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PULVERIZED FUEL BURNER

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Fig. 1.

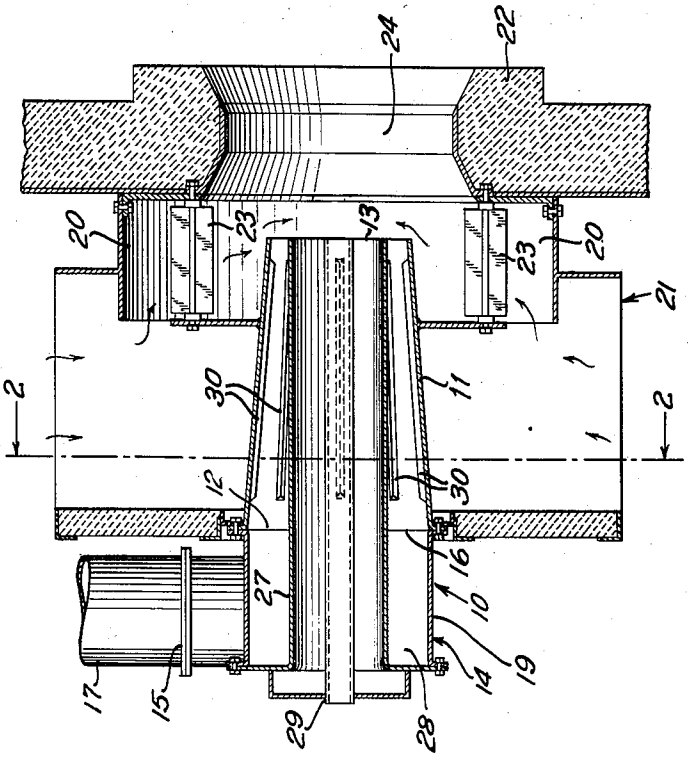
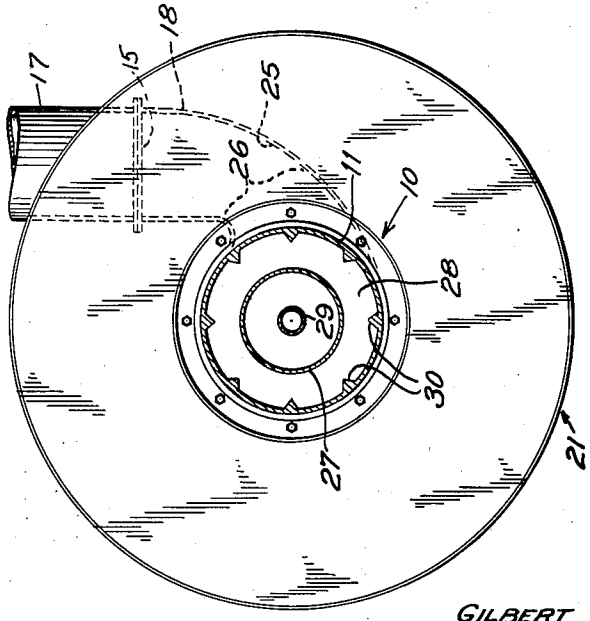


Fig. 2.



INVENTORS.
GILBERT C. WHITNEY, JR.
JAY L. CLARK
BY
E. Francis Wentworth Jr.

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PULVERIZED FUEL BURNER

Gilbert C. Whitney, Jr., and Jay L. Clark, Dansville, N.Y., assignors to Foster Wheeler Corporation, New York, N.Y., a corporation of New York

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5 Claims. (Cl. 110—104)

The present invention relates to a fuel burner and more particularly to a fuel burner which uses pulverized solid fuel.

In the usual fuel burner for pulverized solid fuel, a mixture of air and pulverized fuel is introduced as a stream through a volute inlet section into a cylindrical burner body. Upon entering the cylindrical body, the solid fuel particles in the mixture are thrown to the outside of the stream against the inner surface of the cylindrical body. Thereafter, both the separated fuel particles and stream of air from which the particles separate, move toward the burner body's outlet with a velocity that is the resultant of the axial velocity component of the mixture and a circumferential velocity component imparted to the mixture in the volute inlet section. The separated stream of air moves centrally of the burner body toward the body's outlet while the fuel particles, move along the inner surface of the body toward the outlet. Where the scroll of the volute fades into the diameter of the burner body, another stream of air moves axially forward, as well as circumferentially, in the burner body toward the body's outlet. This other stream of air is of materially higher velocity than the average velocity of the above-mentioned stream of air and persists down through the burner body in the form of a spiral air rope. Since it is a characteristic of dust laden streams that the majority of the dust is transported in the high velocity areas of the carrier stream, the net effect in the conventional burner where coal is the fuel and air is the carrier stream, is the formation of a spiral-shaped rope of coal dust which delivers, for example, ¾ of the pulverized coal in approximately ¼ of the circumference of the tip or outlet of the burner body. It has also been found that this effect persists practically unchanged regardless of the distribution of air-coal stream in the supply conduit leading to the burner.

In accordance with the present invention, a fuel burner for pulverized fuel is provided with novel means for uniformly distributing the pulverized fuel around substantially the entire circumference of the burner outlet.

The present invention further provides a novel fuel burner for pulverized fuel and wherein internal recirculation of the fuel and overheating of the burner is prevented.

The invention, together with its various features and objects will be understood by reference to the accompanying drawing, in which:

Fig. 1 is a longitudinal sectional view, in elevation, of the burner of the present invention; and

Fig. 2 is a sectional view of the burner taken along line 2—2 of Fig. 1.

Like characters of reference refer to similar parts throughout the views.

Referring to the drawing, the reference character **10** designates a fuel burner for pulverized fuel comprising a main body **11** with an inlet **12** and an outlet **13**, and a volute inlet section **14** having an inlet **15** and an outlet

16. Body **11** comprises a frusto conical shaped casing which tapers gradually toward the axis thereof from inlet **12** to outlet **13** thereof. Inlet **12** communicates with outlet **16** of volute section **14** while outlet **13** communicates with a windbox **20** of air supply means **21** which provides combustion supporting air to the burner. Dampers **23** in windbox **20** control the flow of air to the burner. Air supply means **21** is attached to a furnace wall **22** adjacent a burner opening **24** therein.

Volute section **14** comprises a volute portion **18** (Fig. 2) and a horizontally disposed cylindrical portion **19**. Volute portion **18** has a scroll **25** (Fig. 2) which joins portion **19** to form a scroll inlet **26** (Fig. 2) which scroll inlet is not unduly restricted by reason of the construction of such portions. A cylindrical sleeve **27** extends axially within cylindrical portion **19** and body **11** of the burner. Sleeve **27** is of a smaller diameter than portion **19** and body **11** and together with the latter define a generally tapered annular passage **28** between the outer periphery of said sleeve and the inner surface of said portion and body. An inner tube **29** is disposed concentric with and in sleeve **27** and provides means for lighting off the burner.

Disposed on the inner surface of body **11** are a plurality of vanes or bars **30** which are circumferentially spaced apart and which extend substantially longitudinally of burner **10**. Bars **30** are triangular-shaped in cross-section and have their apexes facing toward the burner axis. The opposite ends of bars **30** are spaced from inlet **12** and outlet **13**, respectively, of the body **11**.

In operation, when a mixture of pulverized fuel and air, as for example, a mixture of coal and air, is supplied to burner volute section **14** by conduit **17**, the mixture enters inlet **15** and impinges against scroll **25** whereby a tangential or circumferential velocity is imparted to the mixture due to its change in direction. As the mixture leaves scroll **25**, the coal particles are thrown to the outside of the coal-air mixture against the inner surface of cylindrical portion **19** by centrifugal force and the coal particles separate from the air stream. Thereafter, the coal particles move along the inner periphery of portion **19** and body **11** toward body outlet **13** while part of the separated air stream moves centrally of portion **19** and body **11** toward outlet **13**. Another part of the separated air stream moves in the form of a spiral and at a higher velocity than the first-mentioned part of the separated air stream toward the body's outlet **13** in portion **19** and body **11**. The separated coal dust travelling along the inner periphery of portion **19** and body **11** moves into this high velocity area and is transported in the high velocity carrier stream thereby forming a spiral rope of coal dust.

In accordance with the present invention, when the spiral rope of coal, carried in the air stream, passes forward of body inlet **12** toward outlet **13**, the coal rope impinges against bars **30**, which are at substantially right angles to its flow path, and is dispersed or broken up. After the coal and high velocity carrier stream are dispersed by impingement against a bar **30**, the carrier stream tends to reform and the coal tends to move into said stream to form another coal-air rope. However, before a coal-air rope can be again formed, the dispersed coal and carrier stream impinges on another bar **30** at substantially right angles to the flow path, until the coal and carrier stream flow out of body **11** through outlet **13**. Thus, bars **30** prevent a coal-air rope from reforming in body **11** and a uniform mixture of coal and air is discharged around the periphery of outlet **13** for proper commingling with air to support combustion.

Sleeve **27** prevents the coal-air mixture passing through outlet **13** from recirculating back through said outlet to

fill the low pressure area or void extending along the axis of the burner. This low pressure area or void is caused by air having no velocity along said axis moving outwardly toward the inner surface of burner body **11**. Thus, in the present invention, since the burner flame extends outwardly into the furnace when the burner is fired and not inwardly of the burner, overheating of the burner is prevented.

Optimum results are obtained in accordance with the present invention when the opposite ends of bars **30** are positioned in spaced relationship with the inlet and outlet of body **11**, as shown in Fig. 1. If the ends of bars **30**, nearest inlet **12**, are extended rearwardly in the burner to scroll **25**, a portion of the coal-air mixture entering inlet section **14** will slide along the sides of the bars toward body outlet **13** instead of impinging against the bars to be uniformly dispersed thereby, as above described. Conversely, if the ends of bars **30**, nearest inlet **12**, are moved too far away therefrom, and toward body outlet **13**, the density of the coal-air rope spiral increases and the rope becomes so compact that when the rope strikes the side of a bar **30**, it slides over the top of the bar and down the other side of the bar without being dispersed, as above described.

If the ends of bars **30**, nearest outlet **13**, are extended toward said outlet, the coal-air mixture discharged through outlet **13** will be in the form of jets equal to the number of bars **30** disposed in the burner since the coal-air rope does not have sufficient time to be uniformly dispersed. Conversely, if the ends of bars **30**, nearest outlet **13**, are moved away from said outlet too great a distance, the coal-air rope spiral will reform since the high velocity carrier stream reforms resulting in a non-uniform distribution of coal-air mixture from said outlet.

Inasmuch as various modifications may be made in the embodiment of the invention herein disclosed without departing from the principles thereof, it will be understood that the invention is not to be limited excepting by the scope of the appended claims.

What is claimed is:

1. An apparatus for introducing a mixture of pulverized fuel and air into a furnace, comprising a hollow body having an inlet to receive a mixture of pulverized fuel and air and an outlet for discharging said mixture therefrom, means for supplying a mixture of pulverized fuel and air to said body inlet for providing a helicoidal stream of said mixture flowing through said hollow body, and a plurality of spaced straight vanes secured to the inner surface of said body, each of said vanes being disposed in the same plane as the longitudinal axis of said hollow body and extending substantially the length of the body from a point in spaced relationship with said body inlet to a point spaced from the body outlet for continuously disrupting the helicoidal stream of pulverized fuel to effect substantially uniform distribution of the pulverized fuel across the flow area of the body at said outlet and a substantially uniform discharge of pulverized fuel from the outlet.

2. An apparatus for introducing a mixture of pulverized fuel and air into a furnace, comprising a substantially cylindrical hollow body having an inlet to receive a mixture of pulverized fuel and air and an outlet to discharge said mixture therefrom, means for supplying a mixture of pulverized fuel and air to said body inlet for providing a helicoidal stream of said mixture flowing through said body, and a plurality of straight vanes spaced from each other circumferentially around the inner peripheral surface of said body, each of said vanes being disposed in the same plane as the longitudinal axis of said body and extending from a point in relatively close spaced relationship with the body inlet to a point in relatively close spaced relationship with the body outlet for continuously disrupting the helicoidal stream of pulverized fuel by impingement against said vanes thereby providing substantially uniform distribution of pulverized fuel across the flow area of the body at said outlet and a discharge of pulverized fuel from the outlet of substantially uniform distribution.

3. The apparatus of claim 2, wherein the vanes are triangular shaped in cross-section and are disposed with their apexes facing toward the longitudinal axis of the body.

4. A burner nozzle for introducing a mixture of pulverized fuel and air into a furnace, comprising a main hollow body having an inlet and an outlet, a volute-shaped inlet section having an inlet for receiving a mixture of pulverized fuel and air and having an outlet, said volute outlet being in communication with said main body inlet to pass said mixture of pulverized fuel and air tangentially into said body inlet for providing a helicoidal stream of pulverized fuel flowing through said body, a plurality of spaced straight vanes secured to the inner surface of said body, each of said vanes being disposed to lie in the same plane as the longitudinal axis of said body, the opposite ends of each of said vanes being spaced inwardly from said body inlet and said body outlet for continuously dispersing said helicoidal stream of pulverized fuel and uniformly distributing the pulverized fuel across the flow area of the body outlet.

5. An apparatus for introducing a mixture of pulverized fuel and air to a furnace, comprising a frusto-conical shaped hollow body having an inlet and an outlet, a volute outlet section forming a plenum chamber having an inlet to recevie a mixture of pulverized fuel and air and an outlet, said volute outlet being in communication with said hollow body inlet to pass said mixture of pulverized fuel and air tangentially to said hollow body inlet for providing a spiral flow of said mixture through said hollow body, a plurality of spaced straight vanes disposed circumferentially around the inner peripheral surface of said hollow body, each of said vanes disposed to lie in the same plane as the longitudinal axis of said hollow body and extending substantially the entire length of said hollow body from a point in relatively close spaced relationship with the body inlet to a point in relatively close spaced relationship with the body outlet for continuously disrupting the spiral stream of pulverized fuel to effect a uniform distribution of pulverized fuel across the flow area of said hollow body at said body outlet and a discharge of pulverized fuel from said body outlet of substantially uniform distribution.

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