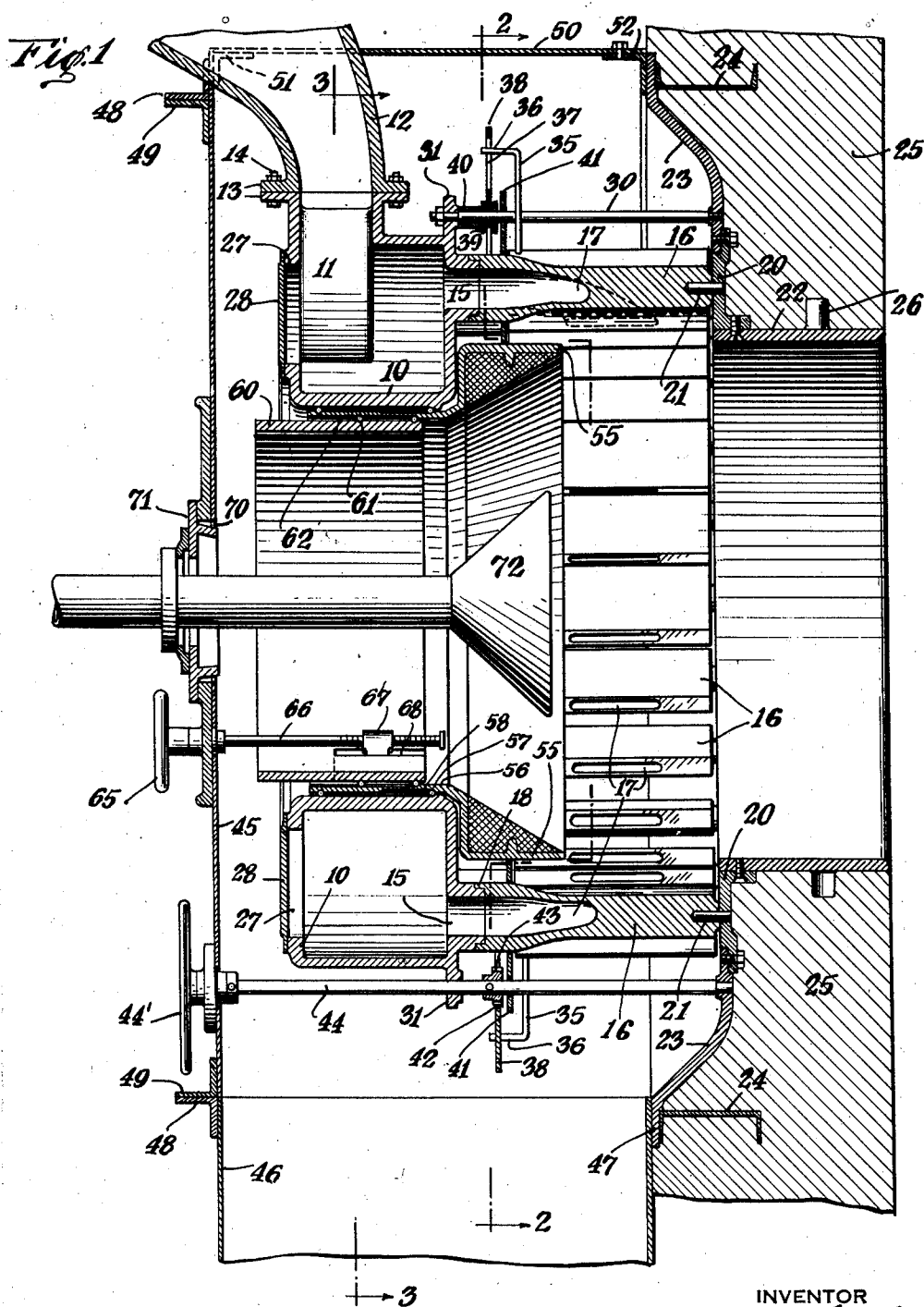


1,910,893

BURNER

Filed March 21, 1930

3 Sheets-Sheet 1



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May 23, 1933.

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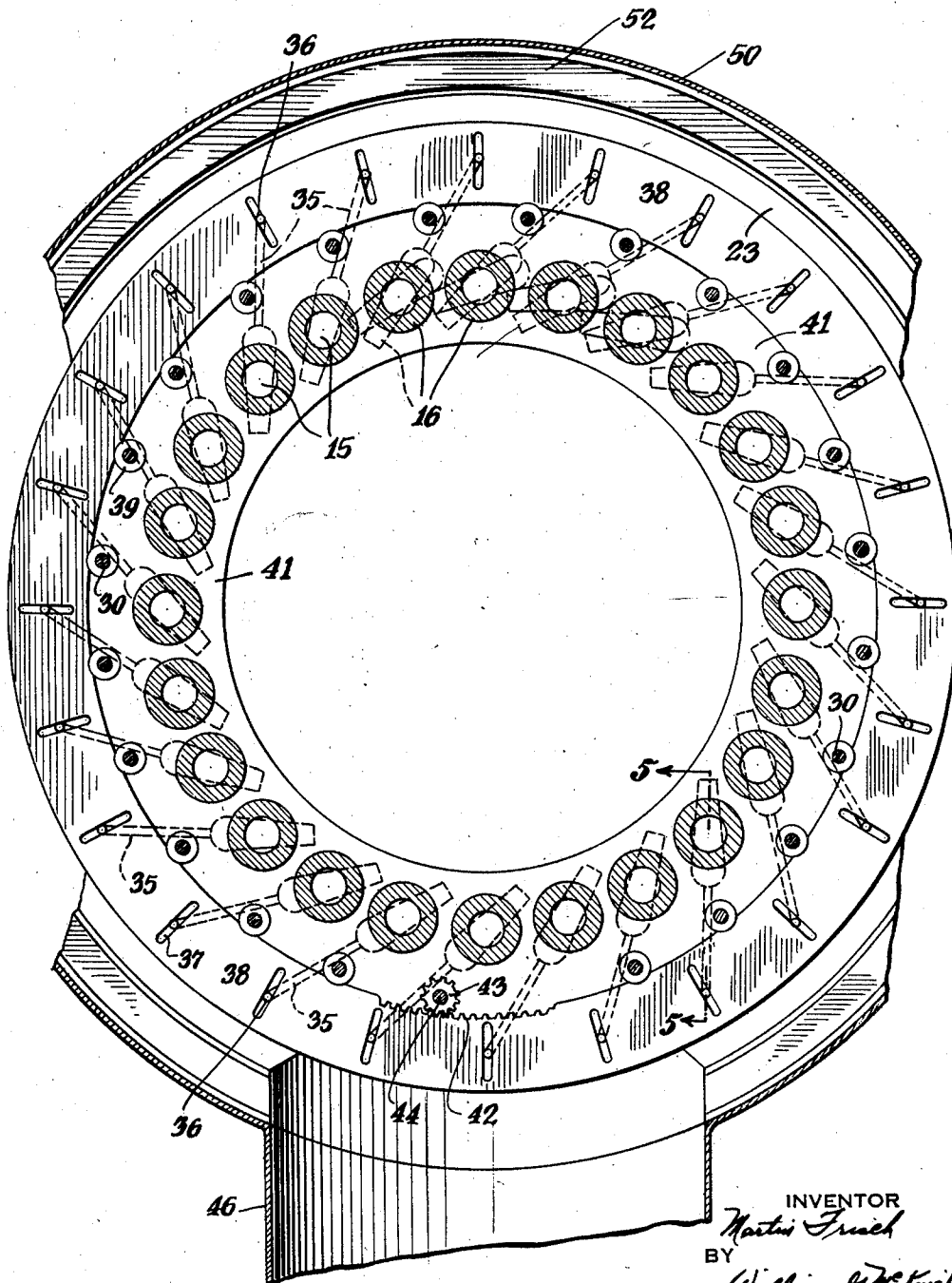
1,910,893

BURNER

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3 Sheets-Sheet 2

Fig. 2



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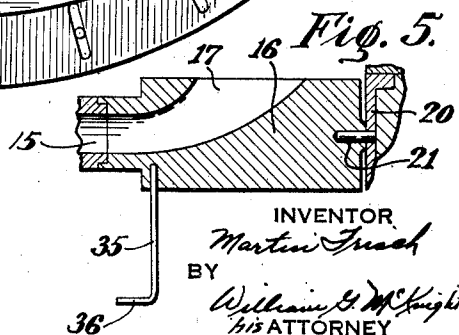
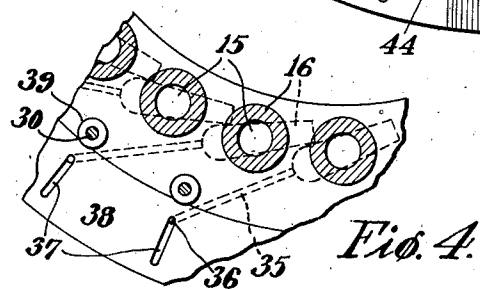
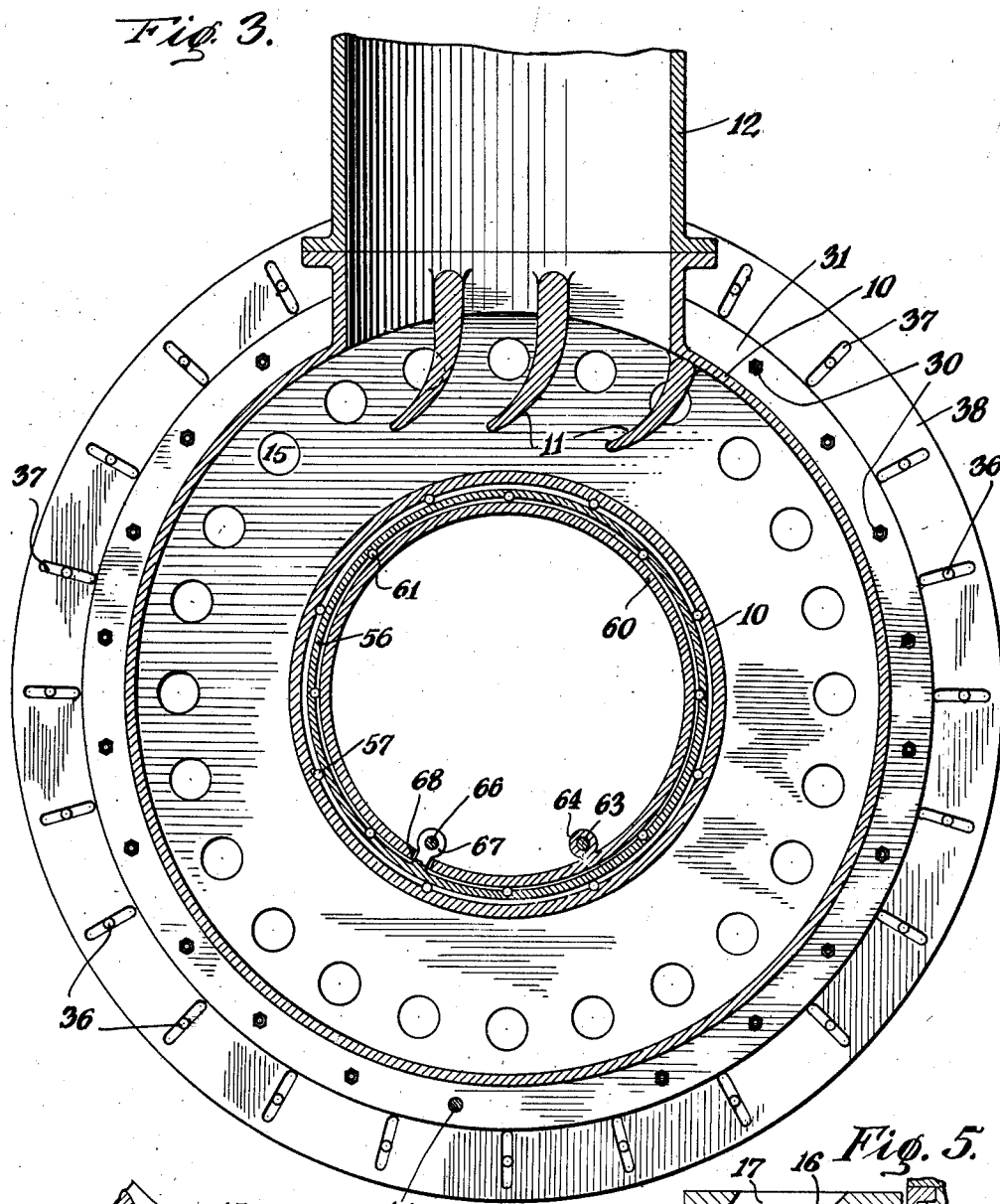
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1,910,893

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3 Sheets-Sheet 3



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BURNER

Application filed March 21, 1930. Serial No. 437,850.

This invention relates to apparatus for supplying a combustible mixture to a furnace and more particularly to a burner for supplying fuel such as pulverized coal and air to the furnace of a steam boiler.

The invention provides for securing an intimate mixture of fuel and air which is necessary for efficient combustion and for controlling the relative quantity and distribution thereof. Turbulence is produced by applying air and fuel alternately about the periphery of the burner in a general tangential direction and by supplying additional air for combustion axially of the burner. The center of the burner is unobstructed to provide space for an auxiliary burner or for cleaning, inspection or repair.

This is accomplished by providing a hollow, annular fuel housing with a plurality of peripherally spaced, axially extending discharge ports, each of which communicates with a hollow vane having an internal opening. The vanes are inclined to radii of the annular housing and apply the fuel in a corresponding direction. Air is admitted between the vanes in a position to form an intimate mixture with the fuel and in a direction to produce a turbulent rotating mass of fuel and air. The quantity of air is regulated by pivoting the vanes about axes parallel to the axes of the burner and the fuel is controlled by a cylindrical damper which covers the internal openings of the vanes. The additional air supply through the center of the annular housing is controlled by a second cylindrical damper associated with the air casing.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, the mode of its operation and the manner of its organization may be better understood by referring to the following description taken in connection

with the accompanying drawings forming a part thereof, in which

Fig. 1 is a vertical section through a burner constructed in accordance with the present invention;

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

Fig. 3 is a section taken on the line 3—3 of Fig. 1 showing the construction of the fuel inlet;

Fig. 4 is a part sectional view of the vanes in closed position; and

Fig. 5 is a longitudinal section of a vane showing the fuel passage.

Like reference characters denote like parts in the several figures of the drawings.

In the following description and in the claims, parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Referring to the drawings more in detail, the invention is shown as applied to a burner comprising a hollow, annular fuel housing 10 which is provided with blades 11 (Figs. 1 and 3) for directing the incoming fuel and air in a tangential direction and causing the same to whirl about the annular channel. A duct 12 through which the mixture of powdered coal and primary air herein considered as the fuel is received is secured to housing 10 in any suitable manner, as by cooperating flanges 13 and bolts 14 (Fig. 1).

Housing 10 is provided with a plurality of peripherally spaced, axially extending ports 15 through which the fuel is discharged. Vanes 16 having ducts 17 formed therein are pivotally mounted on bearings 18 formed on housing 10 around ports 15. Ducts 17 register with ports 15 and extend to the inner edge of said vanes which are inclined to radii of the housing whereby the fuel is discharged in a general tangential direction and turbulence is produced.

Vanes 16 are also pivoted to ring 20 as by pins 21 which are in axial alignment with bearings 18. Ring 20 is secured to tubular member 22 which forms the furnace supply channel and is carried by member 23 which

is supported from the steel work of the furnace in any convenient manner. Flange 24 is secured in the brick work 25 surrounding the burner opening and secures the burner in position. Tubular member 22 is also provided with extensions 26 which extend into said brick work for the same purpose.

Housing 10 is secured to annular member 23 by rods 30, which are threaded into said annular member, and extend through flange 31 formed on said casing. An annular port 27 is formed in housing 10 for purposes of inspection or cleaning and is covered by member or members 28 which is secured thereto in any convenient manner.

Each vane 16 has secured thereto a rod 35 having its end portion 36 bent at right angles and extending through a slot 37 formed in annular member 38. Said member 38 is supported on a plurality of rollers 39 which are journaled on rods 30 between bushings 40 and retaining ring 41.

Annular member 38 is provided with a rack 42 cooperating with pinion 43 pinned to shaft 44 which is journaled in annular member 23 and flange 31 of housing 10. Said rod extends through the air casing to be described and is provided with a hand-wheel 44' by which it may be operated.

An air casing 45 surrounds housing 10 and vanes 16 and is supported from annular member 23 in any convenient manner. Said casing communicates with a supply pipe 46 which is secured to flange 47 of annular member 23 and to a flange 48 which is in engagement with flange 49 carried by said casing 45. The top of casing 45 is closed by plate 50 which extends between said casing and annular member 23 and is secured to angles 51 and 52.

A movable cylindrical damper 55 is formed with a tubular extension 56 which is slidably mounted within housing 10 as by bearings 57 which cooperate with recesses 58 therein. Said recesses are adapted to form stops for controlling the extent of movement of said damper. Damper 55 is adapted to be moved axially to variably close the opening of ducts 17 and the air inlet channels between the various vanes 16.

A second movable cylindrical damper 60 is slidably mounted within extension 56 by bearings 61 which engage recesses 62 formed in said extension 56. Damper 60 is controlled by threaded rod 63, cooperating with a lug 64 which is secured to said damper. Rod 63 extends through casing 45 and is provided with a hand-wheel (not shown) by which it is controlled.

Damper 55 is controlled by a similar rod 66 (Fig. 3) which cooperates with a lug 67 formed on extension 56 and extending through a slot 68 in damper 60. Rod 66 may be provided with a hand-wheel 65 for operating purposes. Housing 45 is provided axially of the burner with an aperture 70 contain-

ing a bushing 71 through which an auxiliary burner 72 may be inserted. Said burner may be adapted to burn auxiliary fuel, as for example, gas or oil. Bushing 71 is so formed that the aperture therein may be used for purposes of observation, cleaning or repair when burner 72 is removed.

In the operation of the above described burner the pulverized fuel is blown through duct 12 into housing 10 and a rotary motion is imparted thereto by blades 11. This fuel is discharged from housing 10 through ports 15 and ducts 17 in vanes 16 and is applied to the burner in substantially tangential directions. The air from supply pipe 46 is applied to casing 45 and is admitted to the burner between the various vanes 16. It is to be noted that this air and the fuel are applied alternately about the periphery of the burner in such direction as to produce turbulence and effect an intimate combustible mixture.

The amount of air which passes between the vanes is controlled by rotating the vanes axially about bearings 18 and pins 21. For this purpose hand-wheel 44' is rotated, thereby rotating rod 44 and gear 43 and displacing annular member 38 in a circumferential direction. Rods 35 are thus caused to slide in slots 37 and to vary the pivotal position of the vanes, thereby controlling both the direction of application of the fuel from ducts 17 and the quantity of air admitted between the vanes.

For controlling the quantity of both air and fuel, damper 55 may be moved axially by hand-wheel 65 and rod 66. This damper passes in front of ducts 17 for controlling the quantity of the fuel discharged therefrom and also controls the quantity of air which passes between the vanes.

A portion of the air from casing 45 is applied axially of the burner through damper 60. The quantity of air thus supplied may be controlled by axially moving said damper in response to operation of rod 63. This damper is particularly useful when the axial air supply is to be cut off for any desired reason, as, for example, in lighting the burner.

It is to be noted that the center of the burner is substantially free from obstruction whereby the burner is rendered readily accessible. This is also useful for observation purposes and, furthermore, permits the auxiliary burner to be inserted whenever required.

The bulk of the air for combustion passes into the burner tangentially between the various vanes 16. The alternate portions of combustible fuel and air mix and pass into the furnace as a rotating mass. The mixing is assisted by distributing the fuel mixture through the air for combustion, as above mentioned, so that the friction and eddies produce relative motion between the fuel particles and

the air. It will be noted that the vanes in which the fuel ducts are located extend beyond the ends of the ducts, so that clean secondary air entering the burner between the vanes, in the section between the end of the fuel ducts and the burner mouth 2, tends to keep fuel out of contact with the burner mouth and thus minimizes coking by the interposition of a whirling layer of clean air between the burner mouth 22 and the whirling fuel mixture.

It is also to be noted that the above described design is such that the entire burner may be assembled and shipped as a unit, since all parts, including the ring of brick work 25 around the burner mouth, are carried from annular member 23 which transmits the weight of the burner to the furnace steel work.

While certain novel features of the invention have been shown and described and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes in the forms and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

What I claim is:

1. In a burner for pulverized fuel, a fuel supply housing and an air supply casing, means for introducing said fuel and said air alternately about the periphery of said burner, and means for introducing additional air for combustion axially of said burner.

2. In a burner for pulverized fuel, a fuel supply housing and an air supply casing, means for introducing said fuel and said air alternately about the periphery of said burner, and means for controlling the relative quantities and direction of said air and fuel.

3. In a burner for pulverized fuel, means for introducing said fuel at spaced points about the periphery thereof, means for introducing air at alternate points about said periphery, and means for simultaneously varying the direction of the fuel flow and air flow.

4. In a burner for pulverized fuel, a plurality of hollow vanes spaced about the periphery thereof, means for discharging fuel through said vanes into said burner, and means for introducing air between said vanes.

5. In a burner for pulverized fuel, a plurality of vanes spaced about the periphery thereof, means for discharging fuel through said vanes into said burner, means for introducing air between said vanes, and means for varying the position of said vanes for controlling the quantity of air supplied therebetween.

6. In a burner for pulverized fuel, a plurality of vanes spaced about the periphery thereof, means for discharging fuel through said vanes into said burner, means for intro-

ducing air between said vanes, and means for pivotally moving said vanes to vary the opening therebetween whereby the quantity of air introduced into said burner may be controlled and whereby the direction of the fuel supply may be varied.

7. In a burner for pulverized fuel, a plurality of vanes spaced about the periphery thereof, means for discharging fuel through said vanes into said burner, and means for introducing air between said vanes, said vanes being pivotally movable about axes parallel to the axes of said burner for varying the effective opening therebetween.

8. In a burner for pulverized fuel, a plurality of vanes spaced about the periphery thereof, and having fuel discharge passages located internally of said burner, means for introducing air between said vanes, and means for varying the effective opening between said vanes and of said passages comprising a cylindrical damper movable axially of said burner.

9. In a burner for pulverized fuel, a plurality of peripherally disposed vanes having passages therein for discharging pulverized fuel, means for supplying air for combustion between said vanes, means for pivoting said vanes for varying the opening therebetween and controlling the air supply, and a cylindrical damper movable axially of said burner for varying simultaneously the supply of air and fuel.

10. A burner for pulverized fuel having peripherally spaced fuel ducts adapted to discharge fuel in a substantially tangential direction, means for applying air for combustion between said fuel ducts, and means for supplying additional air for combustion axially of said burner.

11. A burner for pulverized fuel having peripherally spaced fuel ducts adapted to discharge fuel in a substantially tangential direction, means for applying air for combustion between said fuel ducts, means for supplying additional air for combustion axially of said burner, and means for controlling the amount of said additional air supply.

12. A burner for pulverized fuel having peripherally spaced fuel ducts adapted to discharge fuel in a substantially tangential direction, means for applying air for combustion between said fuel ducts, means for supplying additional air for combustion axially of said burner, means for controlling the fuel supply and the tangential air supply, and means for controlling the axial air supply.

13. A burner for pulverized fuel comprising a hollow, annular casing, means for supplying fuel to said casing and causing said fuel to rotate therein, said casing having peripherally spaced discharge ports, a plurality of vanes having ducts in register with said ports and opening at the edges of said

vanes for discharging fuel in a substantially tangential direction, means for pivotally mounting said vanes whereby the direction of fuel supply may be controlled, and means
5 for introducing air for combustion between said vanes, the pivotal position of said vanes being adapted to control the quantity of air thus applied.

14. A burner for pulverized fuel comprising an annular casing, means for supplying
10 fuel to said casing and causing said fuel to rotate therein, said casing having peripherally spaced discharge ports, a plurality of vanes having ducts in register with said ports
15 and opening at the edges of said vanes for discharging fuel in a substantially tangential direction, means for pivotally mounting said vanes whereby the direction of fuel supply may be controlled, means for introducing air
20 for combustion between said vanes, the pivotal position of said vanes being adapted to control the quantity of air thus supplied, means for controlling the amount of air and fuel comprising a cylindrical damper mounted
25 axially of said burner, and means for moving said damper in an axial direction whereby the quantity of air and fuel discharged into said burner may be varied.

15. A burner for pulverized fuel comprising a hollow annular casing, means for supplying
30 fuel to said casing and causing said fuel to rotate therein, said casing having peripherally spaced discharge ports, a plurality of vanes having ducts in register with
35 said ports and opening at the edges of said vanes for discharging fuel in a substantially tangential direction, means for pivotally mounting said vanes whereby the direction of fuel supply may be controlled, means for
40 introducing air for combustion between said vanes, the pivotal position of said vanes being adapted to control the quantity of air thus supplied, and means for introducing further quantities of air for combustion axially
45 of said burner.

16. A burner for pulverized fuel comprising an annular casing, means for supplying
50 fuel to said casing and causing said fuel to rotate therein, said casing having peripherally spaced discharge ports, a plurality of vanes having ducts in register with said ports and opening at the edges of said vanes
55 for discharging fuel in a substantially tangential direction, means for pivotally mounting said vanes whereby the direction of fuel supply may be controlled, means for introducing air for combustion between said vanes, the pivotal position of said vanes being
60 adapted to control the quantity of air thus supplied, means for controlling the amount of air and fuel comprising a cylindrical damper mounted axially of said burner, means for moving said damper in an axial
65 direction whereby the quantity of air and fuel discharged into said burner may be

varied, means for introducing further quantities of air for combustion axially of said burner, and means for controlling the quantity of air thus introduced comprising a second cylindrical damper mounted coaxially
70 with said first damper and movable independently thereof.

17. A burner for pulverized fuel comprising a hollow annular housing, means for introducing fuel therein and causing said fuel
75 to whirl about therein, a plurality of vanes associated with said housing and peripherally spaced thereabout, said vanes having passages communicating with said housing and opening at the edges of said vanes, an air
80 casing surrounding said vanes and said housing, means for causing pivotal movement of said vanes for varying the opening therebetween, a cylindrical damper mounted coaxially with said vanes and adapted to variably
85 control the supply of air and fuel, means for introducing air axially of said burner between said housing and said casing, and a second cylindrical damper for controlling the amount of air thus applied.

18. In a burner for pulverized fuel, a plurality of vanes spaced about the periphery
95 thereof, each one having a fuel duct therein terminating at one end at an edge of the vane and through which fuel is discharged to the burner, each of said vanes extending beyond
100 the said end of the fuel duct in a direction toward the burner mouth, and means for introducing air to the burner between the vanes in the section between said end of the fuel duct and the burner mouth whereby a layer of air
105 is interposed between the burner mouth and the fuel mixture discharged through the fuel ducts to thereby minimize coking in the burner.

19. In a burner for pulverized fuel, means for admitting air and a mixture of fuel and
110 air tangentially into said burner, a member having a cylindrical passageway there-through, a cylindrical sleeve movably mounted in said passageway, means to move said sleeve to vary the quantity of air admitted tangentially and means for forcing air between
115 said sleeve and said member.

20. In a burner for pulverized fuel, means for admitting air and a mixture of fuel and
120 air tangentially into said burner, a member having a cylindrical passageway there-through, a cylindrical sleeve movably mounted in said passageway, means to move said sleeve to vary the quantity of air admitted tangentially, means comprising a second
125 cylindrical sleeve movably mounted within said first mentioned sleeve for regulating flow of air axially through said cylindrical passageway and means for forcing air between said sleeves and between said first mentioned sleeve and said member.

21. In a burner for pulverized fuel, means for admitting air and a mixture of fuel and
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air tangentially into said burner, a member having a cylindrical passageway there-through, a cylindrical sleeve mounted in said passageway, bearing means retained between
 5 said sleeve and said member, means to move said sleeve to vary the quantity of air admitted tangentially and means for forcing air between said sleeve and said member.

22. In a burner for pulverized fuel, means
 10 for admitting air and a mixture of fuel and air tangentially into said burner, a member having a cylindrical passageway there-through, a cylindrical sleeve mounted in said passageway, bearing means retained between
 15 said sleeve and said member, means to move said sleeve to vary the quantity of air admitted tangentially, means comprising a second cylindrical sleeve mounted within said first mentioned sleeve for regulating flow of
 20 air axially through said cylindrical passageway, bearing means between said sleeves and means for forcing air between said sleeves and between said first mentioned sleeve and said member.

23. In a burner for pulverized fuel, an air casing, a fuel housing located within said casing, means for supplying pulverized fuel to said housing, means for supplying air to said casing, a plurality of members defining
 30 a cylindrical mixing zone, said members arranged to admit fuel and air tangentially into said zone, said fuel housing formed with a cylindrical passageway in axial alignment with said zone, a cylindrical sleeve
 35 movably mounted in said passageway, bearing members between said sleeve and said housing, said bearing members spacing the sleeve from the housing, the space thus formed being in communication with said
 40 air casing, and means to move said sleeve into and out of said zone to regulate the supply of fuel and air thereto.

24. In a burner for pulverized fuel, an air casing, a fuel housing located within
 45 said casing, means for supplying pulverized fuel to said housing, means for supplying air to said casing, a plurality of members defining a cylindrical mixing zone, said members arranged to admit fuel and air tangentially into said zone, said fuel housing
 50 formed with a cylindrical passageway in axial alignment with said zone, a first cylindrical sleeve mounted in said passageway, a second cylindrical sleeve mounted in first cylindrical sleeve, bearing members between
 55 said sleeves and between said first sleeve and said housing, said bearing members spacing the sleeves from each other and spacing said first sleeve from said housing, the spaces thus formed being in communication with said air casing, means to move said first sleeve into and out of said zone to regulate the supply of fuel and air
 60 thereto and means to move said second sleeve

to regulate the supply of additional air from said air casing to said zone.

25. In a burner for pulverized fuel, peripherally spaced fuel ducts for discharging
 70 fuel in a substantially tangential direction, a furnace supply channel in axial alignment with said ducts and means for shielding said ducts from heat admitted to said burner through said channel when the burner is idle.

26. In a burner for pulverized fuel, peripherally spaced fuel ducts for discharging
 75 fuel in a substantially tangential direction, a furnace supply channel in axial alignment with said ducts, a cylindrical sleeve movably mounted in axial alignment with said ducts
 80 and means for moving said sleeve to within the space bounded by said ducts to shield the ducts from heat admitted to said burner through said channel when the burner is idle.

In testimony whereof I have affixed my
 85 signature.

MARTIN FRISCH.

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