April 5, 1932. O. A. KREUTZBERG 1,852,531

FUEL BURNER

Filed Nov. 18, 1929 2 Sheets-Sheet 1

Fig. 1.

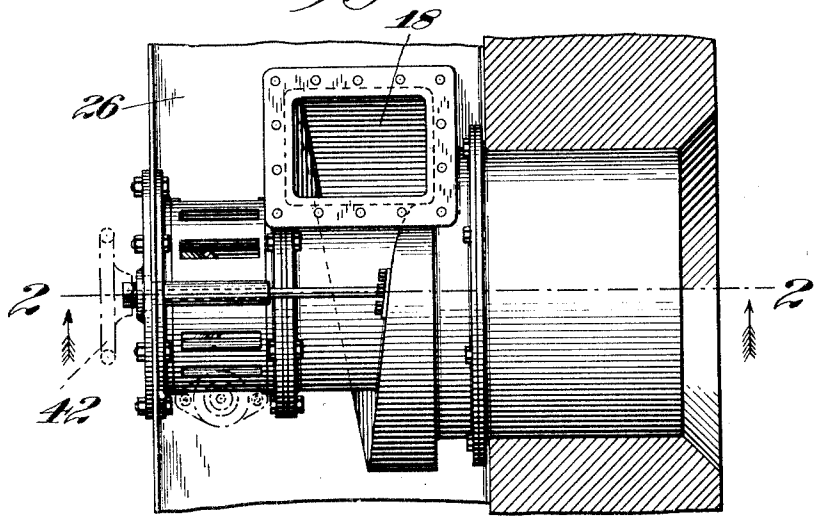

Fig. 2.

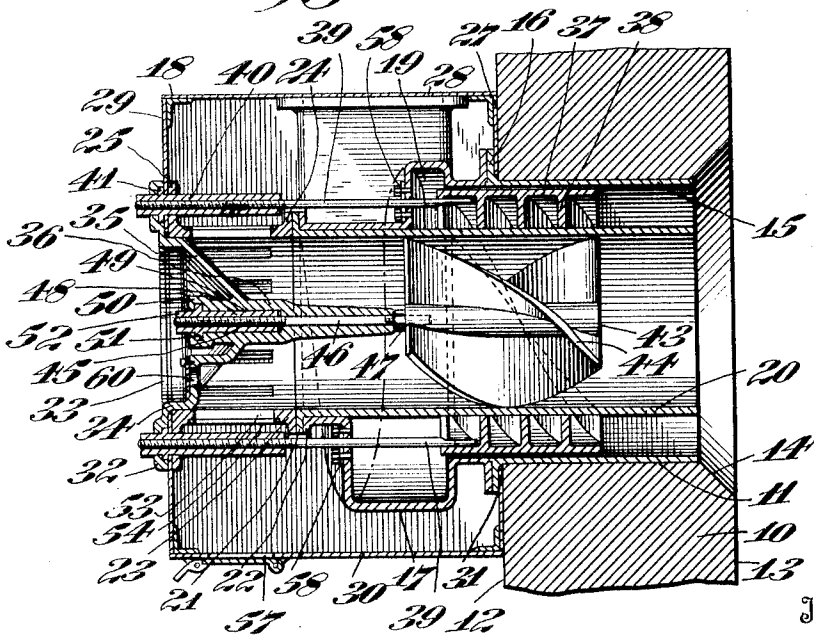

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Fig. 3.

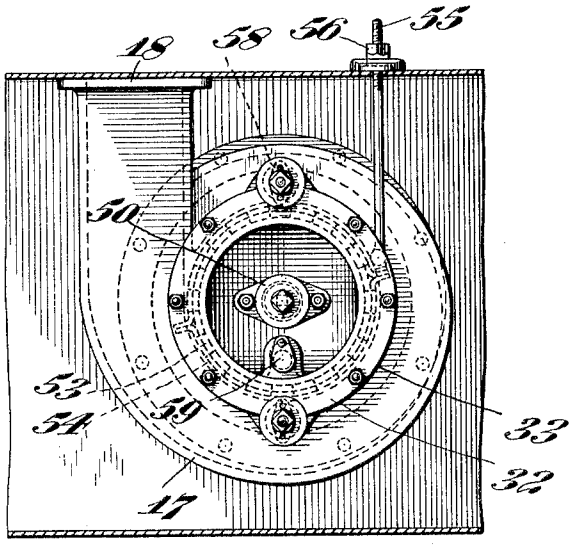
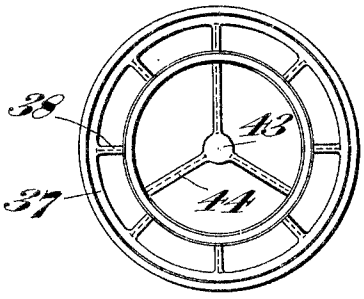


Fig. 4.



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UNITED STATES PATENT OFFICE

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FUEL BURNER

Application filed November 18, 1929. Serial No. 407,992.

This invention relates to burners for pulverized coal furnaces and particularly to that type which is adapted to discharge the incoming stream of fuel and air in the shape of a spirally whirling mass, either in the shape of a hollow cone or of a tubular form.

The principal object of my invention is to provide a burner of this type which can be adjusted so as to alter the shape and length of the flame, and thereby the point where combustion will occur in the combustion chamber.

Another object of my invention is to provide a burner for pulverized fuel in which the incoming fuel will be intermingled with a stream of primary air, means for whirling said primary mixture and means for controlling the shape of the discharge of the primary mixture into the furnace.

Another object of my invention is to provide a burner of this character whereby a secondary stream of air will be caused to expand through the cone of coal and primary air in a whirling motion, the rotation of which is in a direction opposite to that of the primary air, and means for adjusting the whirling means for controlling the shape of the discharging secondary air.

A further object of my invention is to provide a pulverized fuel burner having independent adjustable whirling means for primary and secondary air and means for keeping the primary and secondary air streams separate while passing through the burner.

The novel features of my invention will be more fully understood from the following description and claims taken with the drawings, in which:

Fig. 1 is an outside plan view of the burner;

Fig. 2 is a sectional elevation taken on the line 2—2 of Fig. 1;

Fig. 3 is an end view looking on the outside of the burner toward the furnace; and

Fig. 4 is a view looking on the inside end of the burner from the inside of the furnace.

Referring to the drawings, the furnace wall 10 is provided with an opening 11 extending from the outside 12 to the inside 13. The portion 14 not occupied by the burner is flared outwardly from the inner end of the burner so as to provide a conical outlet having increasing diameter.

The throat sleeve 15 is formed to fit into opening 11 in the furnace wall and constitutes the supporting member for the remainder of the burner parts. The end of sleeve 15 is provided with a flange 16 to which is secured the involute fuel feeder 17.

The feeder has an intake 18 arranged tangentially of the burner through which a mixture of fuel and primary air enters. The entering mixture is under pressure and travels with increasing velocity within the feeder in an involute path which imparts a whirling motion to the mixture before it reaches the discharge opening 19 of the feeder.

Through the center of the feeder 17 is positioned a burner tube 20 which separates the primary air and fuel as it leaves the feeder outlet 19 from the secondary air which is directed into the path of the primary air and fuel through the inside of the tube.

The rear end of burner tube 20 is provided with a flange 21 which is connected to a similar flange 22 of the feeder. A cylindrical air register 23 having front and rear flanges 24 and 25 abuts the flange 21 of burner tube 20. The three flanges 21, 22 and 24 are secured by bolts, thus forming a continuous and separate passage for the secondary air through the center of the burner. The feeder casing 17 acts as a centering means for the tube 20 and register 23 and when the three parts are bolted together a rigid and unit structure is formed therefrom.

The burner as a whole is enclosed within an air duct 26 which supplies secondary air to the burner. The chamber comprises front, top, side and bottom plates 27, 28, 29 and 30 respectively. The front plate 27 is provided with an opening 31 through which throat sleeve 15 passes. An opening is provided in the top plate 28 to correspond with the opening of the intake 18 of the feeder. Plate 29 is provided with an opening through which a central supporting member 32 projects inwardly into the burner. The supporting member 32 comprises an outside flanged portion 33 to which is joined a cylindrical bear-

ing portion 34 having substantially the same outside diameter as the bore of the air register 23. A cone shaped portion 35 leads from portion 34 and adjoins the longitudinally extending stem portion 36. This coned portion is for the purpose of changing the direction of the flow of the air coming through the ports of the register in its flow through the burner. After the support 32 is secured to plate 29 and flange 25 of the air register, communication between the atmosphere and the interior of the burner through opening of plate 29 is cut off.

Within the annular space formed by sleeve 15 and tube 20, is introduced a slidably mounted member 37 having helically shaped vanes 38 adapted to impart a counter-clockwise whirling motion to the primary air passing therethrough. To the rear end of member 37 are attached two adjusting rods 39 having threaded ends and are adapted to be moved longitudinally by means of adjusting nuts 40. The nuts being held in position by means of the flanged portion 33 surrounding the collar 41 of the nuts. The outside ends of the nuts are shaped to accommodate detachable hand wheels 42.

Inside of tube 20 is placed a slidably mounted member 43 having helically shaped vanes 44 adapted to impart a clockwise whirling motion to the secondary air passing through the tube. A rod 45 having a square body portion 46, is screwed into the rear end of spiral 43 and locked thereto by means of nut 47. The square portion of the rod provides for longitudinal movement relative to supporting member 32 but prevents relative turning motion thereto. The outside end of the rod is threaded to cooperate with nut 48 which is confined within a bored portion 49 of member 32. The nut is held in position by means of a cap 50 surrounding the collar 51 of the nut. The outside end of the nut is provided with a squared portion 52 to accommodate a detachable handwheel.

The air register 23 is provided with a plurality of ports 53 through which secondary air is admitted to the central portion of the burner. The air ports are covered with a two-piece band 54, through which a number of ports corresponding to the ports 53 in the register are cut, so that by adjustment of rod 55 by means of nut 56 these ports can be opened or closed to control the quantity of secondary air passing through the burner. This secondary air can either be supplied from air duct 26, which is built around the burner, or it can be atmospheric air admitted through openings 57 in the air duct, as the case may be.

Referring to Fig. 2 it will be noted that suitable packing glands 58 are provided on the outside of the feeder casing to seal the openings through which rods 39 pass.

A fly cover 59 is provided to cover the peep hole 60 in the end supporting member 32.

In the operation of this burner it is intended to pass a mixture of pulverized coal and air known as primary carrying air through the intake opening 18. The source of this mixture can come from either a unit pulverizer or a pulverized coal feeder and primary air. This mixture after entering the feeder passes around the involute through the outside helix 37, which causes a rotation of the mixture of coal and air, and will issue in the form of a circular ribbon from the end of the burner.

Secondary air is supplied by means of air duct 26 and is admitted to the central part of the burner through ports 53. This air passes through helix 43, causing the air to rotate in an opposite direction from the mixture of coal and air which passes through spiral 37. The quantity of secondary air can be controlled by opening or closing ports 53 by means of rod 55 and nut 56.

By means of nuts 40, the spiral 37 can be adjusted either from a position flush with the end of burner tube 20, to the extreme back position as shown in Fig. 2, thus varying the length of the flame or its angular flare.

If spiral 37 is at the extreme end of the burner, the current of coal and air will leave at approximately 45° angle. When the spiral is drawn further back in the tube, this angle of discharge will be reduced and it is possible to discharge the current of air in almost a parallel tubular form.

The secondary air passing through the burner through spiral 43 expands through the cone of coal and primary air into the furnace. The angle or deflection of this air can also be controlled by the adjustment of helix 43, similar to the outside cone, thus making it possible to vary the shape of the flame from a wide flaring cone to a long tubular form. Further, by changing the length of tube 20, the secondary and primary air can be brought into impingement before the material leaves the burner nozzle, and this also will have an effect upon the length and nature of the flame.

As will be seen from this description, it will be possible, by the installation of these burners on almost any shape furnace, to adjust the shape and size of the flame emitting from the burner to the most advantageous condition for any particular furnace.

Furthermore, all adjustments of the burner can be made from the outside, also all of the parts of the burner are removable through the front, so that if replacements are necessary, same can be made without entering the furnace chamber.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit

thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art, or as are specifically set forth in the appended claims.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. A pulverized fuel burner comprising in combination, inner and outer coaxially mounted cylinders forming an annular passage of uniform section therebetween, means for admitting secondary air to said inner cylinder and means for admitting air and fuel into said annular passage, and means slidably mounted in said annular passage and in said inner cylinder to cause the fuel mixture and said secondary air to be gyrated in opposite directions so as to cause said stream of secondary air to expand through said mixture after its discharge from the burner.

2. A pulverized fuel burner comprising in combination, inner and outer coaxially mounted cylinders forming an annular passage of uniform section therebetween, means for admitting secondary air to said inner cylinder, means for admitting air and fuel into said annular passage, and means slidably mounted in said annular passage and in said inner cylinder to cause the fuel mixture and said secondary air to be gyrated in opposite directions and to cause said fuel mixture to issue from the burner in either a helical or spiral form.

3. A pulverized fuel burner comprising in combination, inner and outer coaxially mounted cylinders forming an annular passage of uniform section therebetween, means for admitting a mixture of air and fuel to said passage, said means comprising a feeder in the form of an involute, means for admitting secondary air to said inner cylinder, and means slidably mounted in said annular passage and in said inner cylinder to cause said mixture and said secondary air to be gyrated in opposite directions and to control thereby the point where combustion will occur in the combustion chamber.

4. A pulverized fuel burner comprising in combination, inner and outer coaxially mounted cylinders forming an annular passage of uniform section therebetween, a feeder in the form of an involute for admitting a mixture of air and fuel to said passage, means for admitting secondary air to said inner cylinder, means for regulating said secondary air, a member in the form of a helical ribbon slidably mounted in said passage, a slidable member having helically formed vanes slidably mounted in said inner cylinder, and means to change the positions of said members so as to control the shape of the flame issuing from the burner and the point of combustion.

5. A burner for pulverized fuel comprising in combination an outside sleeve, and involute fuel and air passage communicating with the rear end of said sleeve, a central burner tube for secondary air passing through said involute and sleeve to form an annular space of uniform section between said tube and said sleeve, said tube being supported at its rear end by said involute, means for admitting air to the rear end of said tube, means for regulating said air, a member in the form of a helical ribbon fitting the annular space between said tube and said sleeve, a second member having helically formed vanes adapted to fit the bore of said tube, and means to adjust the positions of said helical members longitudinally of the burner so as to control the shape of the flame issuing from the burner.

6. A burner for pulverized fuel comprising in combination, an outside sleeve, an involute fuel and air passage of gradually decreasing section communicating with the rear end of said sleeve, a central burner tube for secondary air passing through said involute and adapted to form an annular space of uniform section between the inside of said sleeve and the tube, an air register at the rear of said feeder communicating with said tube, a closure for the rear end of said tube, a cylindrical member in the form of a helical ribbon fitting the annular space between said tube and said sleeve, a second member having helically formed vanes adapted to fit the bore of said tube, an air duct surrounding said register and means outside of said duct for adjusting the relative positions of said helical members longitudinally of the burner and for adjusting said air register for controlling the supply of air to the burner.

7. A burner for pulverized fuel comprising in combination, an outside sleeve, an involute fuel and air passage with a gradually decreasing area toward its outlet end connected to the rear end of said sleeve, a central burner tube for secondary air supported by said involute and extending into said sleeve so as to form an annular space of uniform section between said sleeve and said tube, an air register connected to the rear end of said tube, a closure for the rear end of said register, a peep hole through said closure, means fitted into said annular space and the interior of said tube for causing the gyration of said fuel ladened air and said secondary air in opposite directions, separate means for adjusting said gyrating means longitudinally of the burner, and an air duct surrounding said register, tube and involute, said register comprising a cylindrical member having a plurality of openings and a rotatable perforated band surrounding said cylindrical member, and means outside of said duct for controlling the supply of air to the burner.

8. A burner for pulverized fuel comprising in combination, a cylindrical sleeve adapted to fit into an opening of a furnace wall,

a cylindrical tube of less diameter than said sleeve mounted inside of said sleeve and extending rearwardly thereof, a feeder having an involute passage for carrying air and fuel encircling the rear portion of said tube, said passage communicating with the annular passage formed by said sleeve and said tube, a cylindrical air register for secondary air connected to the rear end of said tube, openings through the wall of said register, a rotatable perforated band surrounding said openings, a conical closure for the rear end of said register, an air duct surrounding said register, means fitted into said annular passage and the interior of said tube to cause the gyration of said fuel ladened air and said secondary air in opposite directions as they issue from the burner, rods connected to said gyrating means passing rearwardly through said feeder and said closure, another rod connected to said perforated band leading to the outside of said duct, and packing glands for said rods where they pass through either the feeder or said duct.

In testimony whereof I hereunto affix my signature.

OTTO A. KREUTZBERG.