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FUEL BURNER

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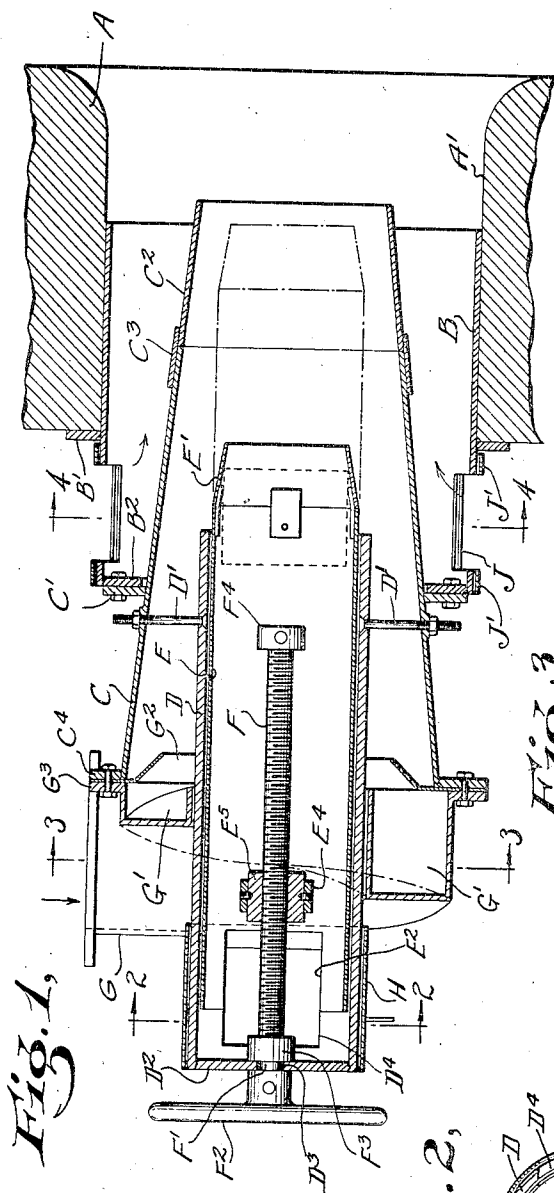


Fig. 1.

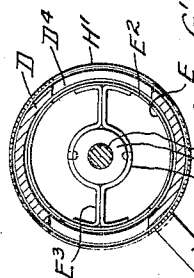


Fig. 2,

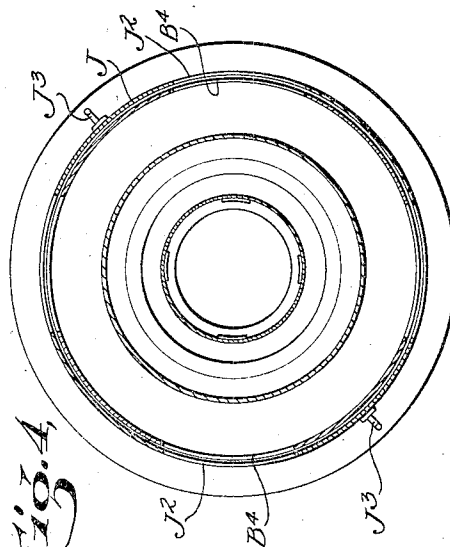


Fig. 4

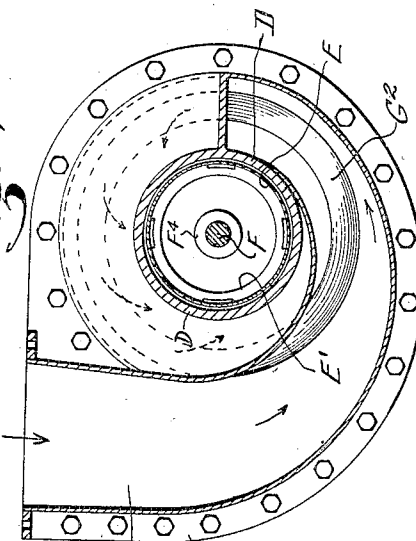


Fig. 3.

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FUEL BURNER

Application filed December 7, 1927. Serial No. 238,274.

The present invention relates to furnaces wherein a combustible mixture of air and comminuted fuel is discharged into the furnace chamber under pressure and burned in suspension. The object of my present invention is to provide improved apparatus for directing and regulating the flow of the stream of combustible material into the furnace chamber. More specifically, the object of my invention is to provide an improved construction of a fuel nozzle for comminuted fuel such as powdered coal which is so constructed and operated that a uniform mixture of powdered coal and combustion air is discharged from the nozzle to the furnace chamber. Further specific objects of my invention are to provide improved means for regulating the rate of discharge of the combustible mixture and for regulating and directing the flow of secondary air to different portions of the stream of combustible material.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, and the advantages possessed by it reference should be had to the accompanying drawing and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

Of the drawing:

Fig. 1 is an elevation partly in section of a preferred embodiment of my invention;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a section taken on the line 3—3 of Fig. 1; and

Fig. 4 is a section taken on the line 4—4 of Fig. 1.

In the drawing I have illustrated a preferred embodiment of my improved pulverized fuel burner mounted in an opening A' in a wall of a furnace A. The burner apparatus comprises a thimble casing B substantially cylindrical in form and arranged with its inner end fitting into the outer portion of the wall opening A' and secured to the

outer face of the wall by a flange B' welded to the outer surface of the casing.

A hollow truncated burner cone or frusto-conical burner member C is arranged with its smaller end portion projecting into the opening A' and extending slightly beyond the inner end of the casing B. The burner cone is secured to the casing B by a flange C' mounted on an intermediate portion of the cone and connected to a flange B² on the outer end of casing B. The inner end of the cone is formed by a detachable burner tip C² secured to the remaining portion of the cone by a tapered sleeve C³.

A cylindrical sleeve casing D is arranged within the outer portion of the cone C and supported therefrom by a series of radial bolts D', each of which has its outer threaded end passing through the cone member and secured thereto by a nut. The sleeve casing is closed at its outer end by a circular plate D² having an opening D³ at the center thereof. The outer end portion of the casing is formed with a pair of diametrically opposite rectangular openings D⁴ therein.

A cylindrical nozzle sleeve E concentric with and slightly less diameter than the casing D is slidably mounted within the casing D. The sleeve E is provided at its inner end with a tapered nozzle tip E' having its larger end detachably secured to the end of the sleeve. At diametrically opposite points at its outer end, the sleeve is provided with recessed portions E² of substantially the same size and arranged to normally register with the openings D⁴ in the burner casing. A spider E³ is mounted in and secured to the sleeve at a point adjacent the bottom of the recesses E² and arranged with its legs forming a circular opening E⁴, within which is secured a circular nut E⁵ having a threaded opening E⁶.

A threaded shaft F is mounted within the casing D and formed with an outer unthreaded portion F' passing through the opening D³ in the end plate D² and with an intermediate portion threaded through the nut E⁵. Secured to the outer end of the shaft F is a hand wheel F² having its hub member abutting the outer face of the end plate D². The

shaft F is held in position relative to the plate D² by a collar F³ secured to the shaft and abutting the inner face of the plate D². On the inner end of the shaft F is mounted a second collar F⁴ beyond which the nut E⁵ cannot pass. In the construction described and on rotation of the hand wheel F², the nut E⁵, being connected to the spider and sleeve E, will move the latter axially of the casing D to vary the position of the nozzle tip E' relative to the cone C and particularly with respect to the cone tip C².

The fuel burner construction heretofore described is provided with means for passing comminuted fuel into the mixing chamber formed by the outer wall of the burner casing and the inner wall of the cone. In the present embodiment an inlet casing G of involute or spiral form is arranged to deliver a mixture of fuel and air to the mixing chamber. The inlet casing wall is connected by an annular flange G³ to an annular flange C⁴ mounted on the outer end of the burner cone. As shown in Fig. 3, the casing is constructed with a spiral passage G' connected at its outer end to a supply of pulverized fuel and arranged to discharge to the mixing chamber through an annular discharge opening G². The casing G is mounted on the casing D with the inner wall of the casing passage G' contacting with the cylindrical surface of the casing D and progressively decreases in width, measured axially of the burner, to provide a tapering cross section in the direction of flow and thereby provide a uniform velocity of flow of combustible mixture through the discharge opening G².

In the operation of the apparatus shown, a mixture of powdered fuel and air is supplied to the passage G'. The shape of the passage forces the mixture of air and fuel to pass in a spiral path winding about the axis of the burner structure and discharging from the opening G² with a whirling motion about the casing D. The whirling mixture passes through the cone tip section C² into the furnace chamber, where it rapidly increases in area due to its centrifugal force.

Where the air carrying the comminuted fuel into the furnace chamber is not sufficient to support complete combustion of fuel, I have provided air inlet means through which secondary air can be admitted in regulable amounts into different portions of the spiral stream of air and fuel from the outlet G². In the construction shown, I have provided the outer portion of the casing D with a cylindrical damped sleeve H having openings H' therein corresponding in size and shape with the openings D⁴ and recesses E². The sleeve H is provided with a handle H², by which it can be rotated on the casing D to vary the size of the opening formed by the corresponding openings D⁴ and H'. Air is drawn

through the opening passing axially through the nozzle E and mixing with the outer portion of the air and fuel mixture at a point beyond the nozzle tip E'.

I have provided additional means for supplying secondary air to the air and fuel mixture. The thimble casing B is constructed with a portion thereof, adjacent its outer end, of slightly less diameter than the remaining portion of the casing and provided at spaced points around its circumference with rectangularly shaped openings B⁴. Mounted on that portion of the thimble member is a cylindrical damper sleeve J having its main portion concentric with and of slightly larger diameter than the reduced portion of the thimble member B. The side portions of the damper J are formed by circular guide rings J' rotatably mounted on the thimble casing B. As shown in Fig. 4 the damper is arranged with openings J² therein of approximately the size and shape of the openings B⁴. The damper J is rotated by means of handles J³ secured to the circumference thereof at spaced points to vary the size of air inlet openings formed by the apertures B⁴ and J².

In the operation of my improved apparatus, a stream of air under pressure carrying a quantity of finely pulverized fuel such as powdered coal enters the inlet end of the inlet casing G and passes in a spiral path through the annular discharge outlet G² into the mixing chamber. The whirling motion given to the coal and air by the form of the casing chamber G' causes the mixture to pass in a spiral path through the burner cone to the furnace chamber. When the amount of air entering the chamber G' is not sufficient for complete combustion of the fuel, the sleeve damper H is rotated to permit a stream of air to be drawn through the nozzle E and mix with the primary air and fuel in the outer portion of the cone. If a greater amount of secondary air is required than can be obtained with the damper H in its wide open position, or if it is desirable to also permit secondary air to enter around the main stream of coal and air when the damper H is partly open, the damper J is moved to permit a stream of air to pass around the outer portion of the burner cone and to mix with the main stream of combustible mixture at a point beyond the discharge end of the cone.

With a given quantity rate of flow the linear velocity of the combustible mixture passing through the outer end of the cone C depends upon the effective cross sectional area at the point of discharge. The effective discharge area may be varied by moving the sleeve E axially of the cone, as for example to the position shown in dotted lines in Fig. 1. Thus on a rotation of the hand wheel F², the position of the nozzle tip E' with respect to the discharge end of the cone is varied,

thereby regulating the velocity of the combustible mixture passing into the furnace chamber. The discharge velocity is especially important as upon that factor depends the length of the flame projected into the furnace. It has been found that too close a flame tends to burn up the tip of the burner cone and nozzle. For that reason, I have provided detachable burner and nozzle tip sections so that those sections may be replaced by similar or differently shaped sections when necessary. While I have described the burner as arranged in the side wall of the furnace, my invention may be installed as well in a horizontal or inclined position in any of the other furnace walls.

My invention is characterized by the simplicity of construction of the various parts and the ease and effectiveness of the regulation of the fuel and air supply. The involute shaped inlet passage is especially advantageous in providing a uniform mixture of fuel and air for combustion.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention as set forth in the appended claims and that in some cases certain features of my invention may be used to advance without a corresponding use of other features.

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

1. A comminuted fuel burner adapted to be mounted in an opening in a wall of a furnace chamber comprising a hollow frusto-conical burner member adapted to extend into said wall opening, an inlet casing having a chamber of involute form secured to and arranged to discharge a combustible mixture into said burner member, a cylindrical casing mounted in said burner member, a nozzle sleeve movable within said cylindrical casing, a nozzle tip on the inner end of said sleeve, means for axially moving said sleeve, a regulable opening for admitting air through said sleeve and a regulable opening for admitting air around the inner end of said burner member.

2. A comminuted fuel burner comprising an outer casing adapted to be mounted in a furnace wall opening, a frusto-conical burner member mounted in said outer casing and having its inner portion spaced from the walls of said casing to provide an annular passage therebetween, an axially adjustable nozzle member positioned within said burner member and spaced from the inner wall thereof to provide a second annular passage therebetween, a comminuted fuel and air inlet

member secured to an outer portion of said burner member, said inlet member having a tangentially arranged inlet, an annular outlet connected to said second annular passage, and a spiral passage connecting said inlet and outlet, and means for axially adjusting said nozzle member to vary the effective discharge area of said second annular passage.

3. A comminuted fuel burner comprising an outer casing adapted to be mounted in a furnace wall opening, a frusto-conical burner member mounted in said outer casing and having its inner portion spaced from the walls of said casing to provide an annular passage therebetween, an axially adjustable nozzle member positioned within said burner member and spaced from the inner wall thereof to provide a second annular passage therebetween, a comminuted fuel and air inlet member secured to the outer end of said burner member, said inlet member having a tangentially arranged inlet, an annular outlet connected to said second annular passage, and a spiral passage of tapering cross-section connecting said inlet and outlet, and means for axially adjusting said nozzle member to vary the effective discharge area of said second annular passage.

4. A comminuted fuel burner comprising an outer casing adapted to be mounted in a furnace wall opening, a frusto-conical burner member mounted in said outer casing and having its inner portion spaced from the walls of said casing to provide an annular passage therebetween, a guide sleeve secured in said burner member, an axially adjustable nozzle member mounted in said guide sleeve and spaced from the inner wall of said burner member to provide a second annular passage therebetween, a comminuted fuel and air inlet member secured to the outer end of said burner member, said inlet member having a tangentially arranged inlet, an annular outlet connected to said second annular passage, and a spiral passage of tapering cross-section connecting said inlet and outlet, regulable means for admitting air for combustion into the interior of said nozzle member, and means for axially adjusting said nozzle member to vary the effective discharge area of said second annular passage.

5. A comminuted fuel burner comprising an outer casing adapted to be mounted in a furnace wall opening, a frusto-conical burner member mounted in said outer casing and having its inner portion spaced from the walls of said casing to provide an annular passage therebetween, angularly spaced openings in said outer casing for admitting air for combustion to said annular passage, a damper sleeve mounted on said casing for regulating the admission of the air, an axially adjustable nozzle member positioned within said burner member and spaced from the inner

10 wall thereof to provide a second annular passage therebetween, a comminuted fuel and air inlet member secured to the outer end of said burner member, said inlet member having a tangentially arranged inlet, an annular outlet connected to said second annular passage, and a spiral passage of tapering cross-section connecting said inlet and outlet, and means for axially adjusting said nozzle member to vary the effective discharge area of said second annular passage.

15 6. A comminuted fuel burner comprising in combination a hollow burner member fixed in position and having a smooth inner surface and tapering towards its discharge end, means movable relative to said discharge end for regulating the effective discharge area of said burner member comprising an axially movable nozzle member having a smooth outer surface radially spaced from the inner surface of said burner member and forming an unobstructed annular passage therebetween, and means for passing a mixture of air and comminuted fuel in a spiral path to and through said annular passage.

20 7. A comminuted fuel burner comprising a hollow burner member fixed in position and tapering towards its discharge end, means for passing a combustible mixture of air and comminuted fuel in a spiral path to and through said burner member comprising an inlet casing of involute form and having an annular discharge outlet opening to said burner member, and means for regulating the linear velocity of said combustible mixture through the discharge end of said burner member comprising an axially movable nozzle member within said burner member.

25 Signed at New York city, in the county of New York and State of New York, this 3rd day of December, A. D. 1927.

WALTER F. KEENAN, JR.

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