Slugging is prevented from occurring in a pulverized coal burner.

A nozzle body 6, which is open to a furnace 1 and which injects pulverized coal together with primary air 14 transporting the coal to serve finally as combustion air, has an outer sleeve 8 and an inner sleeve 9 arranged in and coaxially of the sleeve 8. A fuel flow space 10 is formed between the sleeves 8 and 9. Straightening plates 29 are arranged on at least either of the sleeves 8 and 9 to project to the space 10 and extend axially of the nozzle body. The combustion air (primary air 14) carrying the pulverized coal passes through the space 10 and is injected.
PULVERIZED COAL BURNER

TECHNICAL FIELD

[0001] The present invention relates to a pulverized coal burner for a furnace such as coal-fired boiler which uses coal as fuel.

TECHNICAL BACKGROUND

[0002] In one of furnaces using coal as fuel, raw coal is pulverized into pulverized coal by a coal pulverizer and pulverized coal is mixed and fed with primary air into a pulverized coal burner where the pulverized coal is injected to the furnace for suspension combustion.

[0003] The conventional pulverized coal burner will be described in conjunction with FIG. 1.

[0004] In FIG. 1, reference numeral 1 denotes a furnace; and 2, a wall of the furnace 1.

[0005] A throat 3 is installed on the furnace wall 2 and a wind box 4 is arranged on a side away from the furnace 1. A pulverized coal burner 5 is arranged in the wind box 4 coaxially of the throat 3.

[0006] The pulverized coal burner 5 comprises a nozzle body 6 and a secondary air adjusting device 7 which surrounds a front end of the nozzle body 6.

[0007] The nozzle body 6 comprises an outer sleeve 8, an inner sleeve 9 coaxial of the sleeve 8 and an oil burner 11 arranged on an axis of the sleeve 9.

[0008] The outer sleeve 8 comprises a base (an end away from the furnace 1) 8a, an intermediate portion 8b contiguous with the base 8a and a front end 8c contiguous with the intermediate portion 8b. The base 8a is a cylinder with a constant radius of cross section; the intermediate portion 8b and the front end 8c are cylinders tapered with radii of cross section reduced toward the furnace 1, respectively. The front end 8c has a tapered angle greater than that of the intermediate portion 8b and therefore has reduced more greatly than those of the intermediate portion 8b.

[0009] The inner sleeve 9 comprises a cylindrical portion 9a and a front end 9c contiguous with the cylindrical portion 9a. The cylindrical portion 9a is a cylinder with a constant radius of cross section and extending adjacent to a front side of the outer sleeve intermediate portion 8b, and the front end 9c is tapered with a tapered angle similar to that of the outer sleeve front end 8c. Formed between the sleeves 8 and 9 is a hollow, cylindrical, fuel flow space 10 with an end open to the furnace 1.

[0010] The base (the end away from the furnace 1) of the outer sleeve 8 communicates with a primary air feed pipe 12 through which primary air 14 carrying the pulverized coal to finally serve as combustion air as well as the pulverized coal carried by the air 14 tangentially flow into and swirl in the space 10 and are injected through the front end of the space. A tertiary air feed pipe 13 has one end open to the base of the inner sleeve 9 and has the other end open to the wind box 4, so that combustion air fed to the wind box 4 is taken in and is guided to the inner sleeve 9 as auxiliary combustion air, i.e., tertiary combustion air.

[0011] The secondary air adjusting device 7 comprises an auxiliary air adjusting mechanism 15 accommodating the front end of the nozzle body 6 and a main air adjusting mechanism 16 arranged coaxially and outward of the mechanism 15.

[0012] The auxiliary air adjusting mechanism 15 comprises a first air guide duct 18 with diameters reduced toward a front end of the duct and air volume adjusting vanes 19 circumferentially equidistantly arranged in a base of the duct 18, the vanes 19 being rotatable about rotary axes 21 in sync.

[0013] The main air adjusting mechanism 16 comprises a second air guide duct 22 with diameters reduced toward its front end and air volume adjusting vanes 23 circumferentially equidistantly arranged in a base of the duct 22, the vanes 23 being rotatable about rotary axes 24 in sync.

[0014] The front end of the second air guide duct 22 is contiguous with the throat 3. The front end of the first air guide duct 18 is set back from an inner wall surface of the furnace wall 2. The front ends of the sleeves 8 and 9 are set back further from the front end of the guide duct 18.

[0015] Combustion in the above-mentioned pulverized coal burner will be described briefly. The pulverized coal is fed together with the primary air 14 through the primary air feed pipe 12 into the base of the fuel flow space 10. The primary air 14 swirls in the space 10 toward the furnace 1, is reduced in flow during its passage through the space 10 and is injected through the front end of the outer sleeve 8. The wind box 4 is fed with the secondary air 26 as auxiliary combustion air which is air-volume adjusted by the vanes 23 and is injected together with the primary air 14 and fuel into the furnace 1 via the second air guide duct 22.

[0016] Part of the secondary air 26 taken in the second air guide duct 22 is taken via the air volume adjusting vanes 19 into the first air guide duct 18 and is injected as secondary auxiliary air. Air volume adjustments by the vanes 23 and 19 change feed flow condition of the secondary air to adjust the combustion condition of the fuel.

[0017] Part of the secondary air 26 is guided as the tertiary air 27 via the tertiary air feed pipe 13 into and is injected from the inner sleeve 9. Injection of the tertiary air 27 adjusts the combustion condition of the fuel.

[0018] Thus, by adjustment of, for example, the secondary and tertiary airs, combustion condition of the fuel is adjusted to optimum.

[0019] The oil burner 11 is used for ignition of the pulverized coal.

[0020] In the above-mentioned conventional pulverized coal burner, the outer and inner sleeve front ends 8c and 9c are drastically reduced in diameter toward their front sides, so that the primary air 14 flowing through the fuel flow space 10 and the tertiary air 27 flowing through the inner sleeve 9 are reduced in flow and are injected. Consequently, the primary air 14 transporting the pulverized coal (hereinafter, pulverized coal and primary air 14 in combination is referred to as primary air 14) is injected through the front ends of the outer sleeve 8 and first air guide duct 18 while expanding. The primary air 14 swirls while being reduced in flow, and further expands by centrifugal force due to the swirling. Thus, the pulverized coal in the primary air 14 is burned while expanding.

[0021] As a result, slagging may occur which is a phenomenon that clinker as combustion residue of the pulverized coal impinges and deposits on the furnace wall 2. The slagging may impair heat transmission of the furnace wall 2 and cause heat accumulation on the furnace wall 2, resulting in increase in temperature of the furnace wall 2 and hence of the furnace 1. The increase in temperature of the furnace wall 2 and of the furnace 1 may melt the clinker, so that disadvantageously slagging may occur more easily and NO may be generated more easily.

[0022] In recent years, in order to increase combustion capacity of a pulverized coal burner, i.e., in order that much
more pulverized coal can be burned, pulverized coal burners have been increased in size. To cope with increased combustion capacity of the pulverized coal burner, the nozzle is made larger-sized; however, its axial length remains limitative owing to installational restrictions.

[0023] As a result, the nozzle has larger diameter in comparison with axial length; the pulverized coal burner is short in axial length relative to diameter.

[0024] Because of shortness in axial length, the pulverized coal burner has less straightening effect, so that the primary air 14 flowing into the fuel flow space 10 is injected from the nozzle body 6 while it remains strongly swirling. Thus, due to centrifugal force, the pulverized coal in the primary air 14 expands or impinges, so that slagging may occur very easily.

[0025] [Patent Literature 1] JP 8-145320A

SUMMARY OF INVENTION

Technical Problems

[0026] The invention was made in view of the above and has its object to prevent slagging from occurring in a pulverized coal burner.

Solution to Problems

[0027] The invention is directed to a pulverized coal burner comprising a nozzle body open to a furnace and through which pulverized coal is injected together with combustion air, said nozzle body comprising an outer sleeve and an inner sleeve arranged in and coaxially of said outer sleeve, a fuel flow space being formed between said outer and inner sleeves, straightening plates being provided on at least one of said outer and inner sleeves, said straightening plates projecting in said fuel flow space and extending axially of said nozzle body, said combustion air transporting the pulverized coal passing through said fuel flow space and being injected.

Advantageous Effects of Invention

[0028] According to the invention, a nozzle body open to a furnace and for injection of pulverized coal together with combustion air comprises an outer sleeve and an inner sleeve arranged in and coaxially of the outer sleeve. A fuel flow space is formed between the sleeves. Straightening plates are arranged in at least either of the outer and inner sleeves and are projected to the fuel flow space and extend on an axis of the nozzle body, so that the combustion air transporting the pulverized coal passes through the fuel flow space and is injected. When the primary air transporting the pulverized coal to finally serve as combustion air as well as the pulverized coal flow through the fuel flow space, swirling is weakened by the straightening plates and the pulverized coal injected via the nozzle body is prevented from expanding and impinging, thereby preventing the slagging from occurring.

BRIEF DESCRIPTION OF DRAWINGS

[0029] FIG. 1 is a sectional view showing a conventional pulverized coal burner; and

[0030] FIG. 2 is a sectional view showing a pulverized coal burner according to an embodiment of the invention.

REFERENCE SIGNS LIST

[0031] 1 furnace

[0032] 2 furnace wall

[0033] 3 throat

[0034] 4 wind box

[0035] 6 nozzle body

[0036] 14 primary air (combustion air)

[0037] 18 first air guide duct

[0038] 22 second air guide duct

[0039] 26 secondary air

[0040] 27 tertiary air

[0041] 29 straightening plate

DESCRIPTION OF EMBODIMENTS

[0042] An embodiment of the invention will be described in conjunction with the drawings.

[0043] FIG. 2 shows a pulverized coal burner according to the invention. In FIG. 2, the parts similar to those shown in FIG. 1 are represented by the same reference numerals and explanations thereon are omitted.

[0044] A pulverized coal burner 5 comprises a nozzle body 6 and a secondary air adjusting device 7. The burner 5 is arranged coaxially of a throat 3 open to the furnace wall 2. The burner 5 is arranged in a wind box 4.

[0045] The nozzle body 6 comprises an outer sleeve 8 and an inner sleeve 9 coaxially of the outer sleeve 8. Formed between the sleeves 8 and 9 is a hollow, cylindrical fuel flow space 10. The nozzle body 6 has a greater diameter relative to its axial length (see, for example, the conventional example shown in FIG. 1).

[0046] FIG. 2 shows an example of the nozzle body 6 with larger diameters. That is, the outer sleeve 8 has larger diameters in comparison with the inner sleeve 9, which fact increases cross-sectional area of flow passage in the fuel flow space 10.

[0047] Formed on an inner surface of the outer sleeve 8 are straightening plates 29 which project in the fuel flow space 10. The plates 29 are arranged in parallel with an axis of the outer sleeve 8 so as to project radially and extend axially of the sleeve 8. The plates 29 are positioned circumferentially equidistantly; for example, there are three plates 29 at three positions divided circumferentially equidistantly.

[0048] The wind box 4 is supplied with secondary air 26 from a forced draft fan (not shown). The secondary air 26 is injected from the throat 3 via the secondary air adjusting device 7.

[0049] A base of the nozzle body 6 extends out of the wind box 4 and an outer tube base 8a communicates with a primary air feed pipe 12, and an end of the inner sleeve 9 communicates with a tertiary air feed pipe 13. The primary air feed pipe 12 is connected through a coal pulverizer (not shown) to a forced draft fan (not shown). By the feed pipe 12, primary air 14 transporting the pulverized coal is introduced into the fuel flow space 10. The tertiary air feed pipe 13 takes in and feeds part of the secondary air 26 into the inner sleeve 9.

[0050] The primary air 14, which is fed to the fuel flow space 10, swirls about the inner sleeve 9 and flows forward. The straightening plates 29, which are arranged in the fuel flow space 10, prevents and straightens the swirling in the space 10 into axial straightening flow.

[0051] Weakening of the swirling of the primary air 14 prevents the swirling of the pulverized coal transported by the primary air 14. Thus, expansion of the primary air 14 and dispersing of the pulverized coal injected through the outer sleeve 8 are weakened to prevent slagging from occurring.

[0052] Any straightening plates 29 will do, provided that they have the proper function of weakening the swirling of the primary air 14. The plates 29 may have inner edges substantially in contact with the inner sleeve 9; alternatively, the inner
edges may be spaced apart from the inner sleeve 9 by a required distance so as not to weaken the swirling at the central position. Moreover, the plates 29 may be perforated to allow required swirling. Axial length and numbers of the plates 29 are properly selected so as to attain optimum combustion.

Alternatively, the plates 29 may be arranged on the inner sleeve 9; alternatively, they may be arranged on the inner and outer sleeves 9 and 8, alternately.

1. A pulverized coal burner comprising a nozzle body open to a furnace and through which pulverized coal is injected together with combustion air, said nozzle body comprising an outer sleeve and an inner sleeve arranged in and coaxially of said outer sleeve, a fuel flow space being formed between said outer and inner sleeves, straightening plates being provided on at least one of said outer and inner sleeves, said straightening plates projecting in said fuel flow space and extending axially of said nozzle body, said combustion air transporting the pulverized coal passing through said fuel flow space and being injected.

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