

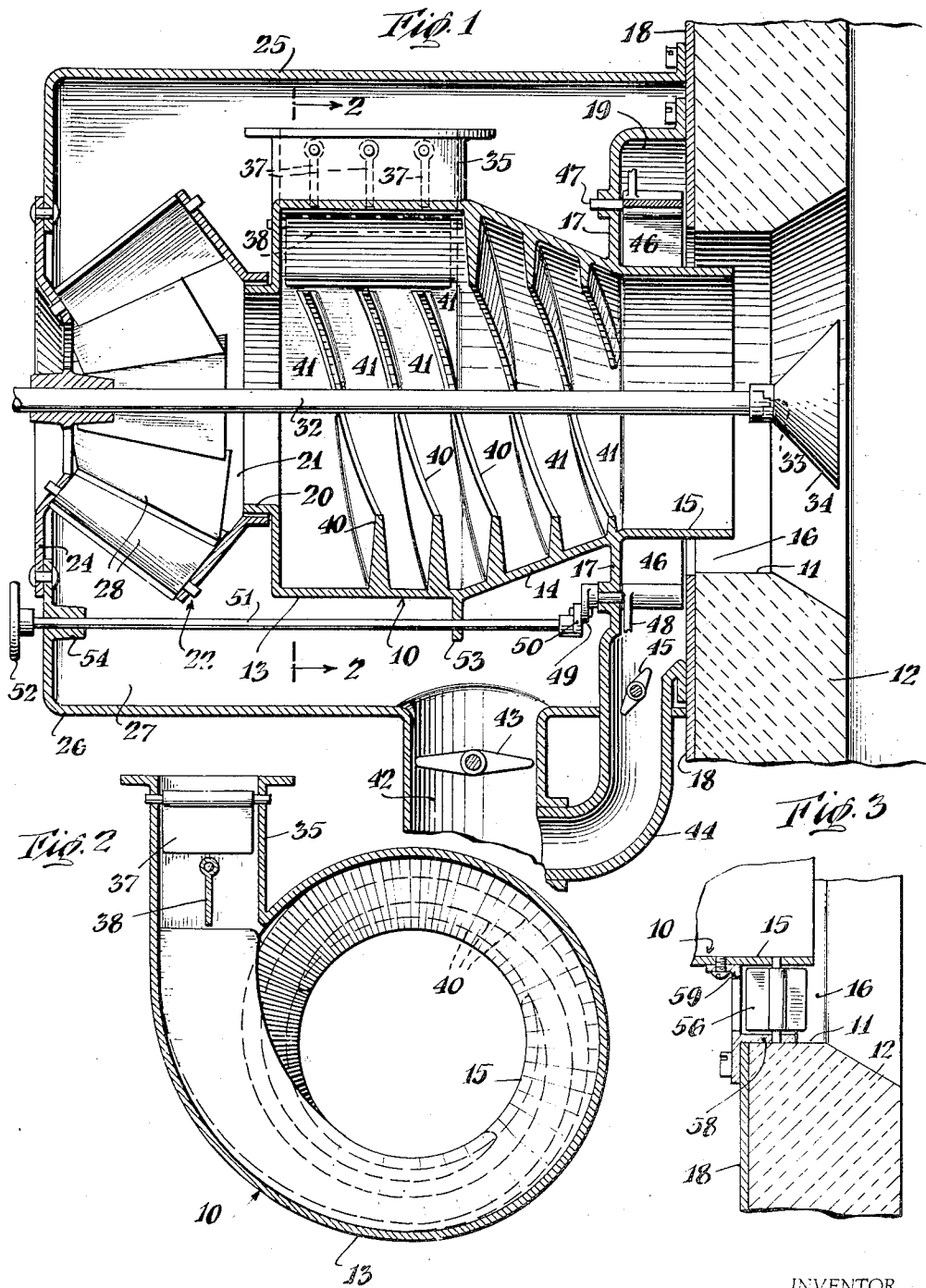
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J. DUNN

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FUEL BURNER

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BY

INVENTOR.
John Dunn
ATTORNEY
Fleck

UNITED STATES PATENT OFFICE

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FUEL BURNER

John Dunn, Yonkers, N. Y., assignor to Peabody Engineering Corporation, New York, N. Y., a corporation of New York

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5 Claims. (Cl. 110—104)

This invention relates to burners and more particularly to burners of the type used for burning pulverized coal.

An object of the invention is to provide a novel an improved burner of the above type in which the entering stream of coal and carrier air is divided into a plurality of separate parts which are individually advanced and are delivered at equally spaced intervals around the periphery of the burner throat.

Another object is to provide a burner of the above type in which a rich, uniformly distributed mixture of fuel and carrier air is supplied to secondary and tertiary air streams at the burner throat.

Another object is to provide a novel and improved burner of the above type which is efficient and stable in operation.

Another object is to provide a burner of the above type having novel and improved details of construction and features of operation.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

Although the novel features which are believed to be characteristic of this invention are pointed out more particularly in the claims appended hereto, the invention itself may be better understood by referring to the following description, taken in connection with the accompanying drawing in which a specific embodiment thereof has been set forth for purposes of illustration.

In the drawing,

Fig. 1 is a longitudinal section through a burner embodying the present invention;

Fig. 2 is a transverse section taken along the line 2—2 of Fig. 1; and

Fig. 3 is a detail view illustrating a different arrangement of the tertiary air inlet doors.

In the following description and in the claims certain specific terms are used for convenience in referring to various details of the invention. These terms, however, are to be given as broad an interpretation as the state of the art will permit.

Referring to the drawing more in detail, the invention is shown as applied to a burner comprising a burner tube 10 which is mounted in registration with a burner opening 11 in a furnace wall 12 forming a part of a combustion chamber. The burner opening 11 is shaped to form the usual burner throat. The tube 10 is shown as having an enlarged cylindrical inlet section 13, a tapered conical section 14 and a cylindrical throat section 15. The throat section 15

is disposed within the burner opening 11 and is shown as spaced radially therefrom to provide an annular tertiary air passage 16. The burner tube may also be provided with a flange 17 which may be attached by suitable means to a plate 18 forming the outer surface of the furnace wall 12 and forms therewith a tertiary air chamber 19.

The inlet end of the burner tube 10 is shown as provided with a flange 20 which is seated within the outlet opening 21 of an air register 22. The air register 22 may be of standard construction and is shown as provided with a front plate 24 attached to a top wall 25 and a bottom wall 26 forming a wind box or plenum chamber 27 and with a plurality of peripheral air doors 28 adapted to receive air from the plenum chamber 27 and to discharge the same through the air discharge opening 21 into the burner tube 10. The air doors 28 are adapted to control the rotary movement of the air supplied through the register. An atomizer barrel 32 is shown as extending axially of the air register 22 through the burner tube 10 and is provided with an atomizing tip 33 and a diffuser 34 at the burner throat. The air register and burner tube may be supported by any suitable means, not shown. This particular form of air register forms no part of the present invention and is accordingly not set forth in detail.

A fuel inlet duct 35 is positioned to admit the stream of fuel and carrier air tangentially to the enlarged inlet section 13 of the burner tube 10. A plurality of transverse dampers 37 and a longitudinal damper 38 are shown as provided in the inlet duct 35 to permit control of the distribution of pulverized fuel and carrier air entering the inlet section 13 of the burner tube.

A plurality of baffles, shown as helical vanes 40 are provided which extend from the inlet duct 35 peripherally around the inlet section 13 and the tapered section 14 of the burner tube 10 and terminate in equally spaced positions around the periphery of the throat section 15 of the burner tube. The baffles or vanes may not be continuous provided they are disposed to control the flow of fuel to the burner throat. In the embodiment shown three such vanes 40 are provided which are spaced across the inlet duct 35 to provide four fuel channels 41. The vanes 40 extend substantially entirely across the inlet duct 35 so that all of the pulverized fuel received from the inlet duct is caused to enter one of the channels 41 and to remain therein until the fuel reaches the outlet end of said channel at the burner throat. The inside diameter of the vanes 40 is at least as

great as that of the outlet opening 21 of the air register and is not substantially less than that of the throat section 15, so that the vanes 40, although of considerable depth, permit a substantially obstructed flow of air from the air register 22 to the burner throat. The vanes 40 are shown as having the same inside diameter throughout, the inlet section 13 and the tapered section 14 of the burner tube being sufficiently enlarged to receive the vanes which are of a height at the inlet end corresponding to the width of the inlet duct 35 and taper in height to their discharge end at the throat section 15.

In the embodiment shown the plenum chamber is connected to an air duct 42 which is connected to supply air under a controlled pressure from a suitable source, such as a blower, not shown, and is provided with a damper 43 for controlling the flow of air to the air register doors 28. The tertiary air chamber 19 is shown as connected by a supply pipe 44, having a control damper 45, to the duct 42 on the high pressure side of the damper 43. The tertiary air chamber 19 communicates through the annular passage 16 with the burner throat to supply the tertiary air to the air-fuel stream as it emerges from the throat section 15 of the burner tube 10. A plurality of peripheral doors 46 are provided in the tertiary air chamber 19 to control the admission and distribution of the tertiary air stream around the burner throat. The doors 46 are shown as mounted on pins 47 which are journaled in the flange 17 and provided with ears 48 which may be joined by links, not shown, to cause the doors 46 to operate in unison with a master door. The pin 47 of the master door may be provided with a cam 49 connected to be actuated by an arm 50 carried by a rod 51 which extends through the front part of the wall 26 and is provided with a handle 52 by which the doors 46 may be actuated. The rod 51 may be supported by suitable means shown as a bracket 53 attached to the burner tube 10 and a boss 54 in the wall 26.

The chamber 19 is shown, for example, as supplied from the pipe 44. It may, however, open directly to the plenum chamber on the downstream (air register) side of the damper 43 and the flow of tertiary air from the chamber 27 may be regulated by the doors 46. In this case the pipe 44 may be omitted and the flange 17 may be of a diameter only sufficient to cover the doors 46, any suitable means, such as struts (not shown), being provided to secure the flange to the plate 18.

In the embodiment shown in Fig. 3 the tertiary air doors 56, which correspond to the doors 46 of Fig. 1, are mounted radially between the throat section 15 of the burner tube and a flange 58 formed on a bracket 59 attached to the throat section 15 and to the front plate 18 of the burner wall. The doors 56 in this embodiment may be adjusted, similarly to the doors 46 of Fig. 1 to control the velocity, rotational effect and quantity of tertiary air received from plenum chamber 27 or duct 42 and supplied to the burner throat.

Operation

In the operation of the above described burner finely divided fuel, such as pulverized coal, blended in a stream of primary or carrier air and uniformly distributed therein, is received from the inlet duct 35 and is fed into the passages 41 between the helical vanes 40 of the burner. The fuel is thus divided into several

streams by means of the vanes 40 and is caused to advance helically to a point of discharge at the burner throat. The vanes prevent any relative shifting of the carrier air and fuel streams and accordingly maintain the fuel and air distributed as received from the inlet duct 35. These air-fuel streams are thus delivered by the passages 41 in a uniformly spaced relationship around the outlet end of the burner tube 10. The distribution of the air-fuel stream in the various passages 41 may be controlled by the dampers 37 and 38.

Secondary air for combustion passes from the plenum chamber 27 through the air register 22 to the interior of the burner tube 10 and emerges from the throat section 15 where it expands due to its rotary motion and is thus brought into contact with the air-fuel stream delivered from the passages 41. Inasmuch as the air-fuel stream is substantially confined within the passages 41 the secondary air remains substantially out of contact therewith until it reaches the burner throat. A rich mixture of fuel and carrier air is thus obtained at the burner throat and tends to stabilize ignition. It is to be noted that the vanes 40 which distribute the air-fuel stream to the burner throat have an inside diameter sufficiently large so as to permit unrestricted flow of secondary air from the air register 22 to the burner throat.

Tertiary air for combustion may be admitted through the tertiary air chamber 19, the doors 56, and the passage 16. This tertiary air is thus mixed with the primary air-fuel stream as the latter emerges from the burner tube 10 and may be regulated by the doors 46 as required for combustion purposes.

The tertiary air supply at the burner throat permits a comparatively large amount of air to be supplied for combustion without increasing to an undesirable value the amount and velocity of air through the air register and through the burner tube. The secondary air may thus be regulated as required to produce a rich, uniform air-fuel mixture and the remainder of the air may be supplied independently of the burner tube at the point required for efficient combustion. It is to be understood, of course, that tertiary air may be omitted if not required in any particular installation.

By connecting the pipe 44 to the high pressure side of the damper 43 controlling the air pressure in the plenum chamber 27, the full pressure is always available for the tertiary air regardless of the pressure in the plenum chamber which is regulated by the damper 43 and controls the flow of secondary air through the air register doors. It is to be understood, however, that the chamber 19 may be open to the plenum chamber 27 if desired or may be open to the atmosphere of the fire room if the furnace is operated under natural draft and there is no plenum chamber.

The atomizer barrel 32 may be provided for use with gaseous or liquid fuels which it may be desirable to burn in certain instances in addition to or in place of solid fuel. It is to be understood that in the event that solid fuel only is to be burned the atomizer barrel may be retracted and the burner tip 33 and diffuser 34 withdrawn into the air register.

It is to be noted that the inlet duct 35 is so arranged that the inner side thereof is substantially tangential to the periphery of the inlet section 13 of the burner tube 10. This avoids restricting the effective diameter of the burner tube

and, due to the arrangement of the inlet ducts and the helical vanes 40, permits the fuel to be supplied with a minimum of friction.

In the event that tertiary air is not desired, the opening 11 may be made of the same diameter as the throat section 15 of the burner tube so that the annular passage 16 is eliminated. The burner throat 11 may, of course, be of any desired shape to obtain efficient combustion and distribution of fuel.

Although specific embodiments of the invention have been shown for purposes of illustration, it is to be understood that the invention may be varied as to details of construction and method of operation and is only to be limited in accordance with the scope of the following claims.

What is claimed is:

1. A pulverized fuel burner comprising a burner tube open at its outlet end to a burner throat and having a secondary air inlet opening at its inlet end to receive secondary air from an air register, a fuel inlet duct supplying pulverized fuel to said burner tube, and a plurality of vanes in said burner tube extending from said fuel inlet duct toward the outlet end of said tube to control the advance of fuel therein and to distribute the fuel uniformly around the periphery of the burner tube at its outlet end, said vanes extending in depth substantially entirely across said fuel inlet duct and tapering in depth to said outlet end, said burner tube being correspondingly enlarged in diameter at the inlet end so that the inner peripheral diameter of each of said vanes is at least as great as the diameter of said secondary air inlet opening and provides an unobstructed passage for said secondary air to said burner throat.
2. A pulverized fuel burner comprising a burner tube open at its outlet end to a burner throat and having a secondary air inlet opening at its inlet end to receive secondary air from an air register, a fuel inlet duct supplying pulverized fuel to said burner tube, and a plurality of vanes in said burner tube extending from said fuel inlet duct toward the outlet end of said tube to control the advance of fuel therein and to distribute the fuel uniformly around the periphery of the burner tube at its outlet end, said vanes extending in depth substantially entirely across said fuel inlet duct and tapering in depth to said outlet end, said burner tube being correspondingly enlarged in diameter at the inlet end so that said vanes have substantially the same inside diam-

eter throughout the length of the burner tube, whereby an unobstructed passage for said secondary air to said burner throat is provided.

3. A pulverized fuel burner comprising a burner tube open at its outlet end to a burner throat and having a secondary air inlet opening at its inlet end to receive secondary air from an air register, said opening being of substantially the same diameter as the diameter of the tube at its outlet end, a fuel inlet duct supplying pulverized fuel to said burner tube near its inlet end, a plurality of vanes in said burner tube extending from said fuel inlet duct toward the outlet end of said tube to control the advance of and to distribute the fuel uniformly around the periphery of the burner tube at its outlet end, said vanes extending in depth substantially across said inlet duct, the portion of the burner tube receiving fuel from said inlet duct being enlarged by at least the depth of said vanes so that the inside diameter of said vanes is at least as large as the diameter of said secondary air inlet opening, said tube tapering from said enlarged portion to its outlet end, said vanes tapering in depth correspondingly so that an unobstructed passage is provided having substantially the same diameter throughout as the diameter of said secondary air inlet opening.

4. In a pulverized fuel burner as set forth in claim 1, a tertiary air passage around said burner tube at the outlet end thereof and means supplying tertiary air through said passage to the air-fuel stream at said burner throat, said burner tube preventing contact between said tertiary air and said air-fuel stream until the latter has mixed with the secondary air and advanced substantially to said throat.

5. In a pulverized fuel burner as set forth in claim 1, a tertiary air passage around said burner tube at the outlet end thereof, means supplying tertiary air through said passage to the air-fuel stream at said burner throat, said burner tube preventing contact between said tertiary air and said air-fuel stream until the latter has mixed with the secondary air and advanced substantially to said throat, and a set of peripheral air doors in said tertiary air passage to impart a rotary movement to the stream of tertiary air so as to produce turbulence which promotes the mixing of the tertiary air with the air-fuel stream.

JOHN DUNN.