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(54) **NOZZLE TIP OF PULVERIZED COAL BURNER**

(57) Disclosed herein is a nozzle tip of a pulverized coal burner, which is capable of preventing the abrasion and separation of flame stabilizers due to the flow of pulverized coal. The nozzle tip includes an inner tubular body (100) having a first passage (120) in which pulverized coal introduced into the inner tubular body (100) flows, an outer tubular body (200) installed outside the inner tubular body (100) while being spaced apart therefrom, and at least one guide plate (300) installed to partition the first passage (120). The nozzle tip further com-

prises:
a plurality of flame stabilizers (400) arranged in a row at the upper and/or lower side in the inner tubular body (100),
wherein each of the flame stabilizers (400) has an inclined surface (420, 1420) formed on a side thereof facing a direction in which the pulverized coal flows in the first passage (120), the inclined surface (420, 1420) being inclined toward a central portion of the inner tubular body (100).

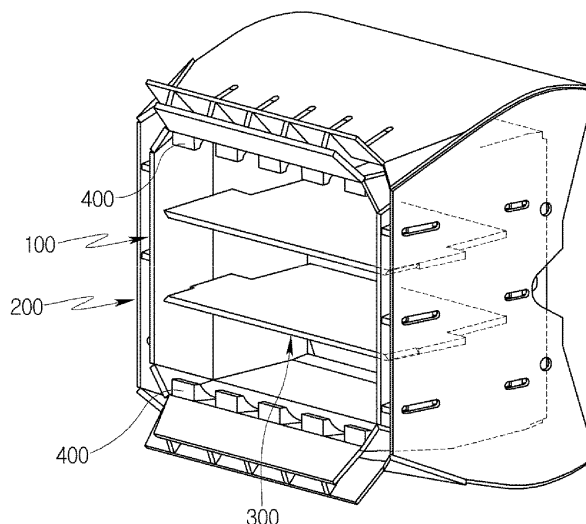


Fig. 6

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to Korean Patent Application No. 10-2016-0063430, filed on May 24, 2016.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] Exemplary embodiments of the present invention relate to a nozzle tip of a pulverized coal burner, and more particularly, to a nozzle tip of a pulverized coal burner, which is capable of preventing the abrasion and separation of flame stabilizers due to the flow of pulverized coal.

Description of the Related Art

[0003] In a tangential firing boiler, the nozzle tip of a coal burner is generally disposed at a corner within a combustion chamber.

[0004] In addition, the direction of the nozzle tip of the coal burner may vary when the boiler is operated. For example, the flame temperature in the combustion chamber may be regulated by changing the direction of the nozzle tip in the upward and downward directions, and the supply direction of coal as fuel may vary by changing the nozzle tip in the clockwise or counterclockwise direction of flame in the state in which the nozzle tip is away from the center of the combustion chamber.

[0005] The configuration of a conventional nozzle tip will be described below with reference to Figs. 1 to 3.

[0006] Fig. 1 is a perspective view illustrating the state in which a conventional nozzle tip is installed at the end of a fuel pipe. Fig. 2 is a perspective view for explaining the configuration of the conventional nozzle tip. Fig. 3 is a cross-sectional view of Fig. 2.

[0007] As illustrated in Fig. 1, a nozzle tip 20 is installed at the end of a fuel pipe 10, and the nozzle tip 20 has driver holes 14 and 16 formed at one side thereof so that an actuator is connected to the driver holes 14 and 16. The nozzle tip may vertically move about a bent shaft 12 by the operation of the actuator.

[0008] The nozzle tip may consist of a plurality of nozzle tips arranged in the combustion chamber in a coal burner. Only some of the nozzle tips are employed and the remaining nozzle tips may be used as spare parts.

[0009] Since the nozzle tip 20 is directly exposed to the combustion chamber, the nozzle tip 20 has a dual wall for an improvement in durability. Coal is supplied to the internal space of the nozzle tip, and a portion of air for combustion is supplied outside the internal space (to the space between the inside and the outside).

[0010] Hereinafter, the conventional nozzle tip 20 will be described in more detail with reference to Figs. 2 and 3. In the nozzle tip, an outer tubular body 40 is disposed

outside an inner tubular body 30, guide blades 50 are disposed inside the inner tubular body 30, and share bars 60 are disposed at the sides of the inner surface of the inner tubular body 30. A gap member is disposed between the inner tubular body 30 and the outer tubular body 40 to define a space portion.

[0011] In addition, one side of the inner tubular body 30 is connected to the end of the fuel pipe 10 by the bent shaft 12, with the consequence that the nozzle tip is assembled to the fuel pipe so as to bend the direction of the nozzle tip.

[0012] The inner and outer tubular bodies 30 and 40 form a square tubular body by welding the corners of four inner and outer panels.

[0013] The share bars 60 serve to pull flame toward the nozzle tip 20 by swirling air and pulverized coal. The share bars 60 are constituted as a single body and each has an elongated rectangular shape. In addition, one surface of the share bar 60 is fixed to the inner surface 32 of the inner tubular body 30 by welding (W), and particularly the respective share bars 60 are fixedly coupled to the front ends of the upper and lower sides of the inner tubular body 30.

[0014] However, one surface of each of the share bars 60 may be partially or entirely worn due to the collision with pulverized coal flowing by the guide blades 50.

[0015] In addition, since the nozzle tip 20 is exposed to high radiant heat in the combustion chamber, the welded portions of the share bars 60 may be cracked due to the radiant heat, resulting in the separation of the share bars from the nozzle tip.

[0016] If the share bars are worn or separated, the nozzle tip may not perform the specific function thereof. In particular, if one of the share bars constituted as a single body is separated, the share bars lose an original function for pulling flame toward the nozzle tip. Hence, there is a problem in the regulation of flame temperature and the assurance of nitrogen oxide (NOx).

SUMMARY OF THE INVENTION

[0017] An object of the present invention is to provide a nozzle tip of a pulverized coal burner, which is capable of preventing the abrasion and separation of flame stabilizers due to the flow of pulverized coal.

[0018] Other objects and advantages of the present invention can be understood by the following description, and become apparent with reference to the embodiments of the present invention. Also, it is obvious to those skilled in the art to which the present invention pertains that the objects and advantages of the present invention can be realized by the means as claimed and combinations thereof.

[0019] The object is solved by the features of the independent claims. Preferred embodiments are given in the dependent claims.

[0020] In accordance with an aspect of the present invention, a nozzle tip of a pulverized coal burner, which

includes an inner tubular body having a first passage in which pulverized coal introduced into the inner tubular body flows, an outer tubular body installed outside the inner tubular body while being spaced apart therefrom, and at least one guide plate installed to partition the first passage, includes a plurality of flame stabilizers arranged in a row at the and/or lower sides in the inner tubular body, wherein each of the flame stabilizers has an inclined surface formed on a side thereof facing a direction in which the pulverized coal flows in the first passage, the inclined surface being inclined toward a central portion of the inner tubular body.

[0021] Preferably, the flame stabilizers may be arranged at the front side of the nozzle tip.

[0022] Preferably, the flame stabilizers may be arranged being spaced apart from each other with a predetermined distance to the adjacent flame stabilizer on the upper and/or lower side of the inner tubular body.

[0023] Preferably, the distance is smaller than the width of the flame stabilizers.

[0024] Preferably, the flame stabilizers may be arranged in a row at each of the upper and the lower side in the inner tubular body.

[0025] The inclined surface may be formed such that the first passage is narrowed in the flow direction of the pulverized coal.

[0026] Alternatively, each of the flame stabilizers may include a flame stabilizer fixing portion fixed into the inner tubular body, and a wear-resistant member detachably coupled to a side of the flame stabilizer fixing portion facing the direction in which the pulverized coal flows in the first passage, and the wear-resistant member may have an inclined surface formed such that the first passage is narrowed in the direction in which the pulverized coal flows in the first passage.

[0027] The inclined surface may be a flat surface.

[0028] The inclined surface may form an angle of 30 to 50° with an inner surface of the inner tubular body.

[0029] Alternatively, the inclined surface may be a curved surface.

[0030] The inclined surface may have a quadrant shape that is concave toward the central portion of the inner tubular body.

[0031] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view illustrating the state in which a conventional nozzle tip is installed at the end

of a fuel pipe;

Fig. 2 is a perspective view for explaining the configuration of the conventional nozzle tip;

Fig. 3 is a cross-sectional view of Fig. 2;

Fig. 4 is a perspective view illustrating a nozzle tip of a pulverized coal burner according to a first embodiment of the present invention;

Fig. 5 is a cross-sectional view of Fig. 4;

Fig. 6 is a perspective view illustrating a nozzle tip of a pulverized coal burner according to a second embodiment of the present invention;

Fig. 7 is a cross-sectional view of Fig. 6;

Fig. 8 is a perspective view illustrating a nozzle tip of a pulverized coal burner according to a third embodiment of the present invention;

Fig. 9 is a perspective view illustrating a nozzle tip of a pulverized coal burner according to a fourth embodiment of the present invention;

Fig. 10 is a view illustrating the flow temperature distribution in the conventional nozzle tip; and

Fig. 11 is a view illustrating the flow temperature distribution in the nozzle tip of a pulverized coal burner according to the first embodiment of the present invention.

DESCRIPTION OF SPECIFIC EMBODIMENTS

[0033] Hereinafter, a nozzle tip of a pulverized coal burner according to exemplary embodiments of the present invention will be described below in detail with reference to Figs. 4 to 11.

[0034] The terminology used herein should be determined in consideration of functionality of the present invention, and it may be variable depending on a user's or operator's intention or customs in the art. The present invention may be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the concept of the invention to those skilled in the art.

[0035] In certain embodiments, description irrelevant to the present invention may be omitted to avoid obscuring appreciation of the disclosure. Throughout the disclosure, like reference numerals refer to like parts throughout the various figures and embodiments of the present invention. In the description, it will be understood that when a component is referred to as "comprising/including" any component, it does not exclude other components, but can further comprises the other components unless otherwise specified.

[0036] Fig. 4 is a perspective view illustrating a nozzle tip of a pulverized coal burner according to a first embodiment of the present invention. Fig. 5 is a cross-sectional view of Fig. 4. Fig. 6 is a perspective view illustrating a nozzle tip of a pulverized coal burner according to a second embodiment of the present invention. Fig. 7 is a cross-sectional view of Fig. 6. Fig. 8 is a perspective view

illustrating a nozzle tip of a pulverized coal burner according to a third embodiment of the present invention. Fig. 9 is a perspective view illustrating a nozzle tip of a pulverized coal burner according to a fourth embodiment of the present invention. Fig. 10 is a view illustrating the flow temperature distribution in the conventional nozzle tip. Fig. 11 is a view illustrating the flow temperature distribution in the nozzle tip of a pulverized coal burner according to the first embodiment of the present invention.

[0037] In general, a coal-fired thermal power plant produces electric power using heat generated by burning pulverized coal. A coal pulverizer pulverizes coal in a particle form to produce pulverized coal, and supplies the pulverized coal to a damper through a conduit. The pulverized coal is mixed with air at a certain ratio in the damper, and the mixed pulverized coal and air are supplied into a furnace. The water in a water pipe is vaporized by the combustion of the pulverized coal supplied to the furnace, and electric power is produced by rotating a turbine using the water vapor. In the coal-fired thermal power plant, a burner nozzle tip corresponds to the end portion of a transfer device that supplies the mixed pulverized coal and air into the furnace, and the burner nozzle tip generally consists of a plurality of nozzle tips installed in the furnace.

[0038] Although the nozzle tip according to exemplary embodiments of the present invention is described below as being used in the furnace of the coal-fired thermal power plant, the present invention is not limited thereto. The nozzle tip may be applied to all types of burners to which fuel is supplied.

[0039] First, the nozzle tip of a pulverized coal burner according to the first embodiment of the present invention will be described with reference to Figs. 4, 5, 10, and 11.

[0040] The nozzle tip of a pulverized coal burner according to the first embodiment of the present invention generally includes an inner tubular body 100, an outer tubular body 200, at least one guide plate 300, and a plurality of flame stabilizers 400.

[0041] The inner tubular body 100 and the outer tubular body 200, which is installed outside the inner tubular body 100 while being spaced apart therefrom, form a dual wall. A spacer is disposed between the inner and outer tubular bodies 100 and 200 so that they may be maintained in the state in which they are spaced apart from each other.

[0042] Each of the inner and outer tubular bodies 100 and 200 may have any tubular shape so as to serve as a passage for the flow of fluid. In the embodiment, the inner tubular body 100 forms a square tubular body by welding a plurality of inner panels, and the outer tubular body 200 forms a square tubular body by welding a plurality of outer panels.

[0043] Hereinafter, the side in which pulverized coal is introduced into the inner tubular body 100 will be referred to as a "rear", and the side in which the introduced pulverized coal is discharged from the inner tubular body 100 will be referred to as a "front"

[0044] The inner tubular body 100 has a first passage

120 which is formed in forward and rearward directions therein so that pulverized coal is introduced into and flows in the first passage 120. The pulverized coal and air introduced rearward through the first passage 120 are discharged forward, and flame is formed close to the front of the first passage 120.

[0045] In addition, in order to help the discharged pulverized coal to be smoothly burned, air may be supplied by the outer tubular body 200 in a flame direction in a second passage 220 which is formed between the outer and inner tubular bodies.

[0046] A bent shaft (not shown) may be installed to one side of the outer portion of the inner tubular body 100 so as to be installed to a fuel pipe. The flame in a furnace may be adjusted by changing the discharge direction of pulverized coal in upward and downward directions depending on the temperature in the furnace.

[0047] Although not shown in the drawings, a cover tubular body may be coupled to the fuel pipe at the rear of the outer tubular body 200 so as to cover a portion of the fuel pipe.

[0048] The guide plate 300 may be horizontally installed inside the inner tubular body 100, in order to guide the introduction direction of pulverized coal and partition the first passage 120.

[0049] The guide plate 300 allows the mixture of pulverized coal and air discharged from the inner tubular body 100 to uniformly flow. When pulverized coal is discharged from the nozzle tip in the upward or downward direction, the guide plate 300 may prevent the mixture of pulverized coal and air from being concentrated upward or downward in the first passage 120.

[0050] The flame stabilizers 400 are arranged in a row at each of upper and lower sides in the inner tubular body 100. The flame stabilizers 400 may be installed at the front ends of the inner tubular body 100, to which pulverized coal is discharged through the first passage 120, in order to actively mix fuel and oxidizer and perform advanced ignition.

[0051] In addition, the flame stabilizers 400 serve to pull flame toward the nozzle tip by swirling air and pulverized coal.

[0052] The number of flame stabilizers may vary according to the size of the nozzle tip, and is preferably two to six. Seven or more flame stabilizers may be provided. However, if the number of flame stabilizers is more than enough, it may take a lot of time and labor to manufacture the nozzle tip. Therefore, it is preferable to provide an adequate number of flame stabilizers.

[0053] Through the arrangement of a plurality of flame stabilizers 400, even when some of the flame stabilizers are separated, the function of the flame stabilizers may be maintained by the remaining flame stabilizers.

[0054] The flame stabilizers 400 may be fixed to the inner surface of the inner tubular body 100 by welding or by separate members such as bolts. Specifically, the inner tubular body is formed with holes for the installation of the flame stabilizers, and the flame stabilizers are

formed with holes at positions corresponding to the holes of the inner tubular body. Subsequently, after pins are simultaneously inserted into the holes of the inner tubular body and the holes of the flame stabilizers, the flame stabilizers may be coupled to the inner tubular body by welding the flame stabilizers to the inner tubular body and welding the pins to the outside of the inner tubular body.

[0055] In addition, each of the flame stabilizers 400 is preferably made of a material having high durability to abrasion and damage, and may be made of a high-hardness material such as ceramic or cemented carbide. The ceramic may include, for example, silicon carbide, alumina, and a mixture of alumina and zirconia, and the cemented carbide may include, for example, tungsten carbide (WC). However, the present invention is not limited thereto.

[0056] The pulverized coal mixed with air flows at a high speed in the first passage 120 of the inner tubular body, and thus pulverized coal particles collide with the flame stabilizers 400.

[0057] In order to prevent the abrasion of the flame stabilizers 400 due to collision according to the flow of pulverized coal, each of the flame stabilizers 400 has an inclined surface 420 which is formed on the side thereof facing the direction in which pulverized coal flows in the first passage 120 so as to be inclined toward the central portion of the inner tubular body 100.

[0058] As illustrated in Fig. 5, since pulverized coal flows from the rear to the front in the first passage 120, the inclined surface 420 is formed on the rear side of the flame stabilizer 400.

[0059] Accordingly, since the inclined surface 420 is formed on the side of the flame stabilizer 400, which collides with pulverized coal, the pulverized coal collides obliquely instead of vertically with the rear side of the flame stabilizer 400. Consequently, the momentum of pulverized coal particles may be dispersed and the wear resistance of the flame stabilizer may be enhanced.

[0060] This may be seen in Figs. 10 and 11. Fig. 10 is a view illustrating the flow temperature distribution in the conventional nozzle tip. Fig. 11 is a view illustrating the flow temperature distribution in the nozzle tip of a pulverized coal burner according to the first embodiment of the present invention. In the conventional nozzle tip, it may be seen that the temperature around the side of the flame stabilizer facing the flow direction of pulverized coal is very high due to collision since the rear side of the flame stabilizer is vertically formed. However, in the nozzle tip according to the first embodiment of the present invention, it may be seen that the temperature of the rear side of the flame stabilizer is not high.

[0061] In addition, when comparing the nozzle tip according to the first embodiment of the present invention with the conventional nozzle tip, there is no change in flow pattern such as a reduction in recirculation region. In addition, it is seen that the flow rates in line A at the outlets of both nozzle tips to which pulverized coal is dis-

charged are similar to each other.

[0062] In addition, since the conventional nozzle tip is exposed to high-temperature environment for a long time, various ingredients of pulverized coal flowing in the first passage are affected by high temperature. For this reason, the pulverized coal may be attached to the inner surface of the inner tubular body or the flame stabilizer, and hence a slagging phenomenon may occur.

[0063] However, since pulverized coal flows along the inclined surface 420 of the flame stabilizer in the present invention, pulverized coal particles are not cumulatively attached to the flame stabilizer and the flow of pulverized coal is not reduced. Therefore, it is possible to effectively maintain the function of the nozzle tip.

[0064] As illustrated in Fig. 5, in the first embodiment, the inclined surface 420 is a flat surface. Specifically, the front side of the flame stabilizer 400 forms an angle of 90° with the inner surface of the inner tubular body 100, and the inclined surface 420 is inclined such that the width of the flame stabilizer is narrowed toward the central portion of the inner tubular body 100 from the inner surface thereof in the cross-section of the nozzle tip.

[0065] In this case, the inclined surface 420 preferably forms an angle of 30 to 50° with the inner surface of the inner tubular body 100. When the angle is less than 30°, the inclined surface is elongated. On the other hand, when the angle is more than 50°, the momentum of pulverized coal particles may not be effectively dispersed in the event that the inclined surface collides with pulverized coal flowing in the first passage 120.

[0066] Since the flame stabilizer 400 has a wide area compared to the conventional flame stabilizer having a rectangular plate shape and is fixed to the inner surface of the inner tubular body 100, it is possible to prevent the separation of the flame stabilizer due to abrasion.

[0067] As describe above, the inclined surface may be integrally formed on the flame stabilizer. Alternatively, in a third embodiment illustrated in Fig. 8, each of flame stabilizers includes a flame stabilizer fixing portion 3400 which is fixed into an inner tubular body and a wear-resistant member 3500 which is detachably coupled to the side of the flame stabilizer fixing portion 3400, facing the direction in which pulverized coal flows in a first passage 120. The wear-resistant member 3500 may have an inclined surface 3520 formed such that the first passage 120 is narrowed in the direction in which pulverized coal flows in the first passage 120.

[0068] That is, the flame stabilizer may have a structure in which the wear-resistant member 3500, having the inclined surface 3520 formed such that the first passage 120 is narrowed in the direction in which pulverized coal flows in the first passage 120, is detachably coupled to the flame stabilizer fixing portion 3400 having a conventional elongated rectangular plate shape as illustrated in Fig. 3. The wear-resistant member 3500 is detachably coupled to the side of the flame stabilizer fixing portion 3400, facing the direction in which pulverized coal flows in the first passage 120.

[0069] Accordingly, since the inclined surface 3520 of the wear-resistant member, with which pulverized coal collides, is formed on the side of the flame stabilizer fixing portion 3400, with which pulverized coal does not directly collide, the pulverized coal collides obliquely instead of vertically with the rear side of the wear-resistant member 3500. Consequently, the momentum of pulverized coal particles may be dispersed and the wear resistance of the flame stabilizer may be enhanced, similar to the first embodiment.

[0070] Moreover, since the wear-resistant member 3500 is detachably coupled to the flame stabilizer fixing portion 3400, the wear-resistant member 3500 may be attached to the conventional flame stabilizer. Thus, only the wear-resistant member may be replaced to thereby reduce replacement costs, and the function of the flame stabilizer may be consistently maintained during the replacement.

[0071] According to the third embodiment, the flame stabilizer fixing portion 3400 may have a rectangular shape, and the wear-resistant member 3500 may have a triangular shape while the inclined surface 3520 is a flat surface. In this case, the inclined surface 3520 preferably forms an angle of 30 to 50° with the inner surface of the inner tubular body 100. The wear-resistant member 3500 may be coupled to the flame stabilizer fixing portion 3400 by welding or bolting. Alternatively, the wear-resistant member 3500 may be coupled to the flame stabilizer fixing portion 3400 in such a manner that the protrusion of the wear-resistant member 3500 is fitted into the groove of the flame stabilizer fixing portion 3400.

[0072] Next, a nozzle tip of a pulverized coal burner according to a second embodiment of the present invention will be described with reference to Figs. 6 and 7. The nozzle tip according to the second embodiment differs from the nozzle tip according to the first embodiment in terms of the structure of an inclined surface, and the remaining structures are identical to each other in both embodiment. Therefore, only a different structure will be described without the description of the same structure.

[0073] In the second embodiment, as illustrated in Fig. 7, an inclined surface 1420 is a curved surface. Specifically, the front side of the stabilizer 400 forms an angle of 90° with the inner surface of the inner tubular body 100, and the inclined surface 1420 may be formed such that the width of the flame stabilizer is narrowed toward the central portion of the inner tubular body 100 from the inner surface thereof in the cross-section of the nozzle tip. That is, the inclined surface 1420 may have a quadrant shape that is concave toward the central portion of the inner tubular body 100.

[0074] As described above, the inclined surface may be integrally formed on the flame stabilizer. Alternatively, in a fourth embodiment illustrated in Fig. 9, each of flame stabilizers includes a flame stabilizer fixing portion 4400 which is fixed into an inner tubular body and a wear-resistant member 4500 which is detachably coupled to the side of the flame stabilizer fixing portion 4400, facing

the direction in which pulverized coal flows in a first passage 120, similar to the third embodiment. The wear-resistant member 4500 may have an inclined surface 4520 formed such that the first passage 120 is narrowed in the direction in which pulverized coal flows in the first passage 120.

[0075] That is, the flame stabilizer may have a structure in which the wear-resistant member 4500, having the inclined surface 4520 formed such that the first passage 120 is narrowed in the direction in which pulverized coal flows in the first passage 120, is detachably coupled to the flame stabilizer fixing portion 4400 having a conventional elongated rectangular plate shape as illustrated in Fig. 3. The wear-resistant member 4500 is detachably coupled to the side of the flame stabilizer fixing portion 4400, facing the direction in which pulverized coal flows in the first passage 120.

[0076] According to the fourth embodiment, the flame stabilizer fixing portion 4400 may have a rectangular shape, and the wear-resistant member 4500 may have the inclined surface 4520 which is curved at the side of the flame stabilizer fixing portion 4400 facing the flow direction of pulverized coal. The curved surface has a quadrant shape that is concave toward the central portion of the inner tubular body 100. The wear-resistant member 4500 may be coupled to the flame stabilizer fixing portion 4400 by welding or bolting. Alternatively, the wear-resistant member 4500 may be coupled to the flame stabilizer fixing portion 4400 in such a manner that the protrusion of the wear-resistant member 4500 is fitted into the groove of the flame stabilizer fixing portion 4400.

[0077] In addition, the nozzle tip according to the fourth embodiment may obtain the same effect as the nozzle tip according to the third embodiment.

[0078] Ultimately, it is possible to prevent the abrasion and separation of the flame stabilizers, to extend the service life of the nozzle tip, and to stably reduce NOx and UBC.

[0079] As is apparent from the above description, in accordance with a nozzle tip of a pulverized coal burner according to the present invention, an inclined surface is formed on the side of each of flame stabilizers or the wear-resistant member thereof, facing the direction in which pulverized coal flows in a first passage in the nozzle tip. Accordingly, the pulverized coal collides obliquely instead of vertically with the flame stabilizer or wear-resistant member, thereby enabling the momentum of pulverized coal particles to be dispersed and enabling the wear resistance of the flame stabilizer or the wear-resistant member to be enhanced.

[0080] In addition, since pulverized coal flows along the inclined surface of the flame stabilizer or the wear-resistant member, pulverized coal particles are not cumulatively attached to the flame stabilizer or the wear-resistant member and the flow of pulverized coal are not reduced. Therefore, it is possible to effectively maintain the function of the nozzle tip.

[0081] In addition, since the flame stabilizer has a wide

area compared to a conventional flame stabilizer having a rectangular plate shape and is fixed to the inner surface of an inner tubular body, it is possible to prevent the separation of the flame stabilizer due to abrasion.

[0082] As described above, it is possible to prevent the abrasion and separation of the flame stabilizers, to extend the service life of the nozzle tip, and to stably reduce NOx and UBC.

[0083] In addition, since the wear-resistant member is detachably coupled to the flame stabilizer, the wear-resistant member can be attached to an existing flame stabilizer. Furthermore, only the wear-resistant member can be replaced to thereby reduce replacement costs, and the function of the flame stabilizer can be consistently maintained during the replacement.

[0084] The present invention is not limited to the foregoing effects, and other effects thereof can be realized by the means as claimed and combinations thereof.

[0085] While the present invention has been described with respect to the specific embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

Claims

1. A nozzle tip of a pulverized coal burner, including an inner tubular body (100) having a first passage (120) in which pulverized coal introduced into the inner tubular body (100) flows, an outer tubular body (200) installed outside the inner tubular body (100) while being spaced apart therefrom, and at least one guide plate (300) installed to partition the first passage (120), the nozzle tip comprising:

a plurality of flame stabilizers (400) arranged in a row at the upper and/or lower side in the inner tubular body (100), wherein each of the flame stabilizers (400) has an inclined surface (420, 1420) formed on a side thereof facing a direction in which the pulverized coal flows in the first passage (120), the inclined surface (420, 1420) being inclined toward a central portion of the inner tubular body (100).

2. The nozzle tip according to claim 1, wherein the flame stabilizers (400) are arranged at the front side of the nozzle tip.
3. The nozzle tip according to claim 1 or 2, wherein the flame stabilizers (400) are arranged being spaced apart from each other with a predetermined distance to the adjacent flame stabilizer (400) on the upper or lower side of the inner tubular body (100).
4. The nozzle tip according to any one of the preceding claims, wherein the flame stabilizers (400) are ar-

ranged in a row at each of the upper and the lower side in the inner tubular body (100).

5. The nozzle tip according to any one of the preceding claims, wherein the inclined surface (420, 1420) is formed such that the first passage (120) is narrowed in the flow direction of the pulverized coal.
6. The nozzle tip according to any one of the preceding claims, wherein each of the flame stabilizers (400) comprises:
 - a flame stabilizer fixing portion (3400, 4400) fixed into the inner tubular body (100); and
 - a wear-resistant member (3500, 4500) detachably coupled to a side of the flame stabilizer fixing portion (3400, 4400) facing the direction in which the pulverized coal flows in the first passage (120).
7. The nozzle tip according to claim 6, wherein the wear-resistant member (3500, 4500) has an inclined surface (3520, 4520) formed such that the first passage (120) is narrowed in the direction in which the pulverized coal flows in the first passage (120).
8. The nozzle tip according to any one of the preceding claims, wherein the inclined surface (420, 3520) is a flat surface.
9. The nozzle tip according to any one of the preceding claims, wherein the inclined surface (420, 3520) forms an angle of 30 to 50° with an inner surface of the inner tubular body (100).
10. The nozzle tip according to any one of the preceding claims 1-7, wherein the inclined surface (1420, 4520) is a curved surface.
11. The nozzle tip according to claim 10, wherein the inclined surface (1420, 4520) has a quadrant shape that is concave toward the central portion of the inner tubular body (100).
12. The nozzle tip according to any one of the preceding claims, wherein the outer tubular body (200) forms a second passage (220) with the inner tubular body (100).
13. The nozzle tip according to claim 12, wherein the second passage (220) is directed away from the front side of the first passage (120) at the front side of the nozzle tip.
14. The nozzle tip according to any one of the preceding claims, wherein the guide plate (300) is horizontally installed inside the inner tubular body (100).

15. Use of a nozzle tip according to any of the preceding claims in a coal fire thermal power plant.

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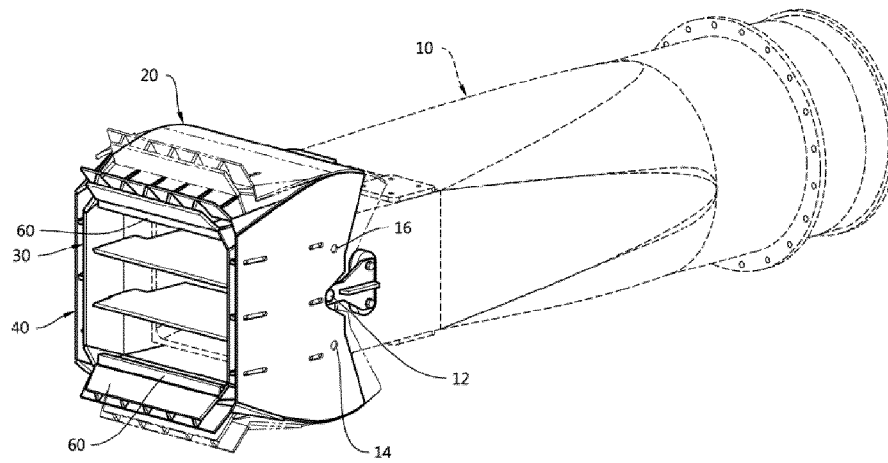


Fig. 1

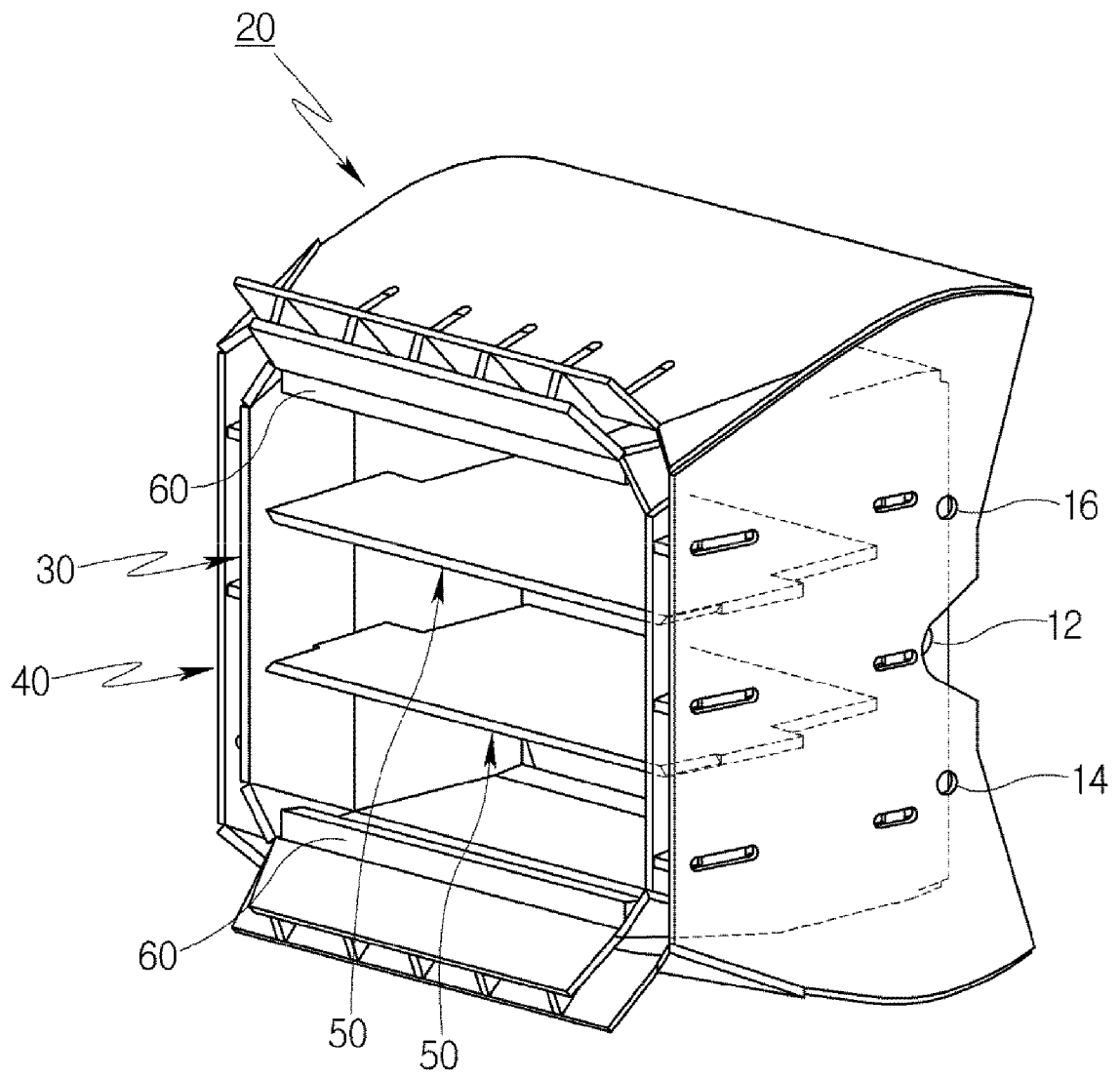


Fig. 2

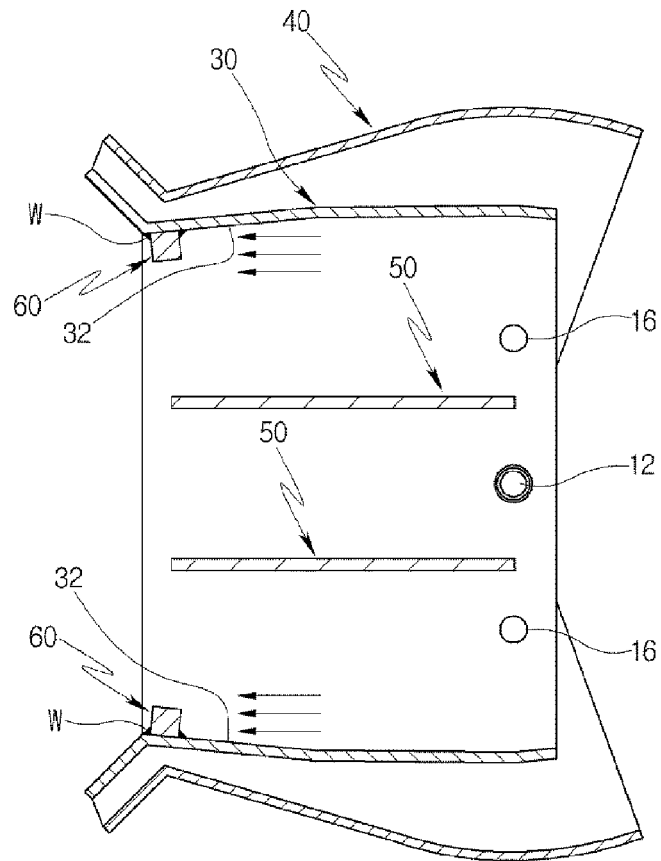


Fig. 3

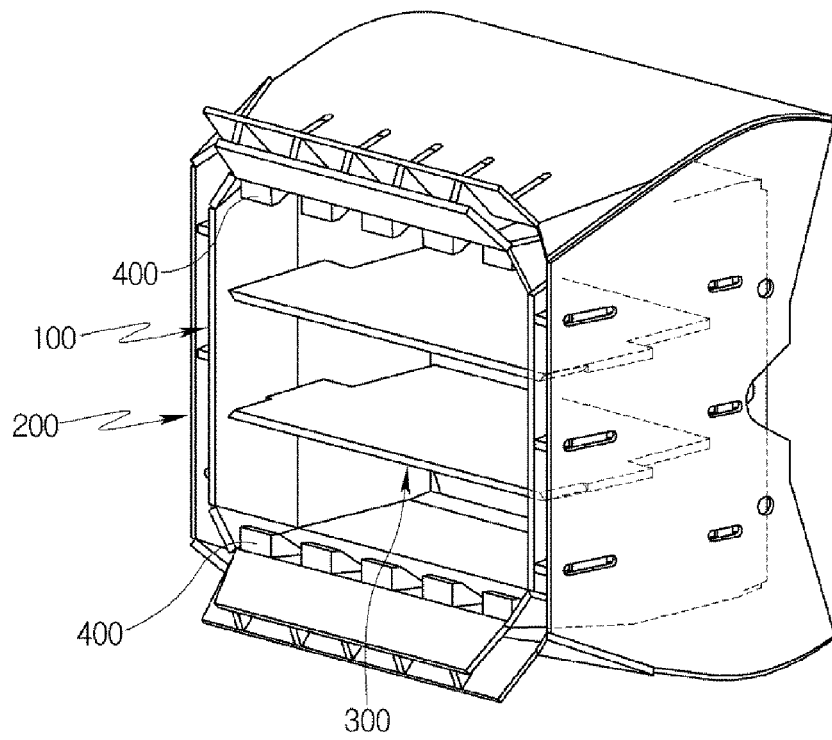


Fig. 4

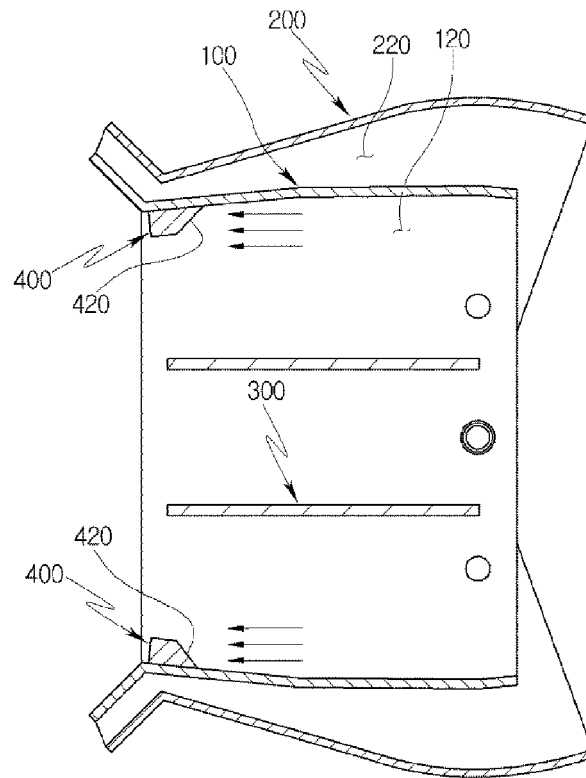


Fig. 5

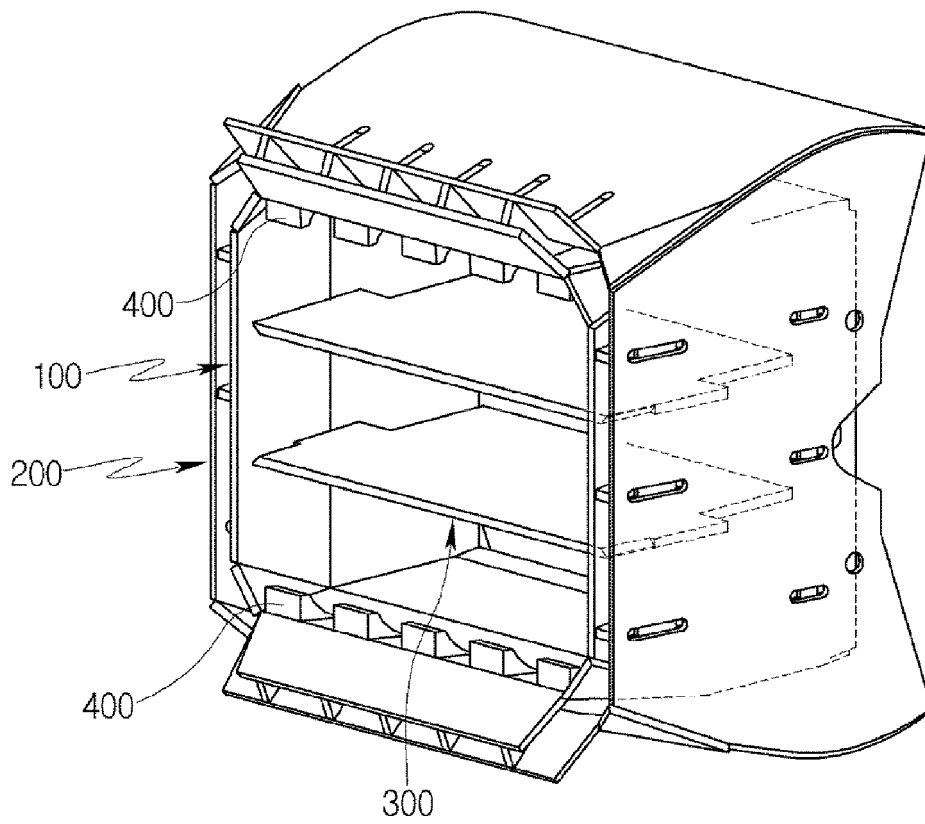


Fig. 6

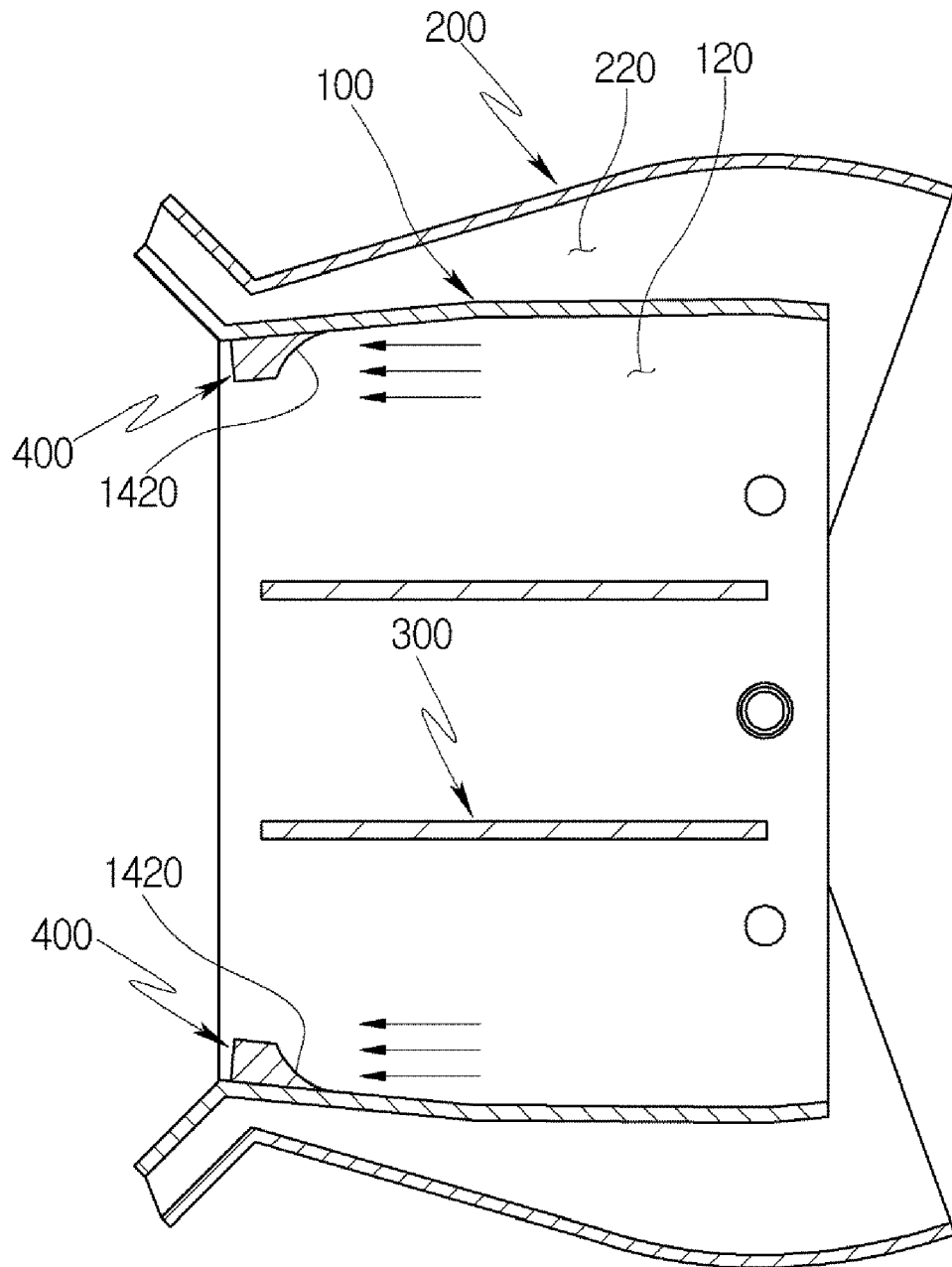


Fig. 7

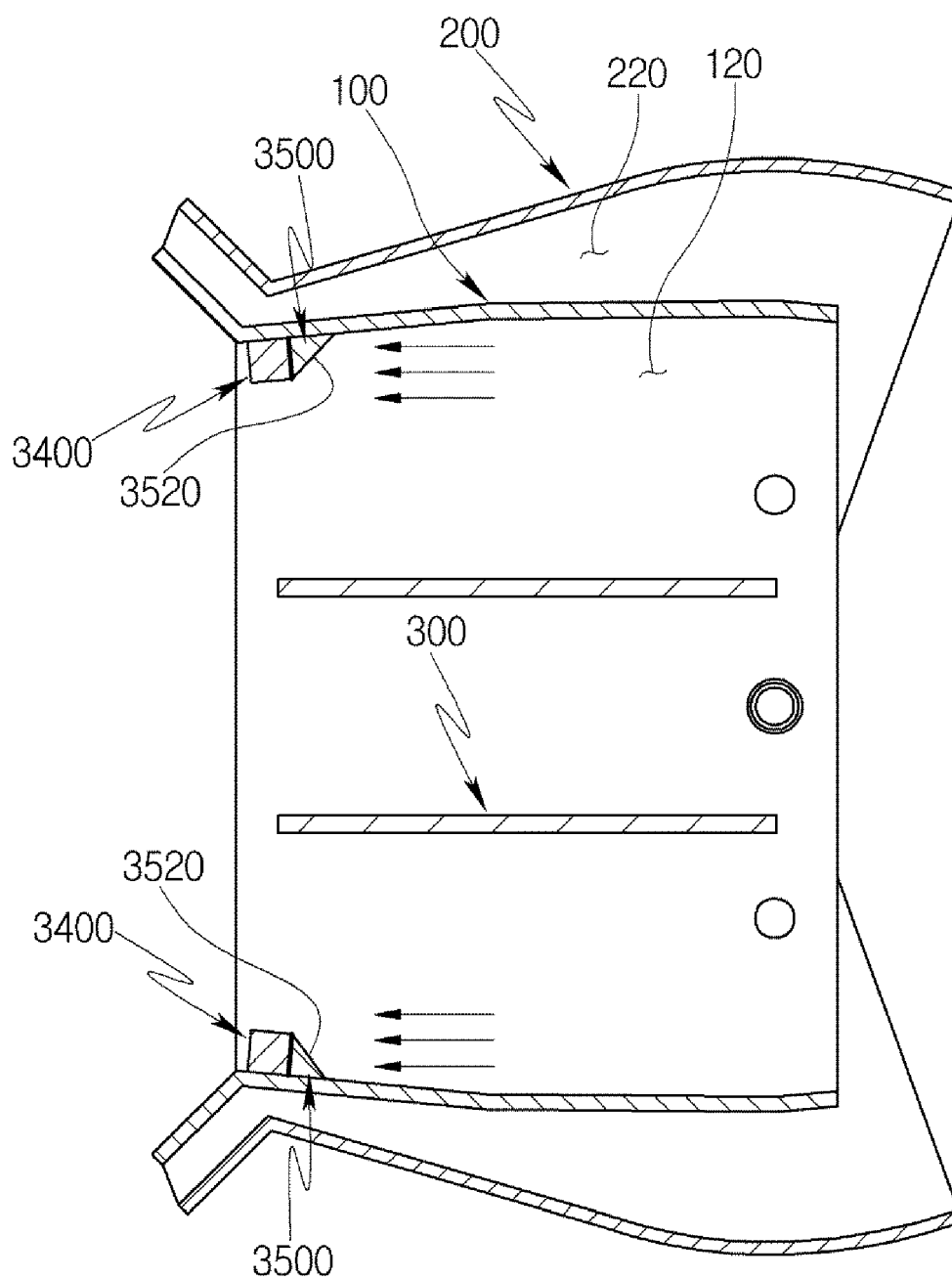


Fig. 8

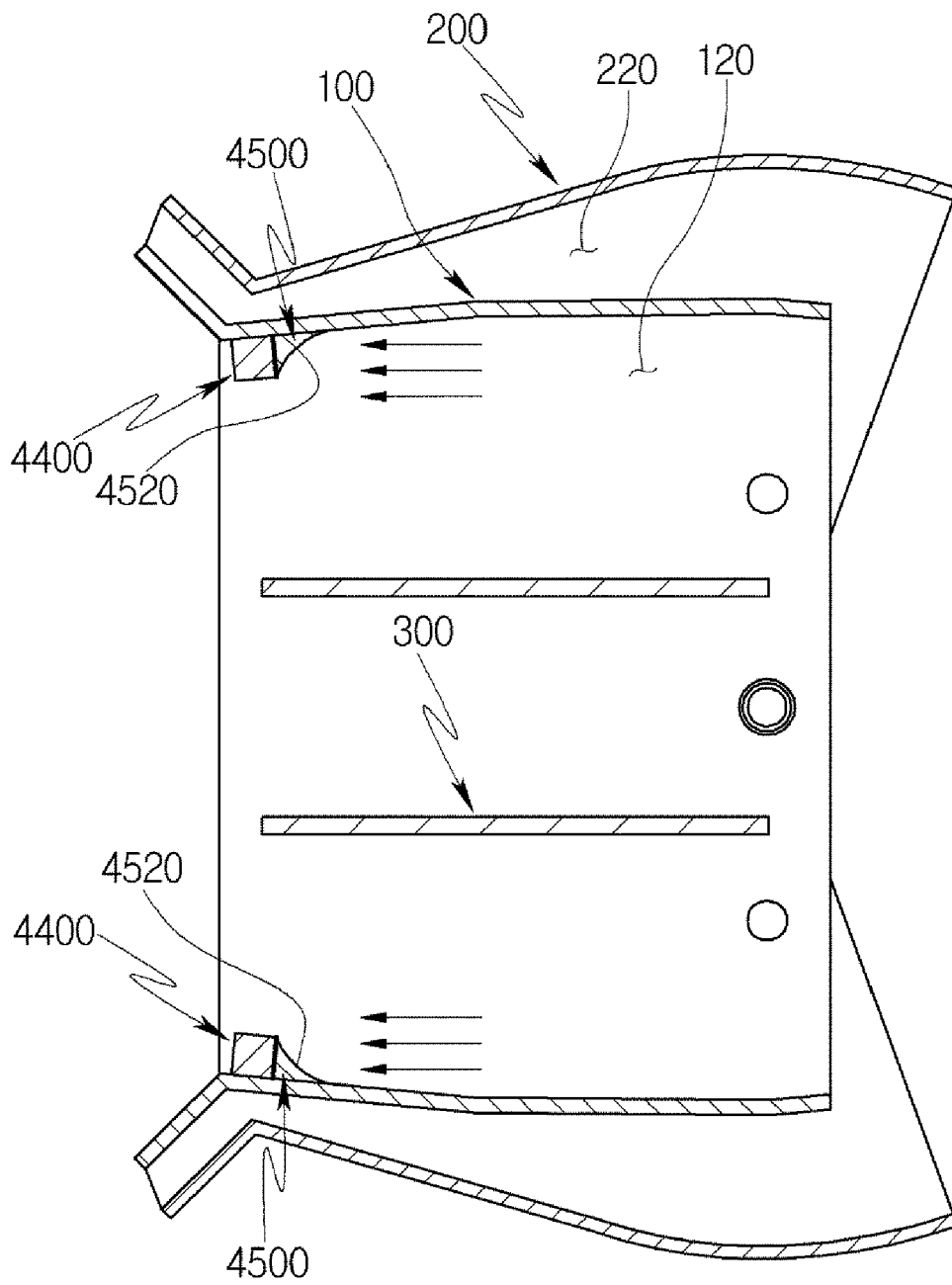


Fig. 9

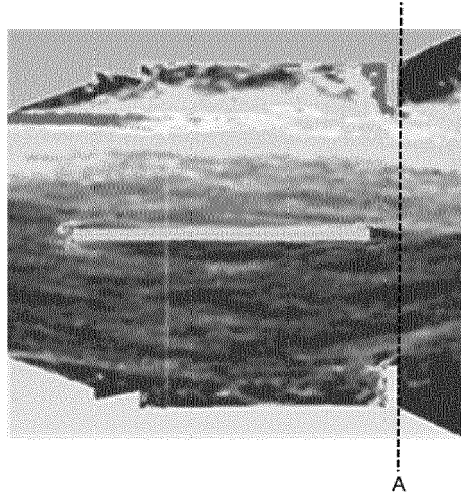


Fig. 10

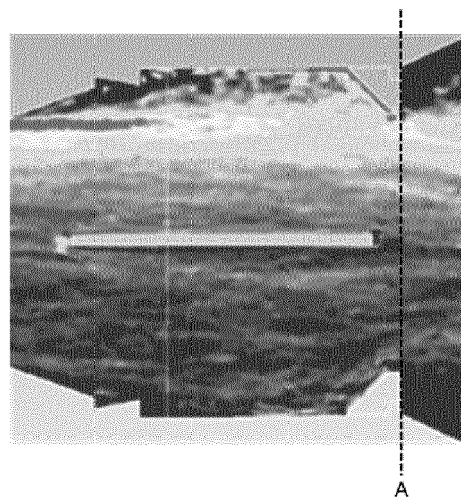


Fig. 11



EUROPEAN SEARCH REPORT

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EPO FORM 1503 03.02 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 94/05952 A1 (NORTHERN ENG IND [GB]; HUFTON PETER FREDERICK [GB]) 17 March 1994 (1994-03-17)	1-5,8,9, 12,14,15	INV. F23D1/00
Y	* page 1, lines 6-10 * * page 2, lines 23-35 * * page 5, lines 10-17 * * figures 1, 7 *	13	
X	WO 2010/081271 A1 (SHANGHAI BOILER WORKS LTD [CN]) 22 July 2010 (2010-07-22) * paragraphs [0011] - [0013] * * figures 1, 2 *	1-5,8, 12,14,15	
Y	KR 2012 0001185 A (DOOSAN HEAVY IND & AMP CONSTR [KR]) 4 January 2012 (2012-01-04) * paragraphs [0039] - [0044] * * figures 2, 3, 4, 5 *	13	
A		1-5,8, 12,14,15	
			TECHNICAL FIELDS SEARCHED (IPC)
			F23D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		21 June 2017	Vogl, Paul
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			



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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-5, 8-15

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

EP 16 20 4468

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-5, 8-15

Location and form of stabilizers, Second passage and Guide Plate

1.1. claims: 12, 13

Second passage

1.2. claim: 14

Guide plate

2. claims: 6, 7

Wear protection of stabilisers

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

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

EP 16 20 4468

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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21-06-2017

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REFERENCES CITED IN THE DESCRIPTION

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