Aug. 16, 1932. J. E. KENNEDY 1,871,853

PNEUMATIC TRANSPORTING AND DISTRIBUTING OF PULVERIZED MATERIAL

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Fig. 3.

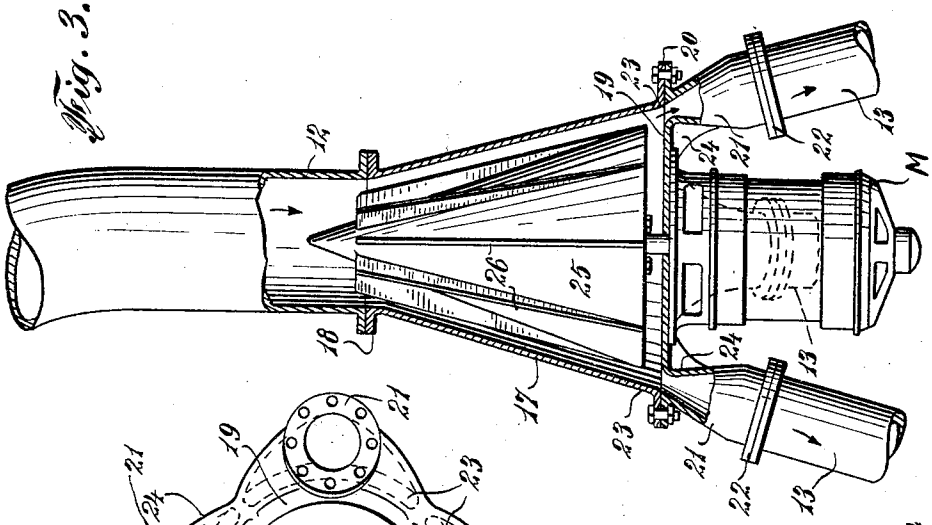


Fig. 2.

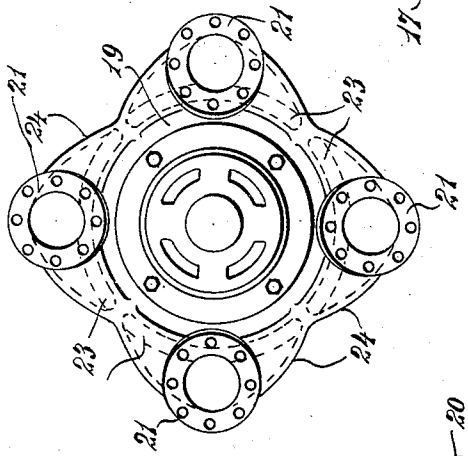


Fig. 1.

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Fig. 6.

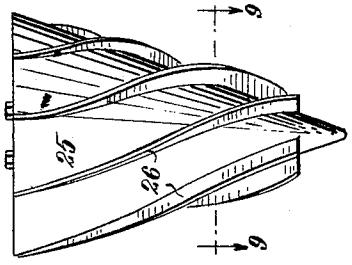


Fig. 9.

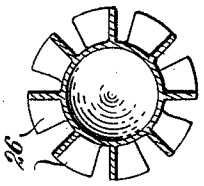


Fig. 5.

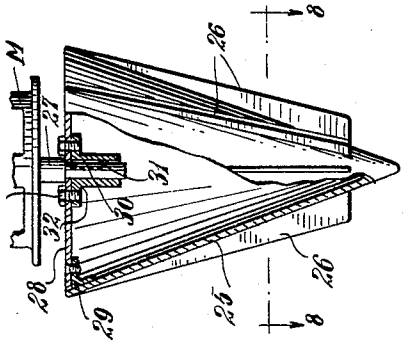


Fig. 8.

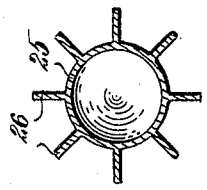


Fig. 7.

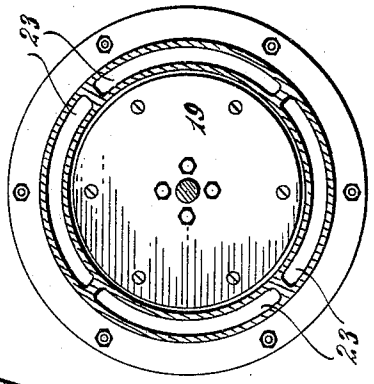
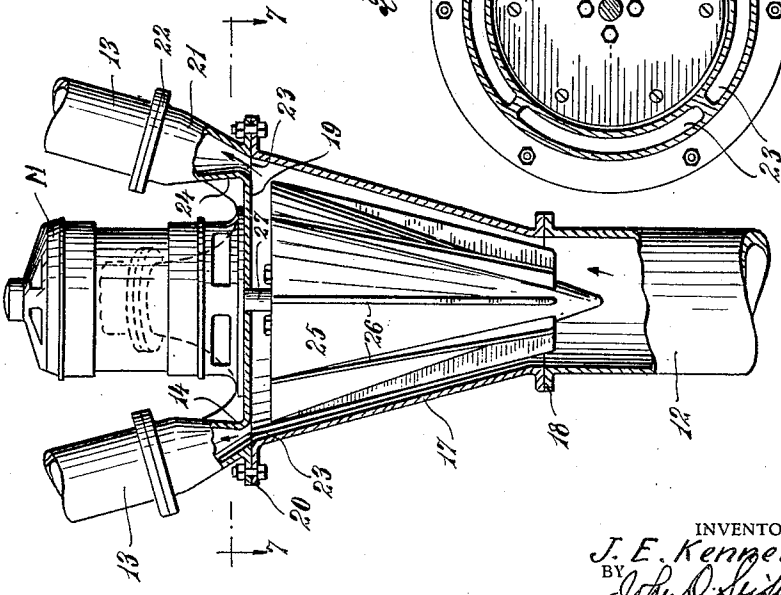


Fig. 4.



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UNITED STATES PATENT OFFICE

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PNEUMATIC TRANSPORTING AND DISTRIBUTING OF PULVERIZED MATERIAL

Application filed August 9, 1927. Serial No. 211,696.

This invention relates to the pneumatic transportation and distribution of pulverized material, such as pulverized coal, from a source of supply, as pulverizing apparatus or a storage bin, to a place of use, as burners leading through an opening to the firing chamber of a furnace or furnaces.

In the pneumatic transporting of pulverized material to constitute a fuel mixture the pulverized material is drawn from pulverizing apparatus or other source of supply by pneumatic means, such as a fan, and delivered from the fan in a single large stream or column through a main conduit, said main conduit having a plurality of branch conduits connected thereto to divide the main stream or column and distribute the same through the branch conduits to burners. In the passage of the pulverulent material laden air stream through the main conduit there is brought about an unequal distribution of the pulverulent material throughout the cross section of the stream with the result that the stream is composed of strata having different density of pulverulent material, and this inequality in the density of the stream is further augmented in cases where additional air is supplied to the material laden air stream drawn from the source of supply, which inequality in the density is maintained when the stream is distributed into the branch conduits with the result that one branch stream may be rich in coal particles while another branch stream or streams may be so lean that combustion thereof will not take place.

It is the object of the present invention to overcome the above disadvantages, and to provide means to mix the particles of coal or solids with the air to make the same a homogeneous mixture by establishing an even density of the pulverulent material throughout the cross section of the stream, and distribute the main stream into branch streams of equal density so that each branch stream will carry the same amount of pulverulent material in proportion to the volume of air.

In the embodiment of the invention illustrated in the drawings Figure 1 is a side elevation of a pneumatic system for drawing off pulverulent material laden air from a source of supply, transporting and distributing the same to a place of consumption with my improved mixing and distributing means interposed in the pneumatic means.

Figure 2 is an end elevation looking at the bottom of Figure 3 with the branch conduits disconnected therefrom.

Figure 3 is a longitudinal sectional view, on an enlarged scale, of the mixing and distributing means.

Figure 4 is a view similar to Figure 3 but showing the use of the same in an inverted position.

Figure 5 is a side elevation of the mixing means, partly broken away, to show the mounting and connection thereof to a rotatable support.

Figure 6 is a side elevation of a modified arrangement of the mixing means shown in Figure 5.

Figure 7 is a cross sectional view taken on the line 7—7 of Figure 4 looking in the direction of the arrows.

Figure 8 is a cross sectional view taken on the line 8—8 of Figure 5 looking in the direction of the arrows; and

Figure 9 is a cross sectional view taken on the line 9—9 of Figure 6 looking in the direction of the arrows.

In the drawings I have illustrated an embodiment of the invention connected in a pneumatic system for the delivery of pulverulent coal wherein the coal is transported in suspension in an air stream or column from a source of pulverulent material supply, which may be a pulverizing apparatus, a portion of which apparatus is shown in a general way at 10, by a fan 11 connected with the pulverizing apparatus and the stream delivered by said fan being directed into a main conduit 12 from which conduit the stream is distributed in a series of streams to branch conduits 13, in the present instance four in number, leading to or having connected therewith burners 14 which lead through an opening to the firing chamber of a furnace or furnaces. In such apparatus means is provided to supply additional air to the material drawn from the pulverizing means, which may be accomplished by a fan of the

duplex type by separating the fan casing into two chambers by a partition, as indicated by the dotted line 15, and arranging a series of fan blades in each of said chambers, the one chamber being connected with the pulverizing means and the other chamber opening through the side 16 to the atmosphere, which opening is provided with regulatable closure means to vary the size of the opening.

In delivery systems for pulverulent material of this character there is a tendency of the pulverulent material assuming an unequal density throughout the cross section of the stream or column delivered by the fan with the result that the stream is composed of strata having different density of pulverulent material, which is augmented when additional air is supplied to the column delivered by the fan, and this inequality in density is maintained in the branch conduits with the result that one or more of the branch streams may transport such a small amount of the pulverulent material or solids that combustion thereof will not take place at the burner or burners connected to said conduits.

In order to overcome this disadvantage I interpose means in the system for agitating the main column or stream to mix the pulverulent material and air and thereby effect or establish an equal distribution or density of the pulverulent material or solids throughout the cross section of said column or stream, and said means being adapted to distribute the stream with the pulverulent material of equal density to the branch conduits and thereby to the burners. This mixing and distributing means may be interposed at any suitable point in the main conduit, but is preferably interposed in the connection of the branch conduits with the main conduit to serve as a means to connect the main and branch conduits, and comprises a truncated conical casing 17 connected at the smaller end with the main conduit 12, as at 18. The opposite or base end of the casing is closed by a plate 19, as at 20, and arranged with projecting portions 21 equal in number to the number of branch conduits, the outer ends of said projections being of circular form and arranged for connection of the branch conduits thereto, as at 22, and having openings 23 therethrough in communication with the casing for the delivery of the air with the pulverulent material in suspension from the casing to the branch conduits, these openings being of segmental form, as shown in Figure 7, and arranged in a restricted portion of the projections at the juncture thereof with the plate, as shown at 24, and diverging toward the circular outer portion of the projections to which the branch conduits are connected. A hollow and conical head or member 25 is mounted in the casing 17 for rotation therein, said head as shown in Figures 3, 4 and 5 has blades or vanes 26 arranged on the peripheral surface extending radially outward from and in parallel relation to the axis of the head, and extending from the base end of the head to a point preferably near the apex thereof, with the one terminus of the blades merging into the head at the base end and gradually increasing in width toward the opposite end, the blades or vanes being secured to the head by welding or otherwise. The blade carrying head is driven by and supported from the shaft 27 of an electric motor M, which is mounted on the closure plate 19 within the projections 21 with the shaft extended through and having a bearing in said plate. The blade carrying head is closed at the base end by a plate 28 secured by screws threaded into a ring of angle shape in cross section, as shown at 29 in Figure 5, the ring being secured to the inner surface of the head by welding or otherwise. To operatively connect the head to and suspend the same from the motor shaft 27 a feather or key 30 is seated laterally in a recess in the shaft which key terminates at a point within the end of the shaft, as at 31, and adapted for engagement in a recess in a bearing member 32 fixed to the closure plate 28 within the head, which bearing is connected to the plate by screws 33 passed through elongated openings in the plate and threaded into a flange of the bearing, as clearly shown in the drawings. The plate has an opening in line with the bearing member arranged with a recess in the wall thereof for the passage of the key 30 when the head plate and bearing is engaged upon the shaft, and when it is engaged upon the shaft it is rotatively adjusted to cause an unrecessed portion of the plate 28 to engage above the key or feather 30, when it is secured by the screws 33. The size of the blade carrying head and casing are proportioned one relative to the other so that the space between the head and casing wall in all cross sectional portions thereof is equal in size or volume to the cross sectional area of the main conduit 12, and also preferably of the same area as the combined areas of the branch conduits, and providing a clear passage through the casing from the main conduit to the openings 23 in the closure plate 19 to which the branch conduits are connected.

In the operation of the mixer and distributor as the air with pulverulent material in suspension is delivered from the main conduit 12 into the casing 17 it is violently agitated or swirled about as it enters the chamber due to the increased width of the head blades at said end of the head thereby effecting an equal distribution of the pulverulent material throughout the column of the air, the violence of the swirling or agitating of the air being gradually reduced as it reaches the inlets 23 to the conduit connecting projections 21 although maintaining the equality in density of the pulverulent material in the

air stream so that when the stream is divided and distributed to the branch conduits the respective branch streams will receive the same proportion of pulverulent material or solids with the result that each branch stream will carry substantially the same amount of pulverulent material and the fuel streams transported to the burners will be of the same consistency as regards the pulverulent material and thus effecting an efficient firing or combustion thereof. The branch conduits may have valves 34 interposed therein, whereby either one or more of said conduits may be shut off from the mixing and distributing chamber, and the shutting off of either one or more of the conduits will not effect the delivery of streams to the connected conduits so far as the equality in the density of the pulverized material is concerned.

In Figure 4 there is shown an arrangement wherein the pulverulent material laden air stream from the main conduit is directed upward and in a vertical direction, as indicated by the arrows, to the mixing and distributing chamber instead of in a downward vertical direction.

In the modified arrangement of the mixer and distributor head shown in Figure 6 the blades 26 on the head 25 are arranged in spiral form about the longitudinal axis of the head. In this arrangement the head not only functions to mix the air and pulverized material to establish an equal distribution of the pulverulent material in the stream, but also serves to boost the divided or distributed streams through the branch conduits.

It will be obvious that various modifications may be made in construction and arrangement of parts without departing from the scope of the invention.

Having thus described my invention I claim:

1. In a delivery and distribution of pulverulent material in suspension in an air stream from a source of supply, suction means to draw the pulverulent material from the source of supply, a main conduit connected with the delivery of said suction means for transporting the material laden air stream delivered from the suction means, branch conduits, a truncated conical casing connected at the smaller end with the main conduit and the branch conduits connected to the opposite end thereof, and a conical blade carrying head rotatably mounted in the casing to agitate and effect an even distribution of the pulverulent material in the air.

2. In the delivery and distribution of pulverulent material in suspension in an air stream from a source of supply, suction means to draw the pulverulent material from the source of supply, a main conduit connected with the delivery of said suction means for transporting the material laden air stream delivered from the suction means, branch conduits, a truncated conical casing connected at the smaller end with the main conduit and having a closure member at the base end with openings circumferentially disposed around said end closure to which the branch conduits are connected, and a conical blade carrying head rotatably mounted within the casing on the closure member for the base of the casing to agitate and effect an even distribution of the pulverulent material in the air.

3. In the delivery and distribution of pulverulent material in suspension in an air stream from a source of supply, suction means to draw the pulverulent material from the source of supply, a main conduit connected with the delivery of said suction means for transporting the material laden air stream delivered from the suction means, branch conduits, a truncated conical casing connected axially at the smaller end with the main conduit, a plate secured to and closing the base end of the casing having circumferentially disposed outlet means arranged for the connection of the branch conduits thereto, a conical blade carrying head rotatable in the casing to effect an even density of the pulverulent material in the air stream, and a motor mounted at the outer side of the closure plate for the base end of the casing with the shaft extended through said blade and operatively connected with the blade carrying head.

4. In the delivery and distribution of pulverulent material in suspension in an air stream from a source of supply, suction means to draw the pulverulent material from the source of supply, a main conduit connected with the delivery of said suction means for transporting the material laden air stream delivered from the suction means, branch conduits, a truncated conical casing connected axially at the smaller end with the main conduit, a conical head rotatable in the casing having spirally arranged blades extending longitudinally thereof to effect an even density of the pulverulent material in the air stream, and a closure plate secured at the base end of the casing having extended tubular projections circularly disposed about the same, the connection of said projections with the closure plate being of segmental form and the outer ends of circular form and adapted for connection of the branch conduits thereto.

5. A system for transporting pulverulent material in suspension in an air stream embodying main and branch conduits, a blower to draw the material from a source of supply and deliver it to the main conduit, a cone shaped casing interposed between said main and branch conduits, and a conical member revoluble in said casing constructed and arranged to agitate and mix the pulverulent material with the air to distribute the pulverulent material in equal density throughout

the air stream and deliver said air stream in said condition to the branch conduits without retarding the velocity thereof.

6. In a system for transporting pulverulent material in suspension in an air stream embodying main and branch conduits, the main conduit having a cross sectional area equal to the combined cross sectional area of the branch conduits, a cone shaped casing interposed between said main and branch conduits, said casing being connected at the smaller end with the main conduit and the branch conduit connected to and circumferentially disposed about the larger end of the casing, and a conical member revoluble in said casing operative to distribute the pulverulent material in equal density throughout the air stream, said member and the casing being arranged to provide a space between the same of a cross sectional area equal to the cross sectional area of the main conduit.

Signed at the city of New York, in the county of New York and State of New York this 2nd day of August, 1927.

JOSEPH E. KENNEDY.