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(54) MODULAR COAL NOZZLE ASSEMBLY FOR VAPOR GENERATION APPARATUS
MODULARE KOHLEDÜSENANORDNUNG FÜR DAMPFERZEUGUNGSGERÄT
ENSEMBLE TUYERE D’ALIMENTATION EN CHARBON MODULAIRE POUR GENERATEUR DE VAPEUR

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DESCRIPTION

TECHNICAL FIELD

[0001] The present invention relates to the coal delivery systems including the coal piping for delivering pulverized coal to coal fired steam generators and more particularly to the construction of the coal nozzle assemblies for cooperation with the coal supply pipes in such systems. Coal fired furnaces are typically provided with a plurality of ducts or pipes through which pulverized coal is directed to a plurality of fuel-air admission assemblies arrayed in respective vertically extending windboxes. The windboxes are disposed in one or more walls of the furnace and each introduces coal and air into the furnace.

[0002] The pipes directing the coal to the respective windboxes are large and cumbersome. Typically the pipes are provided with large couplings or bolted flanges to couple the end abutting axially adjacent portions together. The normal nozzle assembly requires a regular maintenance because the pulverized coal has a severe erosive effect. The conventional nozzle assembly must be entirely removed from the steam generator for such maintenance and in addition the large couplings and pipes must be moved to allow withdrawal of the individual coal nozzle assemblies. More particularly, a typical fuel nozzle assembly will weigh between 136.078 and 589.67 kilograms (300 and 1300 pounds) and may weigh even more.

[0003] The installation or inspection of a specific coal nozzle assembly involves a substantial amount of time to remove the various bolts or couplings while simultaneously supporting the respective sections of pipe. More specifically, the process involves supporting the adjacent sections of pipe, removing two couplings, and removing the nozzle. After that inspection or replacement, the system must be put back together by inserting the nozzle, installing the couplings or bolts in the respective flanges and removing the supports for the respective pipes. Because of (1) the number of the coal nozzle assemblies cooperating with each of the fuel-air admission assemblies in respective vertically extending windboxes, (2) the weight of the individual nozzle assemblies and (3) the very substantial mass and size of the ducting connecting to each of the nozzle assemblies the maintenance time required is substantial. A typical furnace will have between 10 and 80 individual nozzles. The replacement of just one nozzle assembly may require 3 men working for 8 hours to complete.

BACKGROUND ART

[0004] The prior art includes nozzle assemblies that require withdrawal of the individual nozzle assemblies from the windboxes before maintenance for worn portions can be performed. More specifically, the prior art structures have movable portions that are carried on pivots that are inserted in the sides of the generally cylindrical assembly. The generally cylindrical assembly is inserted in the windbox where the walls thereof are disposed in closely spaced relation to the outboard extremity of the pins and prevent the withdrawal of the pins. The disadvantage of such structures is that the nozzle assembly must be completely withdrawn from the windbox so that the pins may be removed and the worn parts replaced.

[0005] WO 84/00314 discloses an improved nozzle tip (10) for a burner on a pulverized coal-fired furnace for receiving a stream of pulverized coal and air discharging from a coal delivery pipe. The improved nozzle tip (10) includes a generally cylindrical body 20 having an inlet and an outlet, a replaceable highly abrasion resistant insert (30), and a replaceable highly temperature resistant end cap (40). The end cap (40) is disposed in generally coaxial relationship with the base body (20). The improved nozzle tip (10) also includes means (48, 49) for mounting the end cap (40) in relation to the base body (20), the means (48, 49) for mounting includes removably securing means (62), which may be bolts.

[0006] WO 84/00314 describes a burner nozzle tip disclosed in U.S. Patent 2,895,435 to Bogot et al., and formed of a steel open-ended inner shell defining a flow passage through which the pulverized coal-air stream from the coal delivery pipe is delivered into the furnace and a steel open-ended outer shell spaced from and surrounding the inner shell so as to define therewith an annular duct through which the air leaving the air conduit is directed into the furnace. Additionally, one or more steel or stainless steel baffles, termed splitter plates, are typically disposed within the inner shell of the nozzle tip and aligned parallel to the longitudinal axis thereof, to impart additional directional force to the coal-air stream discharging through the inner shell and to insure a uniform distribution of the coal-air stream particularly when the nozzle is tilted away from the horizontal for steam temperature control.

[0007] WO 84/00314 also describes a burner nozzle tip disclosed in U.S. Patent 3,823,875 which is formed of an outer shell of particularly heat resistant stainless steel and an inner shell of particularly erosion resistant stainless steel both of which are fabricated by casting and not welding and which are assembled and held together mechanically to form the nozzle tip rather than being welded together. In order to replace the inner shell, which although made of a more erosion resistant stainless steel still must be replaced sooner than the outer shell, the nozzle tip must be completely removed from the coal nozzle itself and the inner shell pulled rearwardly from the outer shell. Then a new inner shell must be inserted within the outer shell and the entire coal nozzle tip again attached to the coal nozzle.
OBJECTS AND SUMMARY OF THE INVENTION

[0008] It is a primary object of the invention to provide a structure that allows replacement of portions of each nozzle assembly from the interior of the furnace (steam generator).
[0009] Another object of the invention is to provide apparatus that is less costly to maintain in terms of both parts and labor.
[0010] More specifically it is an object of the invention is to provide apparatus that allows replacement of the portions of the coal nozzles, that wear during normal operation, with less man hours of labor to accomplish the task.
[0011] Another object of the invention is to provide apparatus that allows maintenance on the respective coal nozzle assemblies to be performed more rapidly and thus results in less down time of the steam generator.
[0012] Still another object of the invention is to provide apparatus that is modular so that when wear does occur only the high wear areas need to be replaced, or in other words, so that when wear does occur the high wear areas will be confined to modules that can easily replaced instead of replacing the entire assembly.
[0013] An additional object of the invention is to provide apparatus that minimizes the need for disassembly in order to replace individual parts of the entire assembly.
[0014] Yet another object of the invention is to provide apparatus that will have a lower cost for replacement parts because only relatively smaller subassemblies will need to be replaced.
[0015] It has now been found that these and other objects of the invention may be attained in a coal nozzle apparatus which includes a generally cylindrical main body having an inlet and an outlet and a generally cylindrical tip section disposed in generally coaxial relationship with the main body. The apparatus also includes means for mounting the tip section in relation to the body section to allow movement of the tip section about an axis that is generally coincident with a diameter of the main body section. The means for mounting includes two coaxial pins, the pins each having an axial portion cooperating with the main body and another axial portion connected to the tip section, each of the pins having a head, each of the heads being disposed proximate to the geometric center line of the body portion. Each of the pins has an axis that is generally coincident with a diameter of the main body.
[0016] The coal nozzle apparatus further comprises a roller and means for mounting the roller on the coal nozzle body to permit rotation of the roller relative to the coal nozzle body while supporting the coal nozzle body.
[0017] In the invention the head of each pin is generally cylindrical in shape and the means for mounting includes respective counterbores dimensioned and configured for cooperation with respective heads of the pins. The means for pivoting may include a generally cylindrical nozzle front that is fixed to the main body and has an inner face. The tip section may be disposed in side abutting relation to the nozzle front. The counterbores may be disposed in the nozzle front and the heads may be disposed in substantially flush relationship to the inner face of the generally cylindrical nozzle front and the pins may be welded to the nozzle front.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The invention will be better understood by reference to the accompanying drawing in which:
[0019] Figure 1 is a partially schematic view in elevation of a coal pulverizer connected to a plurality of fuel nozzles shown in plan view.
[0020] Figure 2 is an exploded plan view of one form of the coal nozzle in accordance with one form of the present invention.
[0021] Figure 3 is a partly schematic plan view of the assembled coal nozzle shown in Figure 2 in exploded relation.
[0022] Figure 4 is a partly schematic elevational view of the assembled coal nozzle shown in Figure 2.
[0023] Figure 5 is a plan view, in partial section, of a prior art structure that is much more difficult to maintain.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0024] Although the present invention will be described in terms of a coal fired steam generator apparatus it will be understood that the apparatus has application to other furnace apparatus and other apparatus. Coal fired furnaces are typically provided with a plurality of ducts or pipes to direct pulverized coal that is burned in the furnace. The pulverized coal and primary air is typically directed to a plurality of fuel-air admission assemblies arrayed in respective vertically extending windboxes. The windboxes are disposed in one or more walls of the furnace. It is conventional to provide secondary air dampers at these fuel-air admission assemblies to control the amount of air in the combustion process.
[0025] Referring now to Figure 5, there is shown a prior art fuel nozzle assembly 110. The fuel nozzle assembly 110 includes a tip 112 that is pivoted on pins 114, 114. The pins 114, 114 are held in place by the abutting walls of the windbox 116. This apparatus requires removal of the entire nozzle assembly 110 in order to remove the pins 114, 114. In part because of the enormous weight and size of the many nozzles assemblies 110 this is a substantial disadvantage.
[0026] Referring now to Figure 1 there is shown apparatus in which the present invention may be employed. The apparatus includes a coal pulverizer 1 that supplies pulverized coal to a furnace 2. The pulverized coal from the pulverizer 1 is ducted to the furnace 2 by means of respective ducts 4, 4, 4, 4. Each is provided with an orifice 6 to balance flow in the individual ducts.
Axial sections of the existing pipe 4 are disposed in coaxial end abutting relationship. The existing pipe 4 is ordinarily cylindrical although other cross-sections such as square or other polygon shapes may be used.

Referring now to Figures 1-4 there is shown a nozzle assembly 10 in accordance with a preferred form of the invention. The coal nozzle assembly 10 is secured by studs or jacking screws to locate the nozzle assembly squarely within the coal compartment of the furnace and lock it securely.

The nozzle assembly 10 includes a coal nozzle body 12 that is elongated and is essentially a duct. At the left (as viewed) extremity of the nozzle body 12 is a flange that mates with a flange of the coal nozzle front 14. The nozzle front 14 is contoured, at least in the elevation view of figure 4, as a conventional nozzle having a converging axial section and a diverging axial section. Mounted for pivotal movement on the nozzle front 14 is a moveable body section 16. The moveable body section 16 is carried on respective coaxial pins 18.

The coal nozzle body 12, moveable body section 16, and removable tip section 20 may be considered to be generally cylindrical although it will be apparent by comparison of the plan and elevational views that the elements are not literally cylindrical although the respective contours approach the shape of a cylinder and may thus inherently each has an axis or center line and a diameter or plurality of diametrically extending lines therein. The coal nozzle body 12 and moveable body section 16 are shown in the drawing as being substantially coaxial. It will be understood that the pivoting action of the moveable body section 16 allows moment of the moveable body section 16 to positions that are not coaxial with the body 12. The moveable body section 16 will be seen to be disposed in side abutting relation to the nozzle front 14.

The pins 18 include a head 18a that is generally cylindrical. The coal nozzle front 14 is provided with coaxial opposed bores 14a that includes a counterbore at the inboard axial extremity thereof. Each counterbore portion of each bore 14a is dimensioned and configured for accommodation of one of the heads 18a of a pin 18 associated therewith. It will thus be seen that, when assembled, the respective pins 18 are flush with respective interior faces of the nozzle front 14 so that no obstruction is presented to the coal which flows through the coal nozzle assembly 10. The respective pins 18 extend through the bores 14a in the walls of the coal nozzle front 14 and engage respective cooperating coaxial end abutting bores 16a in the moveable body section 16. Typically the head 18a of each of the pins 18 is welded to the nozzle front 14. Ordinarily each pin 18 will have an axis and that axis will be generally coincident with a diameter of the nozzle front 14 and the moveable body section 16.

Secured to the body section 16 is a removable tip section 20. The tip section 20 is also generally cylindrical and is coaxial with the body section 16 in the drawings. Typically the two sections are welded together. In some cases this juncture may occur at the job site where the apparatus is ultimately assembled and operated.

A splitter vane extends through the body sections 16 and the tip section 20 direct the flow of coal passing through the nozzle assembly. The enormous weight of the parts involve necessitates a roller 22 on which the body 12 is carried so that the body 12 may be moved into position before being secured.

In the conventional manner, a typical furnace includes a plurality of such nozzle assemblies and having the body sections 16 mechanically coupled or ganged together. The mechanical coupling couples the respective body sections 16 of a plurality of nozzle assemblies 10 at a plurality of elevations. The individual nozzle assembly are synchronously moved to provide optimal combustion in the furnace. It will be seen that the apparatus, in accordance with the illustrated embodiment of the invention, allows such movement. The mechanism for synchronously moving the individual coal nozzle tips includes the lever arm 24.

Those skilled in the art will recognize that the apparatus in accordance with the present invention In addition the apparatus in accordance with the present invention allows the easy replacement and assembly of the major components, that wear in normal operation, within the furnace. This is in contrast to the prior art apparatus that required withdrawal of the entire nozzle assembly 110 from the furnace before the nozzle assembly 110 could be disassembled.

It will be understood that some embodiments of the invention may incorporate a conventional seal plate (not shown) intended to provide a seal between the nozzle front nozzle front 14 and the moveable body section 16. Such structure is not shown in the present application although it will be understood by those skilled in the art, that the seal plate may be incorporated in the illustrated embodiment.

The components of the apparatus of the present invention are made out of thicker materials for longer lasting life, and the coal nozzle 14 can be made out of ceramic or cast materials. The coal nozzle front can be cast or fabricated carbon steel or stainless steel with a 19.05 or 25.4 millimeters (3/4" or 1") thick wall.

Since ordinarily the apparatus 10 will be disassembled from the furnace side (left side as viewed) the head 18a or the equivalent shape will be disposed on the inboard end of the pin 18.

Claims

1. A coal nozzle assembly 10, operative for purposes of effecting there through the injection into a vapor steam generator of fuel supplied to the coal nozzle assembly 10 from a fuel supply means, comprising:
a. an elongated coal nozzle body 12 connectable to the fuel supply means, said elongated coal nozzle body 12 having an inlet end, an outlet end and a mounting flange formed at said outlet end of said elongated coal nozzle body 12;
b. support means for supporting said elongated coal nozzle body 12, said support means including a roller 22 and means for mounting said roller 22 on said elongated coal nozzle body 12 to permit rotation of said roller 22 relative to said elongated coal nozzle body 12 while supporting said elongated coal nozzle body 12;
c. a nozzle front 14 disposed in generally coaxial relationship with said elongated coal nozzle body 12, said nozzle front 14 having an inlet end, an outlet end and a mounting flange formed at said inlet end of said elongated coal nozzle body 12;
d. fastening means for fastening said mounting flange of said nozzle front 14 to said mounting flange of said elongated coal nozzle body 12 such that said nozzle front 14 is removably mounted in supported relation on said elongated coal nozzle body 12;
e. a body section 16 disposed in generally coaxial relationship with said nozzle front 14;
f. means for removably mounting said body section 16 in supported relation on said nozzle front 14 and so as to permit said body section 16 to pivot about an axis extending perpendicular to the longitudinal axis of said elongated coal nozzle body 12, said means for removably mounting said body section 16 in supported relation on said nozzle front 14 including two coaxial pins 18, said pins 18 each having an axial portion cooperating with said nozzle front 14 and another axial portion connected to said body section 16, each of said pins 18 having a head 18a, each of said heads 18a of said pins 18 for ease of removal of said pins 18 being disposed internally of said nozzle front 14, each of said pins 18 having an axis extending perpendicular to the longitudinal axis of said elongated coal nozzle body 12, said head 18a of each of said pins 18 being cylindrical in shape, and said means for removably mounting said body section 16 in supported relation on said nozzle front 14 further including respective counterbores formed in said nozzle front 14, said counterbores being dimensioned and configured so as to be capable of receiving there within respective ones of said heads 18a of said pins 18; and
g. a removable nozzle tip section 20 disposed in generally coaxial relationship with said body section 16, said removable nozzle tip section 20 being mounted in supported relation on said body section 16 so that said removable nozzle tip section 20 will pivot with said body section 16 when said body section 16 pivots.

Patentansprüche

1. Kohledüsenbaugruppe 10 zu dem Zweck, in einen Dampferzeuger Brennstoff zu injizieren, der durch die Kohledüsenbaugruppe 10 von einem Brennstoffzufuhrmittel zugeführt wird, umfassend:

a. einen länglichen Kohledüsenkörper 12, der an das Brennstoffzufuhrmittel angeschlossen werden kann, wobei der länglichen Kohledüsenkörper 12 ein Einlaßende, ein Auslaßende und einen an dem Auslaßende des länglichen Kohledüsenkörper 12 ausgebildeten Montageflansch aufweist;
b. ein Stützmittel zum Stützen des länglichen Kohledüsenkörpers 12, das eine Walze 22 und ein Mittel zum Anbringen der Walze 22 an dem länglichen Kohledüsenkörper 12 enthält, damit sich die Walze 22 relativ zu dem länglichen Kohledüsenkörper 12 drehen kann, während der längliche Kohledüsenkörper 12 gestützt wird;
c. eine in allgemein koaxialer Beziehung zu dem länglichen Kohledüsenkörper 12 angeordnete Düsenvorderseite 14, die ein Einlaßende, ein Auslaßende und einen an dem Einlaßende des länglichen Kohledüsenkörper 12 ausgebildeten Montageflansch aufweist;
d. ein Befestigungsmittel zum derartigen Befestigen des Montageflansches der Düsenvorderseite 14 an dem Montageflansch des länglichen Kohledüsenkörpers 12, daß die Düsenvorderseite 14 entfernbar und in gestützter Beziehung an dem länglichen Kohledüsenkörper 12 angebracht ist;
e. einen in allgemeiner koaxialer Beziehung zu der Düsenvorderseite 14 angeordneten Körperabschnitt 16;
f. ein Mittel zum entfernbaren Anbringen des Körperabschnitts 16 in gestützter Beziehung an der Düsenvorderseite 14 und derart, daß sich der Körperabschnitt 16 um eine Achse drehen kann, die sich senkrecht zu der Längssachse des länglichen Kohledüsenkörpers 12 erstreckt, wobei das Mittel zum entfernbaren Anbringen des Körperabschnitts 16 in gestützter Beziehung an der Düsenvorderseite 14 zwei koaxiale Zapfen 18 enthält, wobei die Zapfen 18 jeweils einen axialen Teil, der mit der Düsenvorderseite 14 zusammenwirkt, und einen anderen, mit dem Körperabschnitt 16 verbundenen axialen Teil aufweisen, wobei jeder der Zapfen 18 einen Kopf 18a aufweist, jeder der
Köpfe 18a der Zapfen 18 zum leichten Entfernen der Zapfen 18 innerhalb der Düsenvorderseite 14 angeordnet ist, wobei jeder der Zapfen 18 eine sich senkrecht zur Längsachse des länglichen Kohldüsenkörpers 12 erstreckende Achse aufweist, wobei der Kopf 18a jeder der Zapfen 18 von zylindrischer Form ist und das Mittel zum entfernабarem Anbringen des Körperschnitts 16 in gestützter Beziehung an der Düsenvorderseite 14 weiterhin jeweilige, in der Düsenvorderseite 14 ausgebildete Senkungen enthält, wobei die Senkungen so dimensioniert und konfiguriert sind, daß darin jeweilige der Köpfe 18a der Zapfen 18 aufgenommen werden können; und
g. einen entfernbaren Düenspitzenabschnitt 20, der in allgemein koaxialer Beziehung zu dem Körperschnitt 16 angeordnet ist, wobei der entfernbare Düenspitzenabschnitt 20 derart in gestützter Beziehung an dem Körperschnitt 16 befestigt ist, daß sich der entfernbare Düenspitzenabschnitt 20 mit dem Körperschnitt 16 drehen, wenn sich der Körperschnitt 16 dreht.

Revendications

1. Assemblage de tuyère 10 d'alimentation en charbon, utilisable pour effectuer à travers lui l'injection dans un générateur de vapeur, de combustible distribué à l'assemblage de tuyère 10 d'alimentation en charbon depuis un moyen d'alimentation en combustible, comprenant :

   a. un corps allongé 12 de tuyère d'alimentation en charbon pouvant être connecté au moyen d'alimentation en combustible, ledit corps allongé 12 de tuyère d'alimentation en charbon ayant une extrémité d'entrée, une extrémité de sortie et une bride de fixation formée au niveau de ladite extrémité d'entrée dudit corps allongé 12 de tuyère d'alimentation en charbon ;
   b. un moyen de support pour supporter ledit corps allongé 12 de tuyère d'alimentation en charbon, ledit moyen de support comportant un galet 22 et des moyens pour fixer ledit galet 22 sur ledit corps allongé 12 de tuyère d'alimentation en charbon pour permettre la rotation dudit corps allongé 12 de tuyère d'alimentation en charbon tout en supportant ledit corps allongé 12 de tuyère d'alimentation en charbon ;
   c. une partie avant 14 de tuyère disposée en relation généralement coaxiale avec ledit corps allongé 12 de tuyère d'alimentation en charbon, ladite partie avant 14 de tuyère ayant une extrémité d'entrée, une extrémité de sortie et une bride de fixation formée au niveau de ladite extrémité d'entrée dudit corps allongé 12 de tuyère d'alimentation en charbon ;
   d. des moyens de fixation pour fixer ladite bride de fixation de ladite partie avant 14 de tuyère à ladite bride de fixation dudit corps allongé 12 de tuyère d'alimentation en charbon de telle sorte que ladite partie avant 14 de tuyère soit fixée de manière amovible en relation supportée sur ledit corps allongé 12 de tuyère d'alimentation en charbon ;
   e. une section de corps 16 disposée en relation généralement coaxiale avec ladite partie avant de tuyère 14 ;
   f. un moyen pour fixer de manière amovible ladite section de corps 16 en relation supportée sur ladite partie avant 14 de tuyère et de manière à permettre à ladite section de corps 16 de pivoter autour d'un axe s'étendant perpendicularly à l'axe longitudinal dudit corps allongé 12 de tuyère d'alimentation en charbon, ledit moyen pour fixer de manière amovible ladite section de corps 16 en relation supportée sur ladite partie avant 14 de tuyère comportant deux broches coaxiales 18, lesdites broches 18 ayant chacune une portion axiale coopérant avec ladite partie avant 14 de tuyère et une autre portion axiale connectée à ladite section de corps 16, chacune desdites broches 18 ayant une tête 18a, chacune desdites têtes 18a desdites broches 18, pour faciliter le retrait desdites broches 18, étant disposée à l'intérieur de ladite partie avant 14 de tuyère, chacune desdites broches 18 ayant un axe s'étendant perpendicularly à l'axe longitudinal dudit corps allongé 12 de tuyère d'alimentation en charbon, ladite tête 18a de chacune desdites broches 18 ayant une forme cylindrique, et lesdits moyens pour fixer de manière amovible ladite section de corps 16 en relation supportée sur ladite partie avant 14 de tuyère comportant en outre des contre-alésages respectifs formés dans ladite partie avant 14 de tuyère, lesdits contre-alésages étant dimensionnés et configurés de manière à pouvoir y recevoir des têtes respectives desdites têtes 18a desdites broches 18 ; et
g. une section de pointe de tuyère amovible 20 disposée en relation généralement coaxiale avec ladite section de corps 16, ladite section de pointe de tuyère amovible 20 étant montée en relation supportée sur ladite section de corps 16 de sorte que ladite section de pointe de tuyère amovible 20 pivotant avec ladite section de corps 16 lorsqu'elle section de corps 16 pivote.