Oct. 6, 1931. J. E. KENNEDY 1,825,668

MIXER AND DISTRIBUTOR FOR PNEUMATIC TRANSPORTED PULVERIZED MATERIAL

Filed March 16, 1928 2 Sheets-Sheet 1

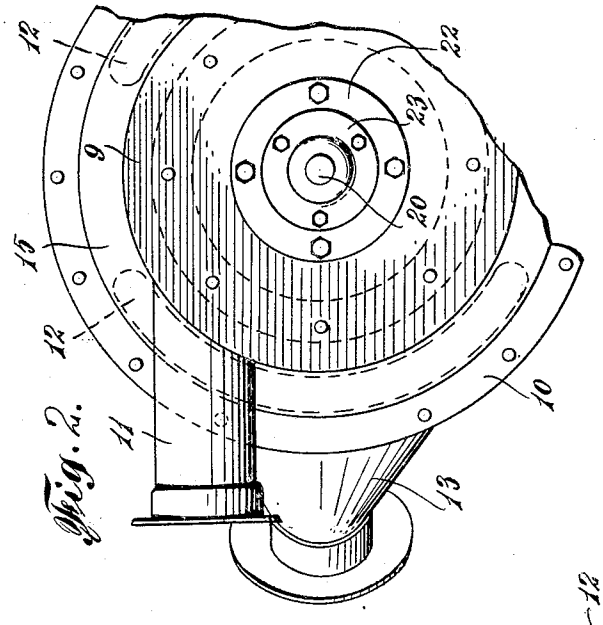


Fig. 2.

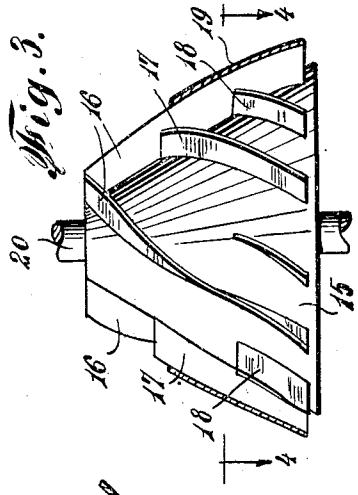


Fig. 3.

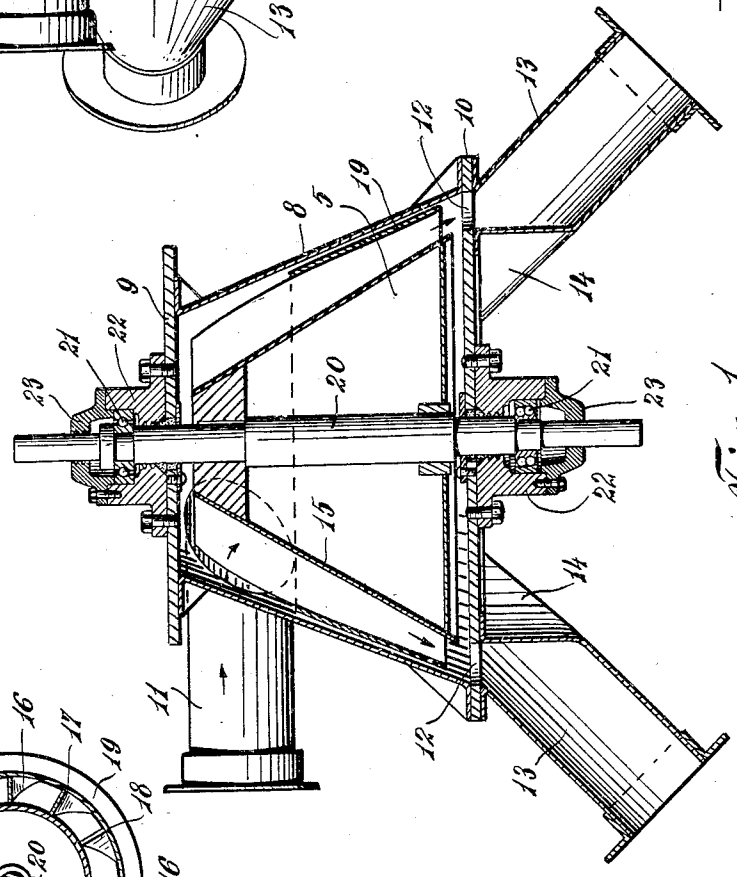


Fig. 1.

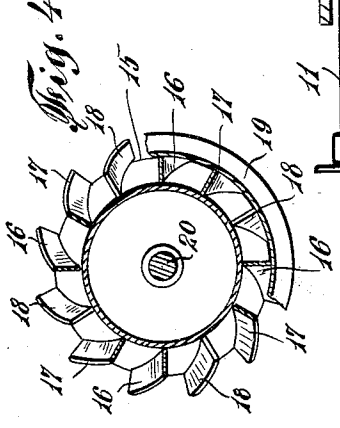


Fig. 4.

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Fig. 6.

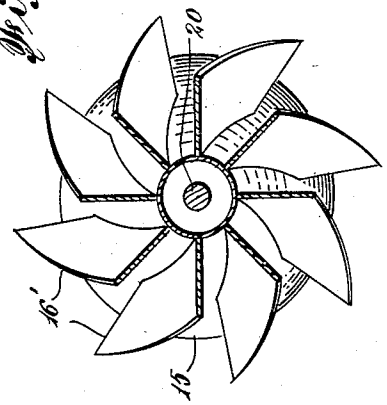
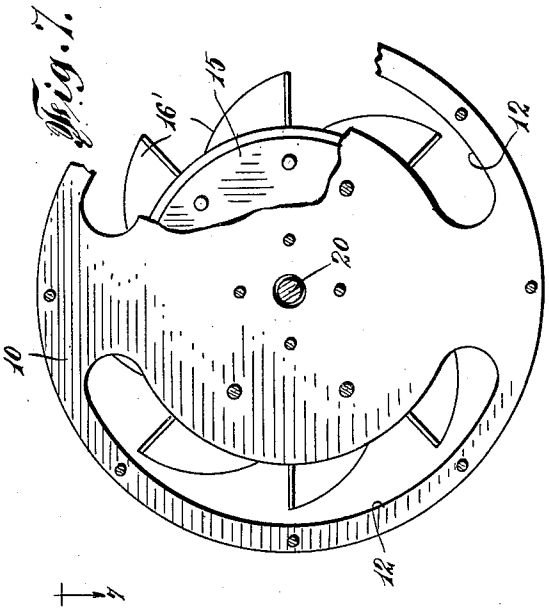


Fig. 7.



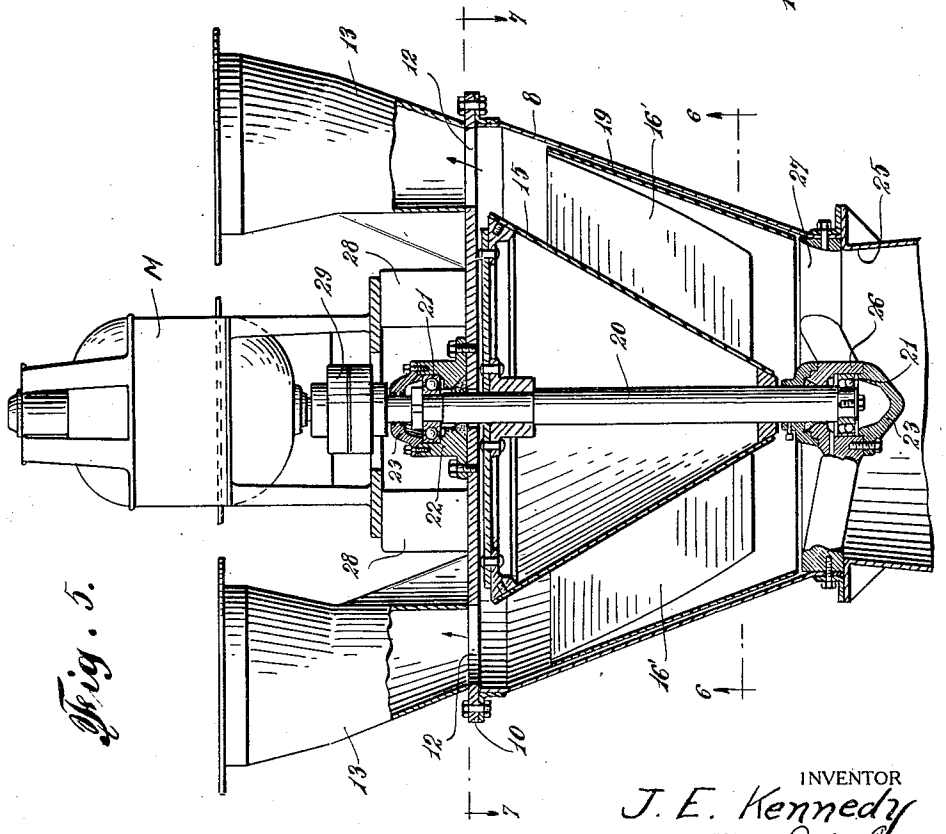


Fig. 5.

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UNITED STATES PATENT OFFICE

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MIXER AND DISTRIBUTOR FOR PNEUMATIC TRANSPORTED PULVERIZED MATERIAL

Application filed March 16, 1928. Serial No. 262,097.

This invention relates to means for use in the pneumatic transporting and distribution of pulverized material in a system for the delivery of a fuel mixture, such as pulverized coal in suspension in an air stream from a source of supply, which may be a disintegrating apparatus or a storage bin, to a place of combustion, such as a burner or burners leading to a furnace or boiler, and it is the object of the invention to provide means to be interposed in a pneumatic pulverized coal delivering system for effecting a mixing and establishing of an equal distribution or density of the coal particles throughout the air stream in such a manner that when the main stream is distributed or divided into divisional streams the pulverized material or coal in each divisional stream will be of the same density; that is, the streams will each carry the same amount of solid material in proportion to the amount of air, and to provide means for this purpose which is simple in construction and efficient in operation.

The present invention is an improvement upon the mixing and distributing means disclosed in my co-pending application Serial No. 211,696, and it is the principal object of the invention of the present application to provide means to effect a more thorough distribution and equal density of the coal particles throughout the air stream by which it is transported, to facilitate the dividing of a main stream in divisional streams, and to assure the maintaining of the equal density of the coal particles throughout the cross section of each of the divisional streams.

In the drawings accompanying and forming part of this application Figure 1 is a longitudinal sectional view of mixing and distributing means illustrating an embodiment of the invention.

Figure 2 is a plan view, partly broken away, looking at the top of Figure 1.

Figure 3 is a side elevation of an agitator constituting a part of the mixing and distributing means.

Figure 4 is a cross sectional view taken on the line 4—4 of Figure 3 looking in the direction of the arrows.

Figure 5 is a longitudinal sectional view showing a modification of the inlet means to the mixing and distributing means and a modified arrangement of the agitator.

Figure 6 is a cross sectional view taken on the lines 6—6 of Figure 5 looking in the direction of the arrows to show the arrangement of mixing and agitating blades on a carrier head therefor; and

Figure 7 is a sectional view, partly broken away, taken on the line 7—7 of Figure 5 looking in the direction of the arrows to show the arrangement of the outlet means from the mixing and distributing means in relation to the mixing and agitating means.

In carrying out the embodiment of the invention shown in Figures 1 to 4 there is provided a casing 8, preferably of truncated conical form, arranged with closure plates 9, 10 at opposite ends. The casing is arranged with inlet means comprising a pipe or conduit coupling member 11 connected to the end of the casing of smaller diameter and leading through an opening in the casing substantially tangential to the side wall thereof, as shown in Figure 2. The outlet means comprises openings 12 through the peripheral portion of the plate 10 at the larger end of the casing, said openings being of elongated segmental shape and of restricted width and equidistantly spaced about the plate, the openings being in number equal to the number of divisional streams into which the main stream entering the casing through the inlet means 11 is to be divided. In the present instance two of such openings are provided arranged diametrically opposite with pipe or conduit coupling members 13 connected thereto, said coupling members having the end at which they are connected with

the outlet openings arranged of arcuate form, as at 14, to correspond with the openings 12 and of circular form at the outer end. The inlet means 11 is connected through a main conduit with a fan outlet the inlet of which is connected with the source of supply, which may be a pulverizing apparatus or a storage bin, the pulverized material being drawn with air from the source of supply and transported by such air stream or column with the pulverized material in suspension therein through the inlet means 11 to the casing. The pulverized material laden air is delivered from the casing through conduits or pipes connected with the outlet coupling members 13 to burners connected with said outlet conduits and arranged in relation to a furnace or furnaces.

In delivery systems for pulverulent material of this character wherein the material is transported in suspension in an air stream through a conduit leading from a fan by which it is drawn from the source of supply, there is a tendency of the pulverulent material to assume an unequal density throughout the width of the stream or column with the result that the stream is composed of strata having different density of pulverulent material. This is especially so when additional air is supplied to the column of air with the pulverulent material in suspension delivered by the fan. It has been found that this inequality in density is maintained when the main stream or column is distributed to 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 with said conduits.

To overcome this disadvantage and maintain the density of the divisional streams means are arranged in the casing to agitate the pulverized material laden air to mix the coal particles therewith and thereby effect or establish an equal distribution or density of the pulverized material throughout the air and in said condition deliver the pulverized coal carrying air in divisional streams to the branch conduits and thereby to the burners connected therewith. This agitator means comprises a head 15 of truncated conical form and of less cross sectional area than the casing with the base of the head of a diameter to come within the openings 12 in the closure plate 10 for the base of the casing, whereby a space is provided between the head and the casing wall. The wall of the head is arranged at a more acute angle to the base than the side wall of the casing whereby the space between the head and casing at the smaller end is of greater width than at the base end to proportion the head relative to the casing so that the space between the head and casing wall in all cross sectional portions thereof will be of equal area or volume, and preferably being of the same cross sectional area as the main conduit connected with the casing through the coupling member 11 and also of the branch conduits connected with the coupling members 13. Vanes or blades are secured to the head, as by welding, and extend longitudinally of the head in spiral formation, certain of the blades equidistantly spaced about the head, as the blades 16, extending for the full length of the head, while intermediate blades extend from the base of the head for only a portion of the length thereof, equidistantly spaced blades 17 of said blades extending for substantially two-thirds of the length of the head, while further equidistantly spaced blades 18 and interposed between the blades 16, 17, extend for only substantially one-third the length of the head. A shell 19 is extended about the head blades and by means of which blades the shell is united with the head to rotate therewith, as by welding the shell to the blades. The shell 19 extends from the opening of the inlet means 11 to adjacent the base of the agitator head and in spaced relation to the casing plate 10, whereby the space between the head and shell at one end is in communication with the space in the casing into which the inlet means opens and terminates adjacent the outlet means 13.

The head 15 is fixed to a shaft 20 the ends of which shaft are extended through axial openings in the casing plates 9, 10 and journaled by anti-friction bearings 21 in bearing blocks 22 fixed to the outer side of the plates 9, 10 and held against axial movement by perforated caps 23 secured to the bearing blocks cooperating with the bearings 21.

In the operation of the apparatus as described the pulverized material laden air stream entering the casing 8 through the inlet means 11 striking against the blades 16 imparts rotative movement to the blade carrying head or agitator, the revolving of the agitator setting up a swirling of the air stream entering the chamber and thereby the thorough mixing of the pulverized material with the air so that the same will be of equal density throughout the air in the chamber. By the arranging of the agitator head at a more acute angle than the wall of the casing and thereby in effect converging the wall of one relative to the other, there is induced a movement or flow of the agitated air in the casing in a direction longitudinally of the agitator head toward the outlet openings 12 distributing the air with the pulverized material of equal density therein through said openings to the coupling members 13 and conduits connected therewith and to burners connected with said branch conduits.

In the modified arrangement shown in Figures 5 to 7, inclusive, the casing and agitator are inverted, the plate 10 with the outlet

openings 12 and coupling members 13 being at the top. Instead of the inlet means to the casing being through the side wall tangential to the agitator head said inlet means is axial to the smaller end of the casing and of the agitator. For this purpose the closure plate 9 utilized in the Figure 1 structure is eliminated and a coupling member, or the conduit for the main stream and leading from the fan outlet, is connected directly to the smaller end of the casing, as at 25 in Figure 5. The wall of the agitator head is also arranged at a more acute angle than the inclination of the casing wall similar to the Figure 1 structure, and the head is carried by the shaft 20 rotatable axially of the casing, the one end of said shaft being journaled in a bearing, as at 26, in a spider 27 secured in the smaller end of the casing. The shell 19 is also provided, the same being inclined at the same angle and lies contiguous to the casing wall. This shell, however, extends from the opening to the casing whereby the incoming stream is directed to the blades between said shell and agitator head and extends for the greater part of the length of said head. Vanes or blades, as shown at 16', to effect a swirling of the air stream entering the casing and a consequent mixing and equal distribution of the coal particles through the air, extend from a point within the base of the agitator head and the one end of the shell adjacent to the apex of the head and terminate within the end of the shell at the entrance to the casing, said blades serving to unite the shell with the head to rotate therewith by welding the blades or vanes at the longitudinal edge portions to the head and shell. The blades are arranged in spiral form longitudinally of the agitator head, as shown in Figure 6. While the force of the air stream entering the casing and leading to the space between the shell and agitator head striking against the vanes will impart rotary movement to the agitator, in this arrangement the agitator is preferably positively driven. The agitator may be driven from a suitable source of power, but preferably comprises an electric motor, shown in a conventional manner at M, mounted upon blocks 28 upon the casing and operatively connected with the agitator carrying shaft 20 by a coupling 29. It will be obvious that the agitator in the Figure 1 arrangement may also be positively driven by connecting a pulley to either of the extended ends of the agitator carrying shaft 20, or by a motor mounted upon the casing 8 and coupled with the agitator carrying shaft.

Having thus described my invention I claim:

1. In a mixer and distributor for pulverized material transported in suspension in an air stream, a casing having inlet and outlet means arranged for connection in a conduit, a head of less cross sectional area than and rotatable in the casing, a shell extended about and spaced from the head in the casing with the space between said head and shell in communication with the inlet and outlet means of the casing for the passage of the pulverulent material laden air stream therethrough, and means to unite said shell with the head to rotate therewith and arranged to agitate the pulverulent material laden air in its passage through the casing.

2. In means for mixing and distributing pulverized material transported in suspension in an air stream, a casing having an inlet at one end arranged for connection of an air stream transporting conduit and outlets at the opposite end arranged for connection of branch conduits, and means rotatable in the casing operative to agitate and induce a flow of the stream through the casing from the inlet to the outlets, said inlet and agitator means being constructed and arranged whereby the stream entering the casing will effect rotation of the agitator.

3. In a mixer and distributor for pulverized material transported in suspension in an air stream, a casing having inlet and outlet means arranged for connecting the casing with stream transporting conduits, an agitator comprising a head rotatable axially in the casing and having vanes circumferentially disposed about the same, and a shell encircling and rotatable with the head and spaced therefrom by the vanes, with the inlet and outlet means leading to and from the space between the head and shell.

4. A mixer and distributor for air transported pulverized material as claimed in claim 3, wherein the casing and head are of truncated conical form with the head of less cross sectional area than the casing and having inlet means at the smaller end of the casing and outlet means at the larger end.

5. A mixer and distributor for air transported pulverized material as claimed in claim 3, wherein the casing and head are of truncated conical form with the head of less cross sectional area than the casing and the wall of the head inclined at a more acute angle than the wall of the casing.

6. A mixer and distributor for air transported pulverized material as claimed in claim 3, wherein the casing and head are of truncated conical form with the inlet means leading to the smaller end of the casing tangential to the head and the outlet means leading from segmental openings in and circumferentially disposed about a closure plate for the larger end of the casing.

7. A mixer and distributor for air transported pulverized material as claimed in claim 3, wherein the vanes are arranged spirally longitudinally of the head and the shell is of less length than the head and arranged

to extend at the same inclination as the wall of the casing and to lie contiguous thereto.

8. A mixer and distributor for air transported pulverized material as claimed in claim 3, wherein the inlet means is to the smaller end of the casing tangentially to the head, and the shell is arranged at the same inclination as the casing wall and lies contiguous thereto, and said shell is of less length than the head and terminates at the side of the inlet means.

9. A mixer and distributor for air transported pulverized material as claimed in claim 3 wherein the agitator and inlet means are arranged whereby the stream entering the casing is directed against the vanes of the agitator to impart rotative movement thereto.

10. A mixer and distributor for air transported pulverized material as claimed in claim 3, wherein certain vanes extend the full length of the head and other vanes extend for only a portion of the length of the head.

11. A mixer and distributor for air transported pulverized material as claimed in claim 3, wherein the shell extends from the base for only a portion of the length of the head, and certain vanes extend for the full length of the head and other vanes extend for only a portion of the length of the head.

12. In a mixer and distributor for air transported pulverized material as claimed in claim 3, a motor mounted on the casing and having an operative connection with the head to rotate the same.

13. A mixer and distributor for air transported pulverized material as claimed in claim 3, wherein the head is fixed to a shaft rotatably mounted and supported by the casing with a portion of the shaft extended to the exterior of the casing arranged for the connection of means to rotate the head.

14. A mixer and distributor for air transported pulverized material as claimed in claim 3, wherein the inlet means leads to the smaller end of the casing, and the outlet means leads through segmental openings in the peripheral portion of a closure plate at the base end of the casing.

15. A mixer and distributor for air transported pulverized material as claimed in claim 3, wherein the inlet means leads to the smaller end of the casing, and the outlet means leads through segmental openings in a closure plate at the opposite end of the casing, and the base of the head being of a diameter to come within said closure plate openings and arrange the space as a passage through the casing to the outlet means.

16. A mixer and distributor for air transported pulverized material as claimed in claim 3, wherein the inlet to the casing is at the smaller end concentric with the axis of the casing and the outlet is through segmental openings in a closure plate at the base of the casing, the base of the agitator head being of a diameter to come within the openings in said closure plate and the side wall inclined at a more acute angle than the wall of the casing, and the shell being inclined at the same angle and arranged contiguous to the casing wall and extending from the inlet end of the casing to a point within the base of the agitator head.

Signed at the city of New York, in the county of New York and State of New York, this 10th day of March, 1928.

JOSEPH E. KENNEDY.