Oct. 7, 1924. 1,510,645

L. H. BERGMAN

PULVERIZED FUEL BURNER

Filed Jan. 7. 1920 2 Sheets-Sheet 1

Fig. 1

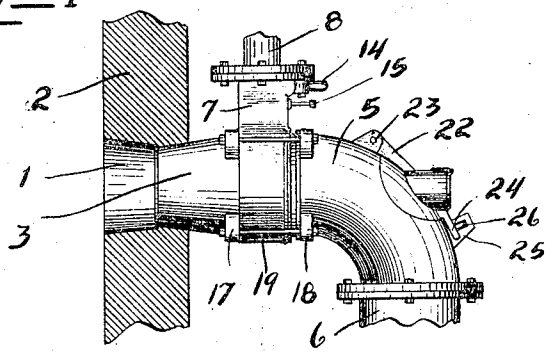
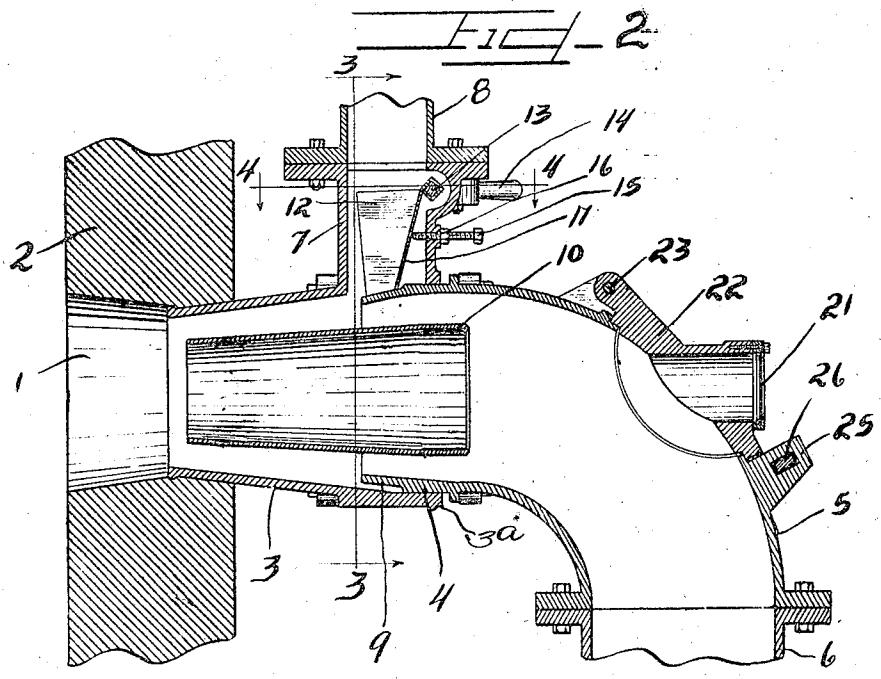


Fig. 2



Witnesses

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Fig. 4

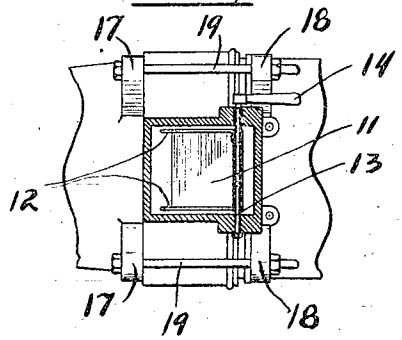


Fig. 3

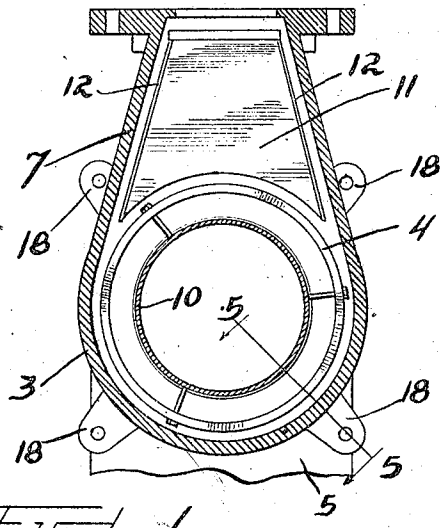


Fig. 5

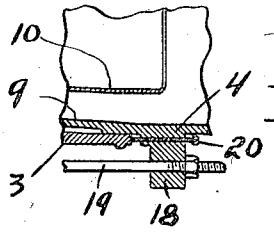
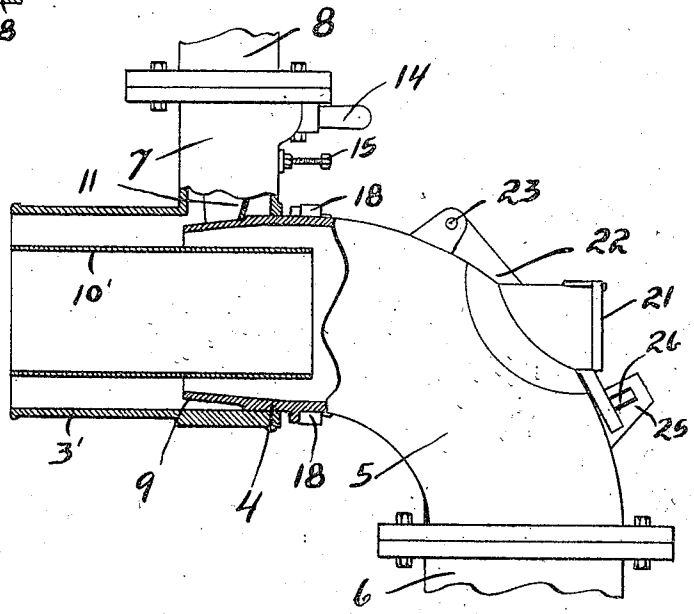


Fig. 6



Witnesses

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Patented Oct. 7, 1924.

1,510,645

UNITED STATES PATENT OFFICE.

LARS HUGO BERGMAN, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO RAYMOND BROS. ENGINEERING CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

PULVERIZED-FUEL BURNER.

Application filed January 7, 1920. Serial No. 350,016.

To all whom it may concern:

Be it known that I, LARS HUGO BERGMAN, a citizen of the United States, and a resident of the city of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Pulverized-Fuel Burners; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings and to the numerals of reference marked thereon which form a part of this specification.

This invention relates to pulverized fuel burners of the type in which pulverized fuel is fed into a stream of air blown into the furnace chamber.

With the burners of this kind considerable trouble has been experienced in producing a uniform mixture of powdered fuel with the air, particularly when the burner is arranged horizontally. If fuel is fed into a horizontal pipe through which air is blown, the upper part of the current of air receives more fuel than the lower part. This may be avoided by providing a frusto-conical sleeve or projection on one part of the pipe which carries the air and then feeding powdered fuel onto this cone so that it may fall therearound and be fed into the current of air around its periphery. It has been found, however, that with a low velocity of air such an arrangement tends to feed more powdered fuel into the lower part than into the upper part of the air current. On the other hand with a high velocity of air the reverse occurs.

One of the objects, therefore, of the present invention is to provide means for varying the location of the various parts of the burner so as to provide substantially uniform mixing of the air and powdered fuel for the particular velocity of air employed.

A further object of the invention is to vary the point at which the fuel is discharged onto the frusto-conical end of the air pipe so as to vary the operation of the device to suit the varying velocities.

A further object of the invention is to provide means for adjusting the space through which the powdered fuel is fed into the air current.

Other and further important objects of this invention will be apparent from the disclosures in the drawings and specification.

The invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings—

Figure 1 is a side elevation of a burner constructed in accordance with the present invention.

Figure 2 is a vertical central section through the same.

Figure 3 is a section on the line 3—3 of Figure 2.

Figure 4 is a section on the line 4—4 of Figure 2.

Figure 5 is a section on the line 5—5 of Figure 3.

Figure 6 is a side elevation partly in section of a further form of construction.

As shown on the drawings—

The burner is shown with its forward or discharge end projecting into an aperture 1 in the wall 2 of a furnace of any desired form and construction. The burner itself consists of a substantially horizontal conduit comprising a discharge nozzle 3 in the rear end 3^a of which is slidably mounted the forward end 4 of an angle pipe 5. This angle pipe 5 is connected through a pipe 6 to a convenient source of air under pressure. On the upper side of the pipe 3 is integrally mounted an extension 7 through which powdered fuel may be fed from a pipe 8 leading to a hopper or other source of powdered fuel. The forward end 4 of the angle pipe 5 is reduced in size and given a tapered form to provide a frusto-conical end 9 which is spaced away from the adjacent wall of the pipe 3. As this frusto-conical end is immediately below the bore of the extension 7, powdered fuel passing down the latter falls onto this frusto-conical end and automatically distributes itself, part over the upper edge of the member 9, and the rest around the same, and discharges into the air current at points therearound. The stream of air passing through the pipe 5 is split up into two concentric streams by means of a short length of pipe 10 concentric with and secured to the end 4 of the pipe 5. With such an arrangement the air which passes around the outside of the

pipe 10 serves to break up all lumps, separating the powdered fuel into its individual particles and to inject it into the furnace, while the air which passes through the pipe 10 supplies the necessary extra oxygen required for the complete combustion of the fuel within the furnace. For this reason I call the air around the outside of pipe 10 fuel separating and conveying air, while the air inside of pipe 10 may be called combustion air. As previously indicated, if the air velocity is high, the suction produced by the flow of air causes the powdered fuel to be drawn into the upper part of the atomizing stream to a much greater extent than at the lower part. If the air is only moved slowly, the reverse action occurs, and consequently it is advisable to cause powdered fuel to fall nearer the edge of the frusto-conical end 9 when the velocity is lower than when the velocity is high. This adjustment of the point of discharge of the powdered fuel may be brought about in one or both of two ways: first, by means of a suitable deflector in the extension 7; second, by adjusting the axial positions of the member 9 with respect to the pipe 3. These two forms of adjustment are shown in the drawings. The deflector may conveniently take the form of a chute 11 provided with side wings 12. This chute is secured to a shaft 13 having secured thereto at one end a handle 14 by which the deflector may be adjusted. The deflector is, preferably, supported in its adjusted position by means of a screw 15 adapted to be locked in any desired position by means of a lock nut 16.

The parts 3 and 5 of the device are provided with apertured lugs 17 and 18 for the passage of clamping screws 19 therethrough. Means are also provided for restricting the extent to which the forward end 4 of the angle pipe 5 may be moved into the rear end 3^a of the pipe 3 by means of the clamping bolts 19. For this purpose adjusting screws 20 are provided in the lugs 18 and the ends of these screws are adapted to engage with the rear end of the pipe 3 and thereby restrict axial movement of the forward end 4 of the pipe 5 within the pipe 3. In this way the position of the frusto-conical end 9 with respect to the aperture in the extension 7 may be adjusted as desired.

In order that the operation of the burner may be observed, a sight glass 21 may be provided. The sight glass is mounted in a frame 22 pivotally mounted at 23 on the member 5 so that it may be swung out of the way when it is desired to clean the burner. The free end of this frame 22 may conveniently be provided with a fork 24 adapted to pass over a lug 25 through which a cotter pin 26 may be passed to retain the frame in position.

For certain kinds of fuel it is desirable to use a different taper on nozzle 3 and the tube 10.

The taper may even be entirely dispensed with for coarsely powdered fuel with which high air pressure is necessary. I have therefore illustrated in Fig. 6 at 3′ and 10′ a nozzle and tube without any taper.

I am aware that numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I therefore do not purpose limiting the patent granted otherwise than necessitated by the prior art.

I claim as my invention—

1. In a pulverized fuel burner, a tubular conduit, a frusto-conical portion converging from the wall of said conduit, projecting toward the discharge end thereof, and demarking a space between said wall and said portion, a fuel supply pipe, a connection between said fuel pipe and said demarked space, means for varying the distribution of fuel in said space, a pipe within said tubular conduit and affording a passage between it and the wall of said conduit for fuel and for air to separate the fuel particles and convey the same, the passage through said pipe serving for combustion air.

2. A burner for pulverized fuel, comprising an approximately horizontal tubular conduit, a tapering tubular partition within said conduit and between the ends thereof, the smaller end of said partition being separated from the wall of said conduit whereby a space is provided between said wall and said partition and opening into said conduit, a substantially vertical pipe for delivering fuel into said space and a pivoted deflector in said pipe for varying the point of discharge of fuel.

3. A burner for pulverized fuel, comprising a tubular conduit including two pipe sections, one of which sections is provided with a tapered end projecting into one end of the other section and providing a space between said tapered end and the wall of said other section, means for feeding fuel into said space, means extending into said space for distributing the fuel therein, means for connecting the pipe section having said tapered end with a source of air under pressure, and clamping means for clamping said sections together and for effecting axial adjustment of said sections to vary the position of said tapered end with relation to said fuel feeding means.

4. A fuel burner including a nozzle and a pipe section connected thereto, which together provide an air conduit, an inner pipe arranged to project into said nozzle and into the forward end of said pipe section and adapted to receive and convey a portion of the air to effect combustion and affording between it and the wall of said conduit an

annular passage, for another portion of said air to separate the particles of fuel and convey the same, a fuel inlet to said passage in front of the rear end of the inner pipe, and means in the fuel inlet cooperating with the end of the said pipe section for adjusting the amount of fuel delivered.

5. A burner for fuels including a nozzle, a fuel feed pipe thereon, an air supply pipe slidably connected to the nozzle, said air supply pipe terminating in a tapered portion, and means in the fuel feed pipe acting in conjunction with said tapered portion for adjusting the amount of fuel delivered.

6. A burner for powdered fuel, comprising a conduit, means associated therewith to provide a fuel space having a discharge orifice concentric to and communicating with the passage through said conduit, means for supplying fuel to said space, and adjustable means extending into said space to distribute the fuel therein, whereby a substantially uniform discharge of fuel is effected throughout the entire area of said discharge orifice.

7. A burner for powdered fuel, comprising a conduit, means associated therewith to provide a fuel space having a discharge orifice concentric to and communicating with the passage through said conduit, means for supplying fuel to said space, means for connecting said conduit with a source of air under pressure and means for maintaining a substantially uniform discharge of fuel throughout the entire area of said discharge orifice comprising a member movable in said space to distribute the fuel therein.

8. A burner for powdered fuel, comprising a conduit, means associated therewith to provide a fuel space having a discharge orifice concentric to and communicating with the passage through said conduit, means for supplying fuel to said space, and means for maintaining a substantially uniform discharge of fuel throughout the entire area of said discharge orifice comprising a deflector extending into said space to vary the distribution of fuel therein.

9. A burner for powdered fuel, comprising a conduit, a flange projecting inward and forwardly from the wall of said conduit and providing a fuel space having a discharge orifice concentric to and communicating with the passage through said conduit, means for supplying fuel to said space, and means for maintaining a substantially uniform discharge of fuel throughout the entire area of said discharge orifice comprising a deflector embracing a portion of said flange and movable in said space to vary the distribution of fuel therein.

10. A burner for pulverized fuel, comprising a conduit for air under pressure, a pipe arranged within said conduit and spaced from the walls thereof to form inner and outer concentric passages, said conduit being provided with a fuel space having a discharge orifice concentric to and communicating with said outer passage at a point intermediate the ends of said pipe whereby the air passing through the said outer passage is mixed with fuel and whereby air only passes through said inner passage, and adjustable means for distributing the fuel in said fuel space with relation to said discharge orifice to insure a substantially uniform discharge of fuel throughout the entire area of said discharge orifice.

11. A burner for powdered fuel comprising a conduit provided with a portion spaced from the wall thereof and defining a fuel space, means for supplying fuel to said fuel space, means for connecting said conduit with a source of air under pressure, and means extending into said space for distributing the fuel therein.

In testimony whereof I have hereunto subscribed my name in the presence of two subscribing witnesses.

LARS HUGO BERGMAN.

Witnesses:

RIDSDALE ELLIS,

EARL M. HARDINE.