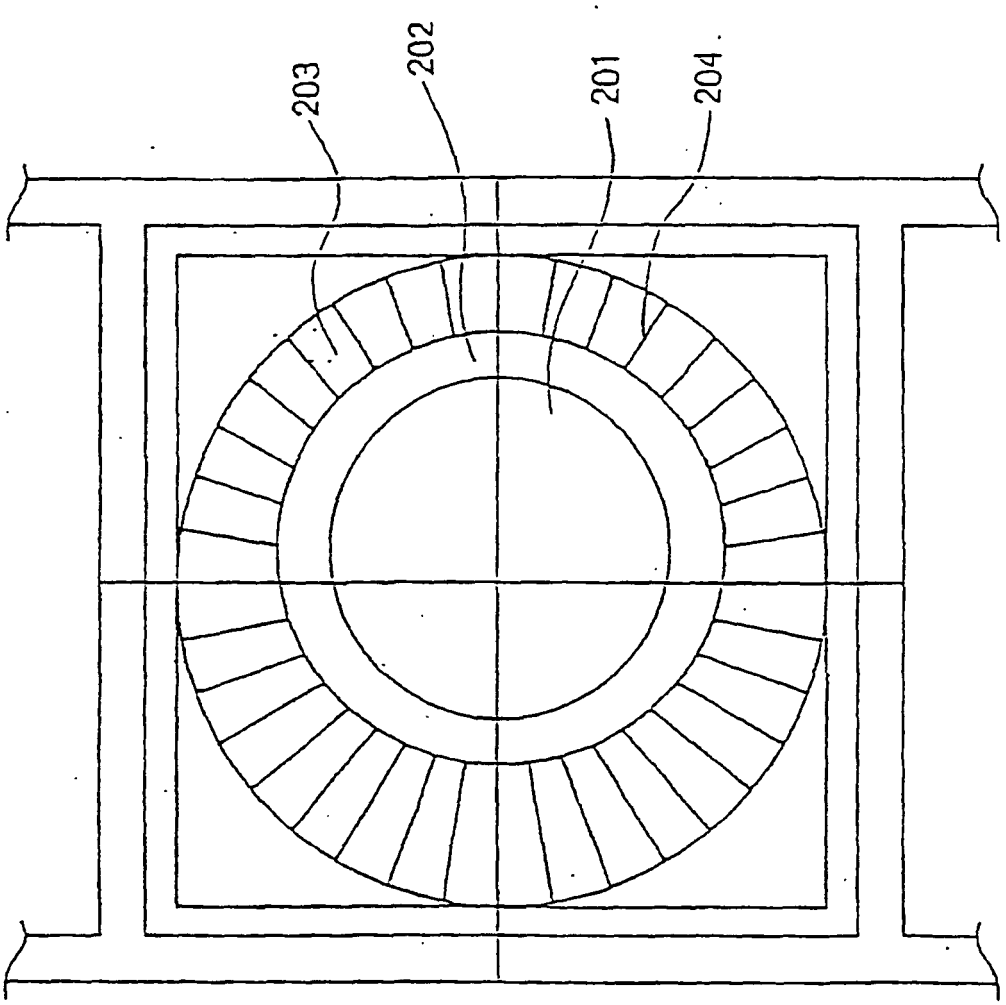


Fig. 4

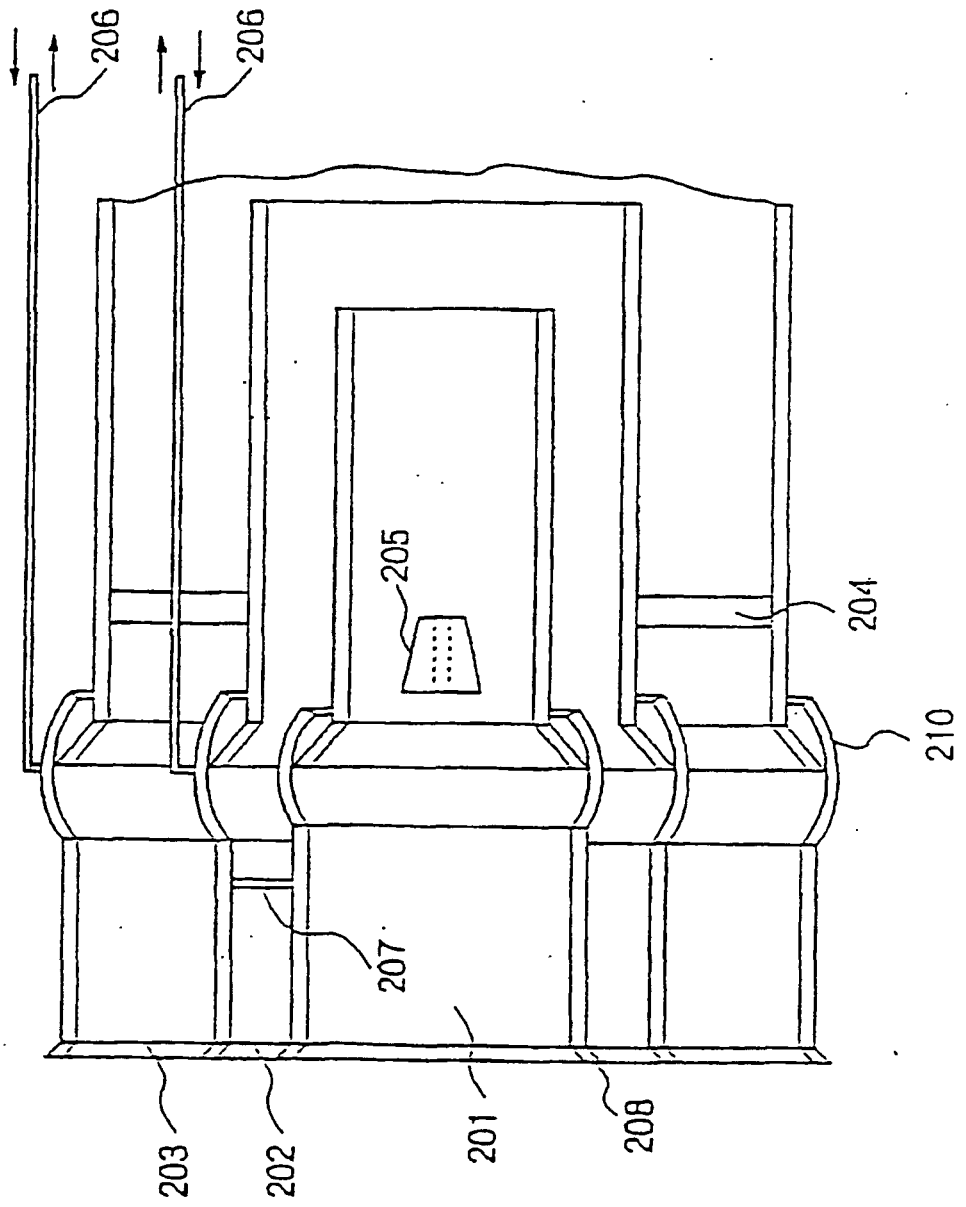


Fig. 5

Fig. 6(a)

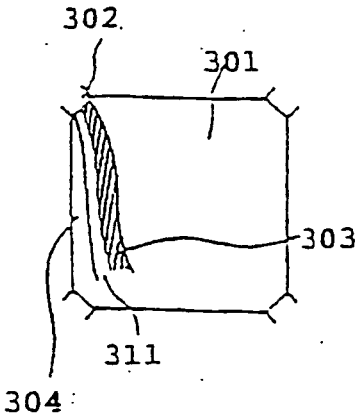


Fig. 6(b)

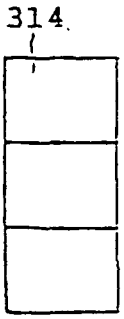
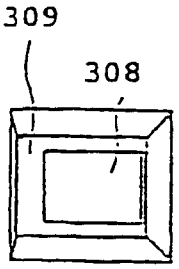


Fig. 6(c)



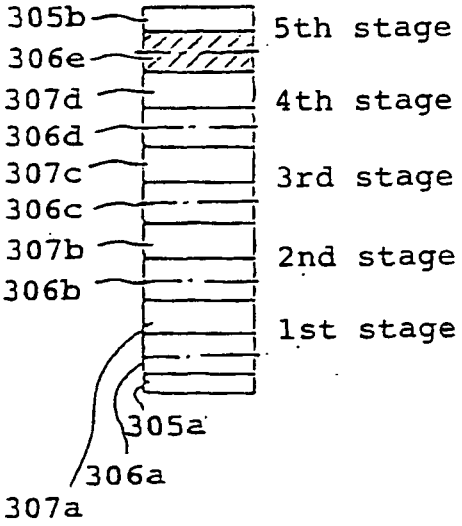


Fig. 6(d)

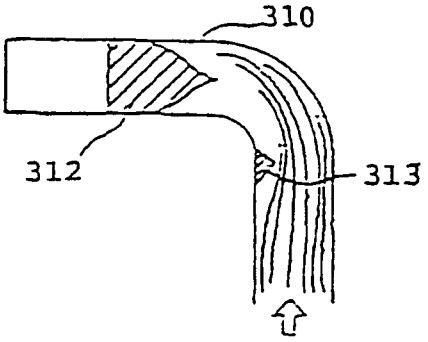


Fig. 7

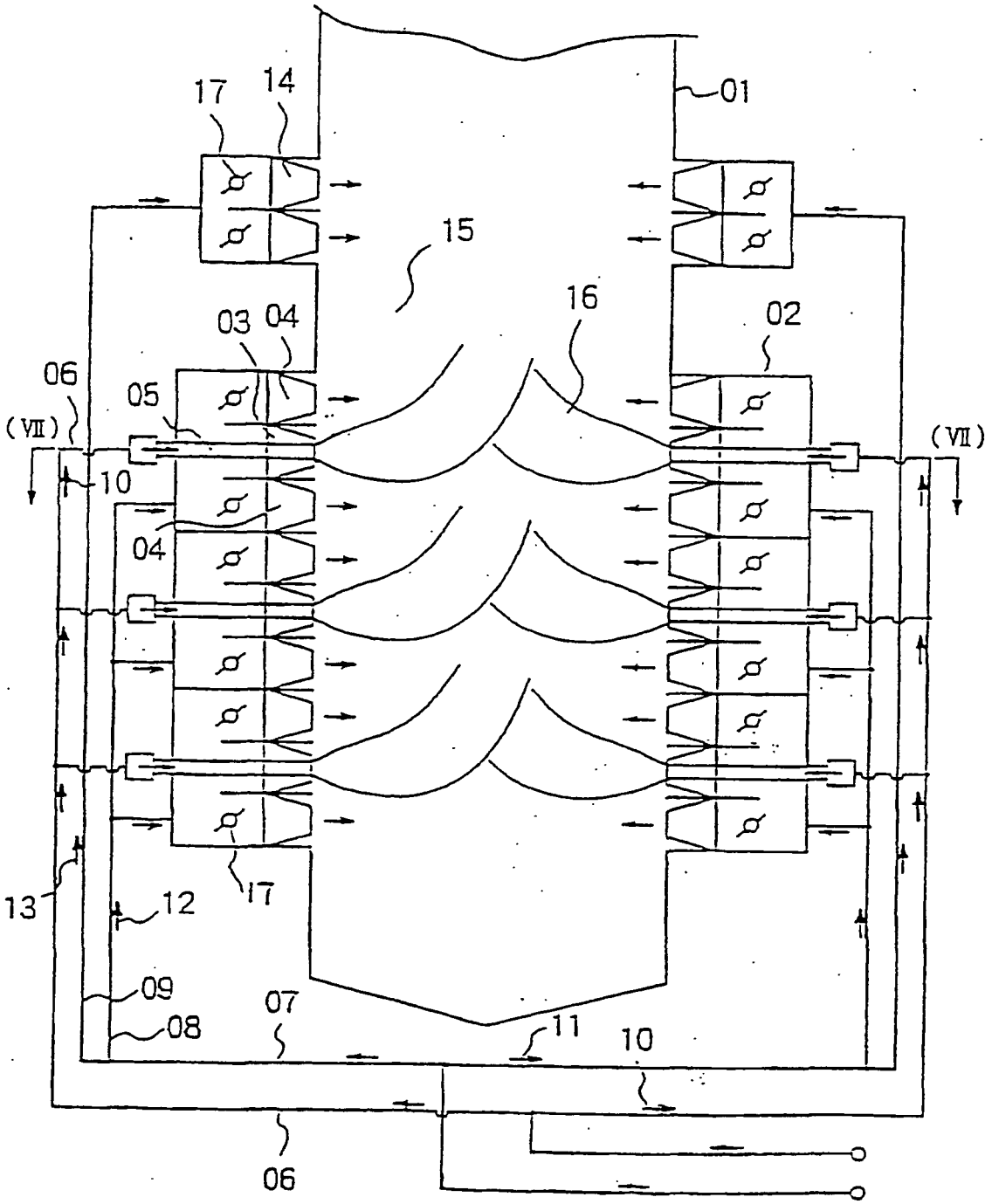


Fig. 8

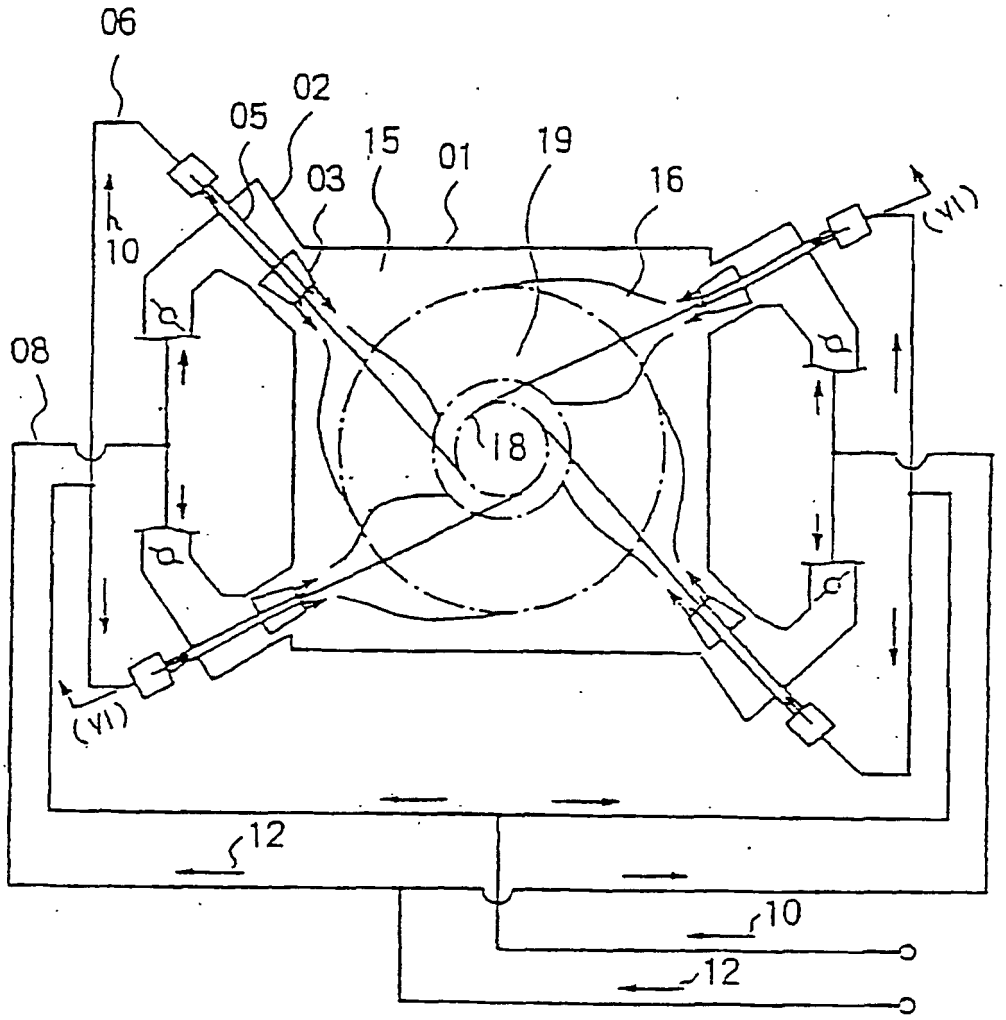


Fig. 9(a)

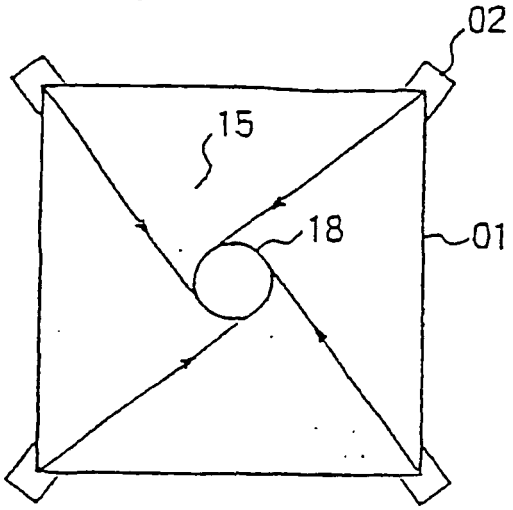


Fig. 9(b)

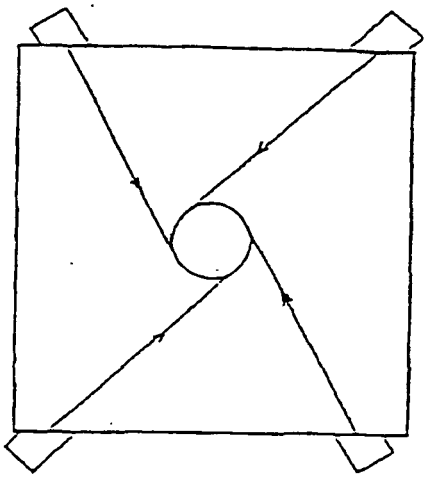


Fig. 9(c)

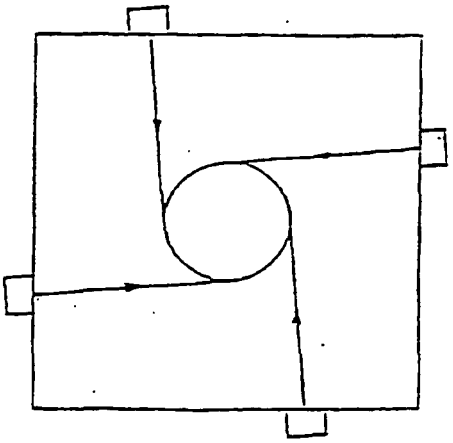


Fig. 9(d)

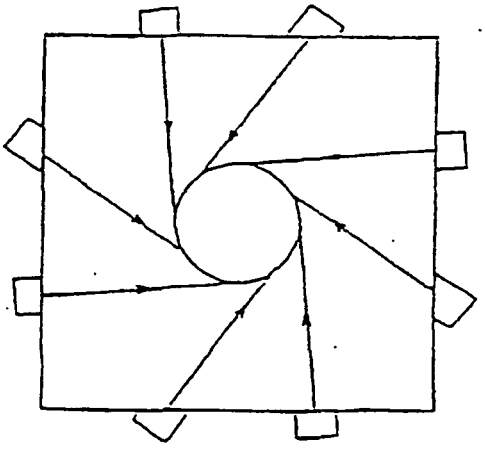


Fig. 10(a)

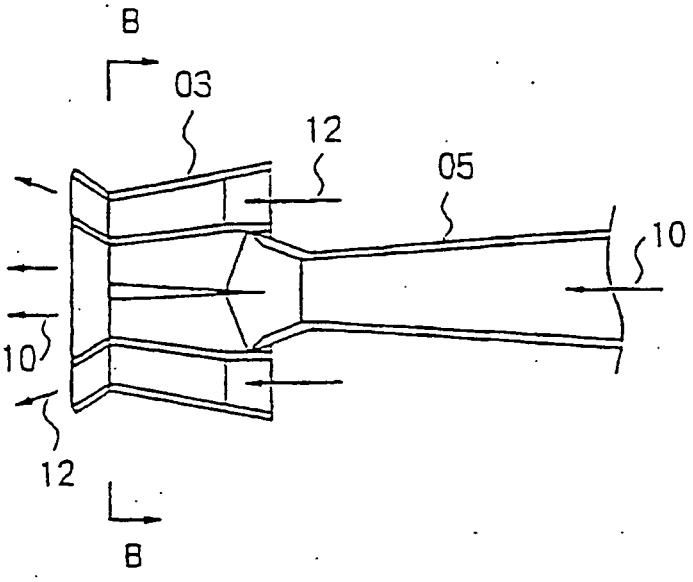


Fig. 10(b)