

Sept. 22, 1931.

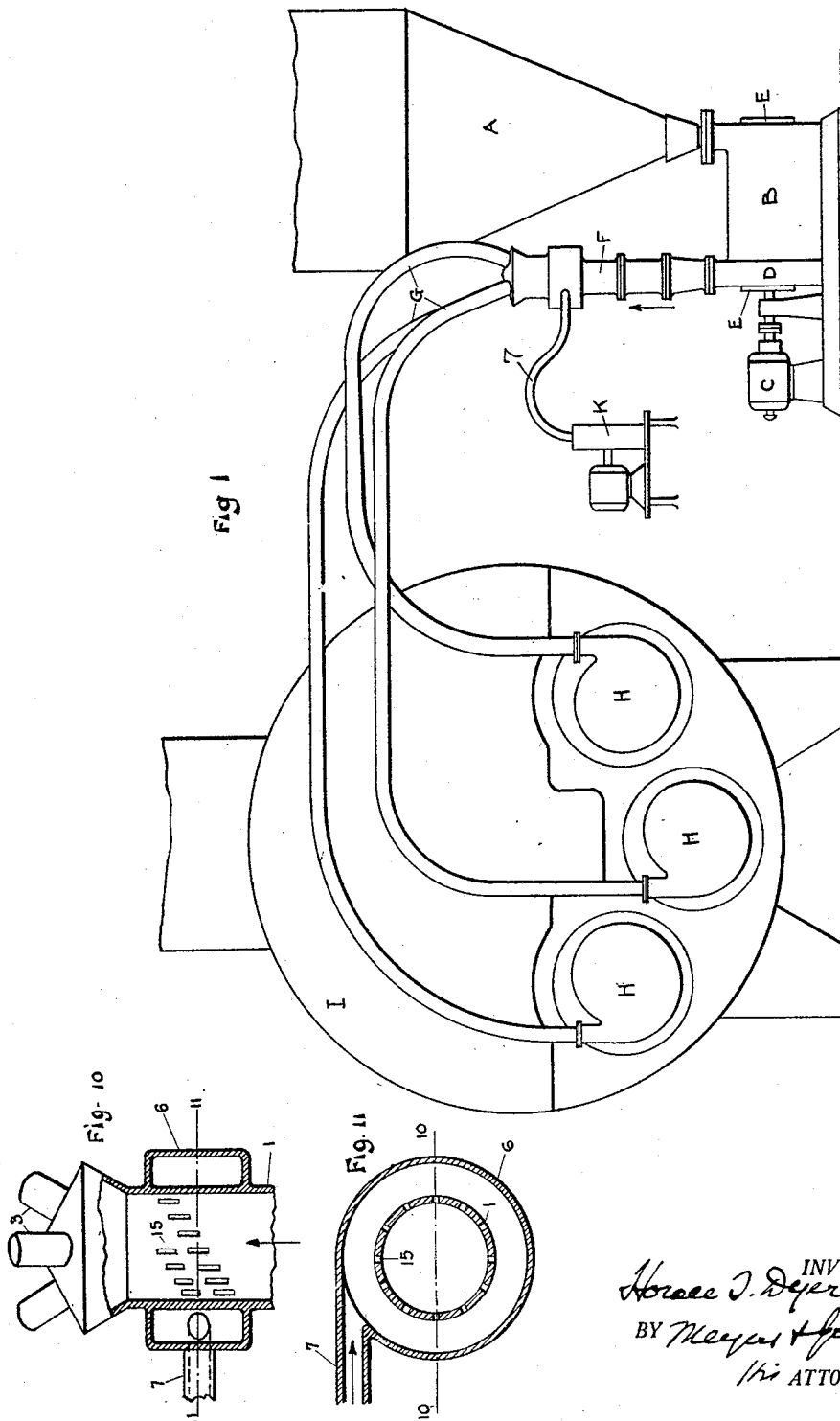
H. T. DYER

1,823,932

APPARATUS FOR PREPARING PULVERIZED FUEL FOR COMBUSTION

Filed April 14, 1928

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

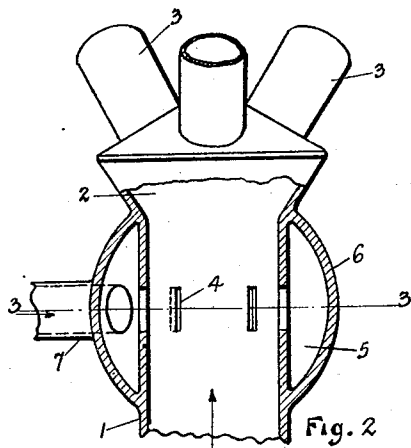


Fig. 2

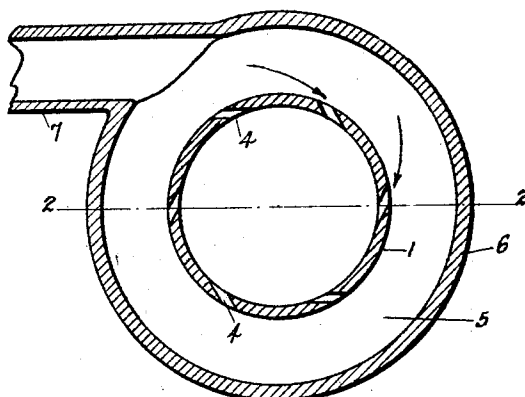


Fig. 3

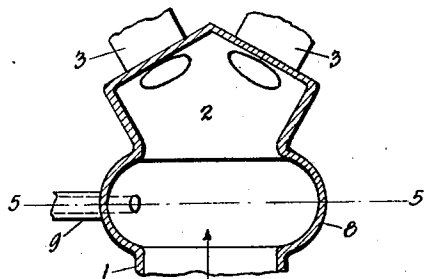


Fig. 4

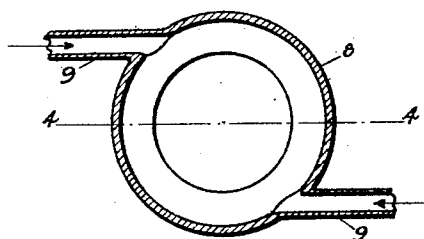


Fig. 5

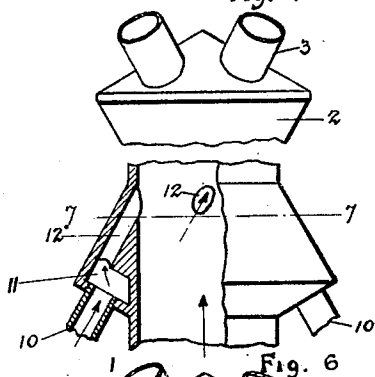


Fig. 6

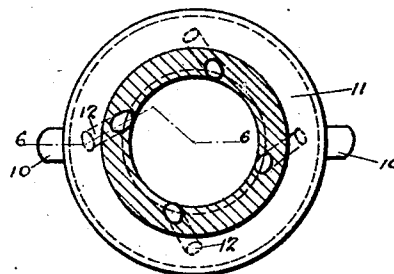


Fig. 7

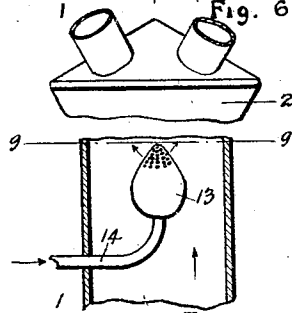


Fig. 8

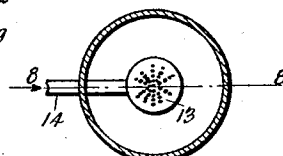


Fig. 9

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APPARATUS FOR PREPARING PULVERIZED FUEL FOR COMBUSTION

Application filed April 14, 1928. Serial No. 269,923.

My invention relates to a system in which finely divided particles of any material are conveyed through a pipe or conduit in suspension in air and where it is desired to obtain at any point in such pipe or conduit a homogeneous or balanced mixture of the particles throughout the carrier air. Having produced a mixture in which the particles are diffused equally throughout the carrier air it is possible, and may be desirable, to divide the stream into two or more streams of equal or unequal size but having the same proportions of particles and carrier air. I use the term air in a generic sense to include atmospheric air or any other gaseous medium adapted for the particular purpose.

The invention is intended more particularly for use in pulverized coal burning systems and will be described in connection therewith.

In the burning of pulverized fuel, and particularly in installations having two or more burners in one furnace, it is of importance that an equal supply of fuel be delivered to each burner. It has been the practice to divide the total supply of fuel from a unit pulverizer or central bin into a plurality of streams to supply individual burners, but the difficulty has been to secure the distribution of the fuel in the carrier air so that substantially the same amount of fuel will at all times be contained in the several streams.

It is the object of the present invention to provide a method by which the fuel particles will be diffused uniformly throughout the carrier air and thereby the desired equality of distribution to each of the burners in the installation secured. This is accomplished without the use of internal moving parts.

In the accompanying drawings Fig. 1 is a more or less diagrammatic representation of a pulverized fuel burning system to illustrate the relation of the distributor to the system; and Figs. 2, 4, 6, 8 and 10 are vertical sections, partly in elevation on the planes of the lines indicated in Figs. 3, 5, 7, 9 and 11; and the latter figures are horizontal sections on the planes of the correspondingly marked

lines of Figs. 2, 4, 6, 8 and 10. These relate to separate embodiments of the invention.

Referring to Fig. 1, the letter A designates a bin containing the fuel to be pulverized; B a pulverizer of any suitable type operated by a motor C. The pulverized material is blown out by a fan inside the casing D, the carrier air being admitted through the openings E. The distributor, designated generally by the letter F, may be located at any convenient point in the discharge line from the pulverizer, and may be of any of the forms hereinafter described. From the distributor the fuel is delivered through separate pipes G to the individual burners, three of them H being indicated as located on the furnace of the boiler I. The air for operation of the distributor is supplied by any suitable pump K and conveyed to the distributor by the pipe 7.

With this description of the general layout in which the relation of the distributor in the system will be understood, I will describe several forms of the distributors which may be used, these being designated in Fig. 1, generally, by the letter F.

Referring to the remaining figures of the drawings, the numeral 1 designates a portion of the discharge line from the pulverizer and through which the fuel, suspended in the carrier air, is conveyed. The outlet end of this pipe may be enlarged to provide a chamber 2 from which pipes 3 lead to individual burners. At some point along the length of pipe 1, and preferably in proximity to the distributing chamber 2 means are provided for setting up sufficient turbulence in the stream of fuel to bring about a re-distribution of the particles of fuel suspended in the carrier air. This may be accomplished by imparting a whirling motion to the stream, one means for so doing being described in the application for patent of E. H. Peabody, Serial No. 193,869 May 24th 1927, in which rotating blades are employed. According to the present invention, however, the desired turbulence is effected by injecting a small current of high pressure air into the moving stream of coal and carrier air, just before it reaches the branch pipes.

The current of air for this purpose may be introduced in any of the ways indicated in the drawings.

Referring first to Figs. 2 and 3, in the desired section of pipe 1 are formed a plurality of ducts 4 tangential to the inner wall of the pipe. These ducts lead from a chamber 5 the outer wall 6 of which completely encloses the section of pipe 1 in which the tangential ducts are located. The inlet connection 7 may be arranged to admit the air tangentially to the walls of chamber 5. The air is thus given an initial whirling motion as it enters chamber 5 and its velocity is materially increased as the air escapes through the narrow ducts 4 into pipe 1.

Taking coal as an example of the fuel used, pulverized to 200 mesh fineness, it is a known fact that whether coming from a unit pulverizer or a central bin, the particles of fuel are not evenly or uniformly distributed through the carrier air. That is, the mixture will vary from rich to lean, as to fuel content, in any section of the stream.

Assuming that the stream through pipe 1 travels at the rate of approximately sixty (60) feet per second and that the air entering through pipe 7 is under a greater pressure than that of the carrier air, the stream of carrier air and fuel as it flows past the ducts 4, will be given a rapid whirling motion by the air jets escaping through the ducts. The creation of a vortex in which the stream has unequal angular velocities at different points, effects a movement of the particles of fuel in a general direction transverse to the line of travel of the stream, the breaking up of the richer portions and a more even distribution of the particles throughout the mass.

From pipe 1 the fuel enters chamber 2 from which it is distributed through pipes 3 in as many streams as there are burners to be supplied, the individual streams being substantially uniformly balanced as to fuel content.

In devising a method for securing substantial uniformity of fuel distribution in the carrier air it is necessary to bear in mind that such air is traveling with its load of fuel through pipe 1 at the rate of approximately 60 feet per second, and that the mass after being given a whirling motion is not retained in chamber 2 but flows therethrough and through the distributing pipes 3 at substantially the same rate. The problem presented is therefore different from that wherein provision is made for giving the fuel a rapid whirling motion as it enters the combustion chamber for the purpose of effecting an intimate mixture of the fuel and the air for combustion. The carrier air is generally from 10% to 50% of that necessary for complete combustion. The secondary air, or that for complete combustion, is in-

troduced into the furnace through a register as described in Patent No. 1,738,176, granted December 3, 1929 for fuel burners.

The present invention is solely for the treatment of the fuel on its way to the burners and is not concerned with the means employed for burning the fuel or for admitting air for combustion thereto.

A modified arrangement is shown in Figs. 4 and 5 in which the pipe 1 is formed with an enlarged section 8 in proximity to the chamber 2. The air is injected through two inlets 9 tangential to the inner wall of section 8. The action of the air currents upon the fuel stream is substantially the same as that described with reference to Figs. 2 and 3.

Instead of injecting the air jets in a plane normal to the direction of travel of the fuel stream they may be projected at an angle thereto by the arrangement shown in Figs. 6 and 7. In this, the air is admitted through one or more pipes 10 to an annular chamber 11 surrounding pipe 1. From this chamber, passages 12, four being shown, inclined to the axis of pipe 1, admit the air to the stream of fuel and carrier air to create the desired turbulent effect with substantially the same result as above described with reference to the operation of the arrangement shown in Figs. 2 and 3. The passages 11 are preferably formed so that their axes are tangential to the inner wall of pipe 1.

In the foregoing description it will be noted that the vortex effect is produced by jets of air under pressure being injected into the fuel stream from a source outside thereof and surrounding the stream so that the direct action of the air is on the periphery of the mass. This is of advantage in that the air jets penetrate the rapidly moving stream of fuel and thus act not only upon its periphery but toward the center thereof, resulting in a more effective diffusion of the fuel particles through the mass.

Some of the advantages attained by the above described means are secured by the use of an air spray nozzle 13 mounted upon the end of a supply pipe 14, as shown in Figs. 8 and 9. The nozzle 13 may be of any suitable form and is perforated as shown, to permit the escape of the air in a plurality of fine jets into the center of the stream of fuel.

As in Figs. 2 to 7, the fuel stream after being acted upon by the jets of air from the nozzle, flows into the chamber 2 from which it is distributed to the burners.

Figs. 10 and 11 indicate another arrangement in which the inlet openings 15 instead of being located in a plane at right angles to the axis of the distributor, as in Fig. 2, are arranged in a helical form about the periphery of the distributor.

While the chamber 2 is shown in the several figures as an enlargement of the pipe 1, or as practically a continuation of said pipe, it is

not essential to the invention that the exact form or relation of these parts be as shown, for, as before stated, the drawings are more or less diagrammatic and are not intended
5 as exact representations of the form or arrangement which may be used in practice. The drawings, however, serve to illustrate the principle of the invention and the mode in which it is to be applied.

10 What I claim is:

1. A system comprising a source of pulverized material suspended in carrier air, a conduit leading therefrom, a plurality of branch conduits, a distributor connecting the main
15 conduit with the branch conduits, said distributor including means for injecting a current of air into a stream of the material flowing therethrough to effect a substantially uniform diffusion of the material through the
20 carrier air.

2. A system comprising a device for pulverizing material, a main line for conveying said material suspended in carrier air, a distributor to which the main line is connected,
25 branch lines connected to said distributor, and means in said distributor for injecting a current of air into the moving stream of fuel and carrier air to effect a substantially uniform diffusion of the material in the carrier
30 air.

3. A system comprising a source of pulverized fuel suspended in carrier air, a conduit leading therefrom, a plurality of branch conduits, a distributor connecting the main conduit and the branch conduits, said distributor
35 including means for injecting a current of air tangentially into a stream of the material flowing therethrough to effect a substantially uniform diffusion of the fuel in the carrier
40 air.

4. A system comprising a source of pulverized fuel suspended in carrier air, a conduit leading therefrom, a plurality of branch conduits, a distributor connecting the main conduit and the branch conduits, said distributor
45 including means for injecting into the moving stream a current of air substantially normal to the path of travel of said stream to effect therein a substantially uniform diffusion of the fuel in the carrier air.
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Signed at New York in the county of New York and State of New York this 11th day of April, A. D. 1928.

HORACE T. DYER.

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