July 8, 1930. J. C. CHAPPLE 1,770,198

FUEL PULVERIZER

Filed Sept. 6, 1928 2 Sheets-Sheet 1

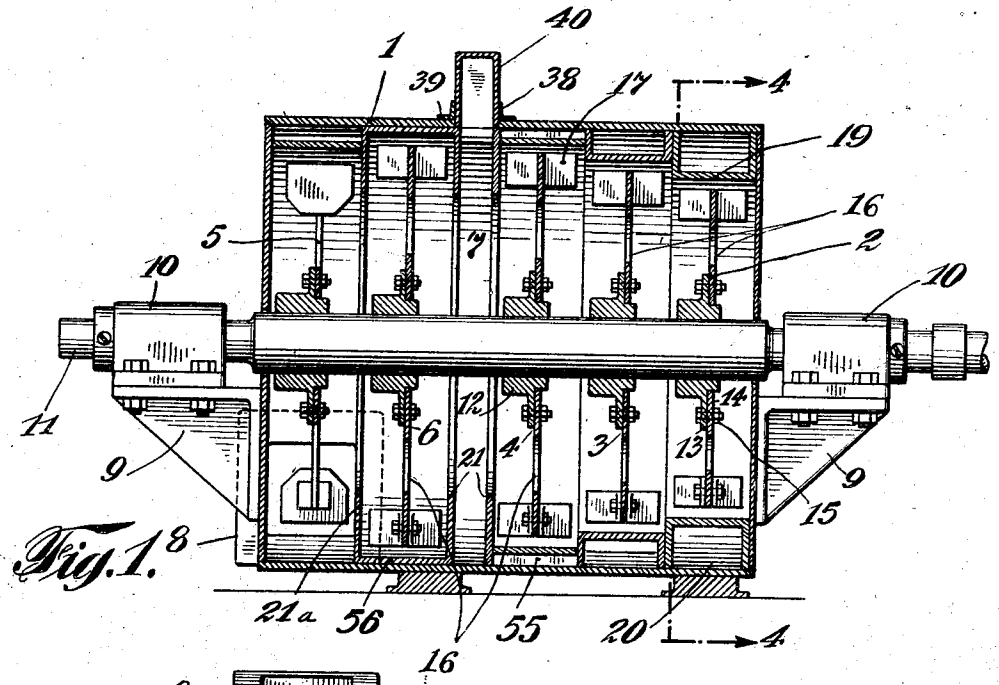


Fig. 1.

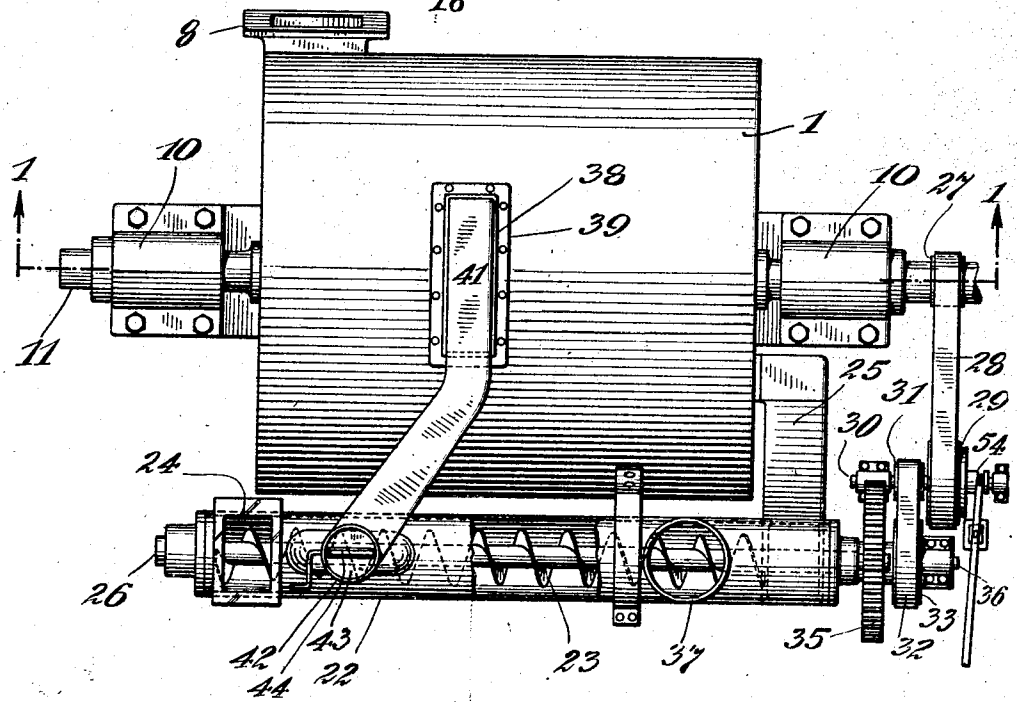


Fig. 2.

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FUEL PULVERIZER

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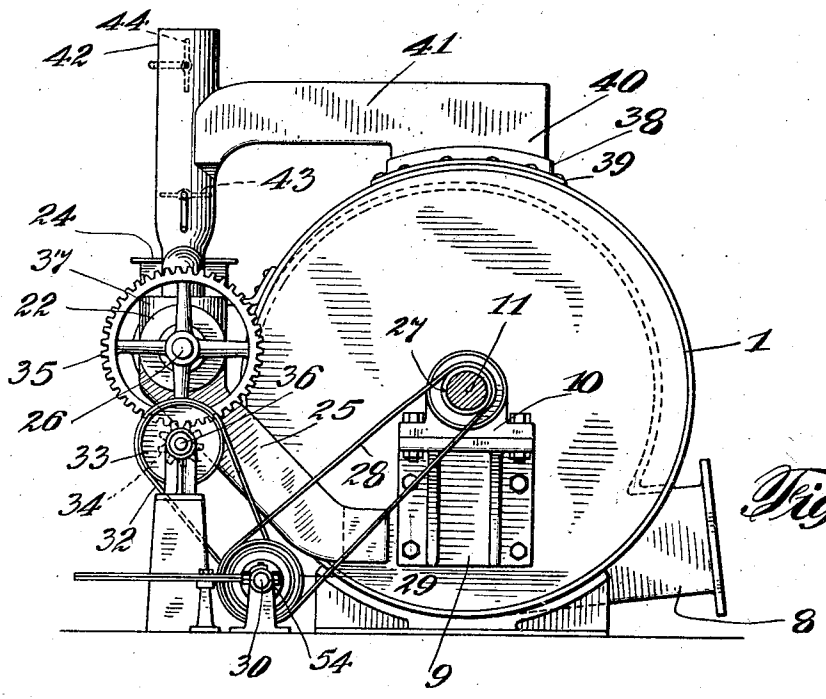


Fig. 3.

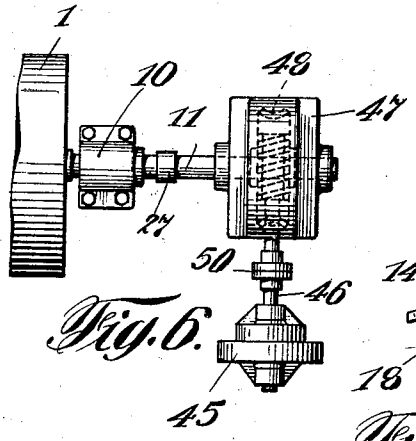


Fig. 6.

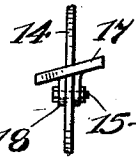


Fig. 5.

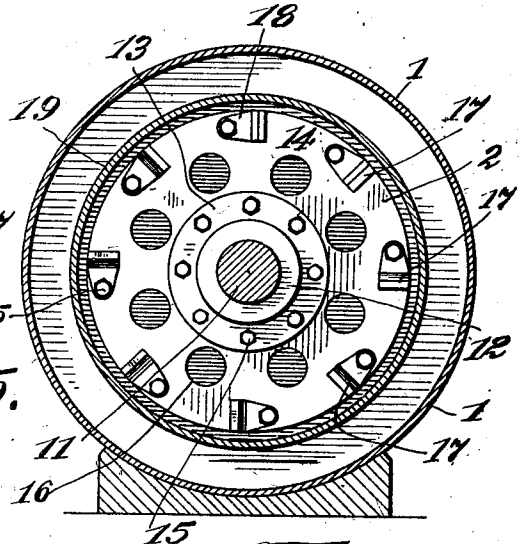


Fig. 4.

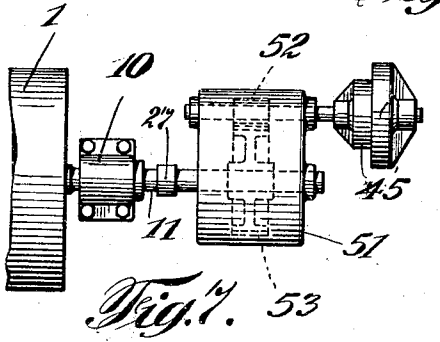


Fig. 7.

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Patented July 8, 1930 1,770,198

UNITED STATES PATENT OFFICE

JOHN C. CHAPPLE, OF ST. LOUIS, MISSOURI

FUEL PULVERIZER

Application filed September 6, 1928. Serial No. 304,240.

This invention relates to improvements in pulverizers for solid fuel which is to be converted into powdered form.

An object of the invention is to provide a pulverizer that is strong but simple in construction, capable of efficient operation and of relatively large capacity.

Pulverizers heretofore constructed generally include beaters in separate chambers, the operation being such that the partitions between the chambers retard the movement of the fuel through the pulverizer until the particles of fuel have been divided to the extent required. In all machines of this type the total amount of fuel to be ground up is fed in at one end and expelled by a fan at the other end; the finer particles of fuel that need no treatment passing through the pulverizing chamber along with the large particles or lumps; and thus the capacity of the pulverizer is reduced.

It is a further object of this invention to construct a pulverizer so that the finer particles will be more or less free to pass directly through the spaces wherein the beating and grinding action takes place; and with the parts further so arranged that the greater portion of the finer particles in the fuel are diverted; and instead of entering the pulverizer at the corresponding inlet, the finer particles are in the main introduced into the pulverizer at a point near the outlet; where said finer particles are mixed with the divided fuel which has already been acted upon in the machine and delivered thereto through the common discharge conduit. Thus the machine for the most part operates only upon the larger lumps and the capacity of the machine is greatly increased.

These and other objects of the invention are made clear in the following description, taken with the accompanying drawings which show a preferred construction by which the invention is practiced. The disclosure however is illustrative only and changes may be made without departing from the principle of the invention or exceeding the scope and meanings of the terms in which the appended claims are expressed.

On the drawings,

Figure 1 is a longitudinal section of the pulverizer according to the invention taken on the line 1—1 of Fig. 2;

Figure 2 is a top plan view thereof partly in section;

Figure 3 is an end view seen from the right of Figures 1 and 2;

Figure 4 is a front view of one set of rotating beaters;

Figure 5 is a detail showing how the blades of the beaters are mounted; and

Figures 6 and 7 indicate two different driving connections for the pulverizer.

The same numerals identify the same parts throughout.

The numeral 1 indicates the casing of the pulverizer which may be in the form of a cylinder supported with its central axis horizontal and containing three sets of blades forming beaters 2, 3 and 4; these beaters being of successively larger diameter from one end towards the middle of the machine. At the opposite end of the machine is a blower fan 5, and between the fan 5 and the beaters 2, 3 and 4, is another beater 6. This beater 6 is separated from the beaters 2, 3 and 4 by a transverse chamber 7 and is of a greater diameter than the beater 4. In operation the fuel is fed into the end of the machine adjacent the beater 2 and acted upon by the beaters 2, 3 and 4 in turn, but only the relatively larger lumps or particles receive this treatment. The lighter and finer particles are taken up by a current of air and introduced into the machine at any location on the circumference of the chamber 7, preferably the upper half, and mixed with the fuel as it is passed from the beater 4 to the beater 6, and all of the fuel mixed with a suitable amount of air is impelled by the fan through the discharge outlet 8. Hence the lighter particles are not acted upon by a majority of the beaters at all. Instead they are diverted and mixed with the body of the charge only after the larger lumps have been broken up and reduced to a certain degree of fineness by the beaters 2, 3 and 4 and the remainder of the grinding and pulverizing action is effected by the last beater 6.

The casing 1 has brackets 9 at each end and supports 10 for the main shaft 11 which passes through the two ends of the casing 1. Inside of the casing 1 the shaft 11 carries a number of hubs or heads 12 fixed thereon. Each of these hubs having flanges or collars 13 to which a disc 14 is secured by bolts 15. The discs of the beaters 2, 3, 4 and 6 support blades 17 spaced apart at points on their circumferences and the disc of the fan 5 carries the blades of the fan. The discs of all the beaters may have openings 16 and the circumferences of the discs 14 may be notched or recessed so that the blades 17 may be easily mounted. These blades will each have a pair of pivoted lugs 18 so that they can be fastened to the discs by bolts similar to bolts 15; the blades 17 will be set in a slightly diagonal position with respect to the plane of revolution, as indicated in Fig. 5, so that the material which is being beaten and broken up is retarded in its movement through the machine towards the discharge opening 8. The fan may be mounted on an open spider to allow ample space for the fuel-air mixture to reach the far side of the fan.

The beaters 2, 3 and 4 are encircled by shells 19 in the casing 1; these shells resting upon fillers or supports 20. The shells are of slightly greater diameter than the respective beaters and the shells are therefore of greater size passing from the smallest beaters 2 to the largest 4, so as to provide a relatively small clearance around the circumference of the beaters 2, 3 and 4. The beater 6 is spaced far enough from the beater 4 to allow for the chamber 7, and at the sides of this chamber are circumferential ribs 21 passing around the inside of the casing 1 but leaving a large opening for the fuel to pass axially out of the casing. Past said chamber a smaller rib 21^a is between the beater 6 and fan 5. The fuel to be pulverized is supplied from a tubular container 22 at one side of the casing 1 and parallel therewith. In this container is a screw conveyer 23 and the inlet opening to the conveyer is shown at 24, at the end of the container adjacent the end of the casing where the fan 5 is disposed. The conveyer screw 23 moves fuel through the container 22 to the opposite end where it passes into the casing 1 adjacent the beater 2 through the intake conduit 25. The container 22 mounts the shaft 26 of the screw conveyer and this shaft can be driven as indicated in Figs. 1, 2 and 3 from the main shaft 11 of the pulverizer. For this purpose the shaft 11 adjacent the intake end of the casing may carry a pulley 27 connected by a belt 28 to a pulley 29 mounted to rotate on the same shaft 30 with a pulley 31. This pulley 31 is connected by a belt 32 with the pulley 33 mounted on the same shaft as the pinion wheel 34 that engages a similar wheel 35 on the shaft 26. Hence the better shaft and conveyer shaft operate together. The common shaft for the parts 33 and 34 are indicated at 36. The two shafts 30 and 36 can be mounted in any suitable manner.

The container 22 has an air inlet 37 near the outlet end of the container, and the top of the casing 1 has an opening above chamber 7 surrounded by an upstanding rim 38 attached to the top of the casing 1 by a flange 39. Within the rim is fixed a hollow section 40, forming the elbowed end of a conduit 41. This conduit extends transversely of the casing 1 and is horizontal, and is united at its outer end by a conduit 42 to the container 22 near the inlet opening 24. The conduit 42 may have a damper 43 therein between the conduit 41 and the container 22 and it may be also open at its upper end above the point of junction with the conduit 42, and this open upper end may be controlled by a damper 44.

In practice when the pulverizer is in operation the fuel is introduced into the container 22 and drawn through the intake 25 into the pulverizing casing 1. But the rotation of the fan 5 causes air to enter the container 22 through the inlet 37, and this air carries or draws along with it the finely divided particles already in the fuel, taking them up and carrying them through the conduits 42 and 41 into the chamber 7. These lighter particles in the form of powder of more or less fineness are thus diverted and passed around the beaters 2, 3 and 4, while the larger pieces or particles enter the casing 1 through the intake 25 together with a portion of the air admitted at 37 and are broken up; at the same time the particles which may not be taken up by the air currents and drawn directly into the chamber 7 but which are fine enough by the time they enter the casing 1 through the intake 25 to be carried along by the air current due to the fan 5, can be passed through the openings 16 in the discs 14; so that the force of the beaters 2, 3 and 4 is exerted only upon the larger particles which require to be broken up and divided further. Where the particles which have been acted upon by the beaters 2, 3 and 4, reach the chamber 7, they are mixed with the fine particles entering from conduit 41. The extremely fine particles from both sources pass through the openings 16 in the disc 14 of the last beater 6; and the coarser particles from both sources are further reduced by beater 6, so that when they arrive at the fan 5, the fuel in a finely divided state mixed with air can easily be blown out through the discharge opening 8. Thus the pulverizer can act more quickly and may pulverize fuel mixed with the required amount of air more quickly; and at the same time relatively less power is required and for a given quantity of power consumed the output is so much larger.

The main shaft 11 can be operated from any suitable source. Figs. 6 and 7 illustrate

devices used for this purpose. In Fig. 6 I show a turbine 45 which turns a shaft 46 extending transversely of the shaft 11 and connected therewith by a worm-gear housed in a casing 47 which also receives the end of the shaft 11 carrying a gear 48 turned by the worm-gear on the shaft 46. This arrangement is useful when the turbine 45 must be located in transverse position with respect to the casing 1. In the line of the shaft 46 may be a coupling 50. In Fig. 7 the turbine 45 is arranged parallel with the main shaft 11 and the shaft 46 of the turbine enters a casing 51 in which is a gear 52 meshing with the gear 53 on the adjacent end of the shaft 11.

I may also utilize the clutch 54 on the shaft 30.

The shells 19 of the beaters 2 and 3 are provided with flanges 20 as above stated to space them from the inside of the casing 1. The shell of the beater 4 however may be spaced from the inside of the casing 1 by blocks or separators 55. The partitions 21 on both sides of the beater 6 may be united by a cylindrical web 56.

While I have shown and described the pulverizer as adapted for treatment of fuel I may obviously employ it in other solid substances to be broken up and powdered.

Preferably the connection between the shaft 11 of the pulverizer and the shaft 26 of the conveyer 23 should be adjustable to permit a change of speed. For this purpose the pulleys 31 can be made according to a well known design of change speed gearing so that their diameters can be changed. For example, the pulley 31 may consist of two cone-shaped discs on the shaft 30, mounted to rotate with this shaft and presenting their conical surfaces to each other and adapted to slide on the shaft 30 towards and from each other. The pulley 33 can be of similar construction and the belt 32 can be a V-belt having converging sides which engage the conical inside faces of the discs mentioned. By suitable mechanism the distance between the discs of the pulleys 31 and 32 is controlled. The farther the discs of the pulley 31 are apart the closer the belt 32 will run to the axis of the shaft 30 and so with the discs of the pulley 33; thus a wide range of speed can be obtained.

I claim:

1. A pulverizer for fuel comprising a casing, a container from which fuel is supplied to the casing to be broken up and divided, and an air conduit connected with the container and joined to the casing at a point between the outlet of the casing and the point where the body of fuel enters the casing.

2. The process of pulverizing solid fuel which consists in retarding the larger particles and simultaneously subjecting them to a breaking up action, subjecting the smaller particles to less retardation, collecting and diverting the finer particles by stream flow, and re-mixing the stream flow with the body of the fuel and subjecting to final pulverization.

3. A fuel pulverizer comprising a casing, a supply container, an intake conduit connecting said container to the casing, beaters in said casing, the container having an inlet for the fuel and an inlet for the air, the casing having an outlet, and a conduit united to the container between the fuel and air inlets and joined to the casing at a point between the fuel intake and discharge.

4. A fuel pulverizer comprising a casing, a shaft extending through the casing, beaters on said shaft extending substantially from one end to the other, a fan in said casing between said beaters and said other end of the casing, a fuel container outside of the casing, a conveyer in said container, an intake uniting the container to the casing at the end remote from the fan, the casing having a discharge outlet adjacent the fan, and a conduit connecting the container to the casing adjacent the beaters which are nearest to the fan, the container having an air inlet at the end thereof adjacent the intake leading to the casing.

5. A fuel pulverizer comprising a casing, a shaft passing through the casing, beaters on the shaft in the casing and extending substantially from one end to the other, a fan in the casing adjacent the other end, each of said beaters comprising a perforated disk with blades mounted on the peripheries thereof, the casing containing a transverse chamber between two of said beaters adjacent the fan, and a conduit uniting said chamber with the supply of fuel so that the finer particles of fuel can be diverted.

6. A fuel pulverizer comprising a casing having an intake at one end and an outlet at the other, a shaft passing through the casing, beaters on the shaft, each of said beaters comprising a perforated disc bearing blades on its periphery, the beaters increasing in diameter from the intake to the discharge end of the casing, a fan on the shaft in the casing adjacent said discharge end, and means forming a chamber between two of said beaters adjacent the fan, the chamber having connection with the fuel supply.

7. A fuel pulverizer comprising a casing, a shaft in the casing, the casing having an intake for fuel at one end and a discharge outlet at the other, beaters comprising perforated discs carrying blades on their peripheries in the casing on the shaft, the beaters increasing in size from the intake to the outlet, a fan in the casing on the shaft adjacent the outlet, shells in the casing encircling the beaters, the spaces between the shells and the inside surface of the casing being closed, the casing having a transverse chamber between the beater nearest to the fan

and the adjacent beater, a container outside the casing having an inlet at one end for fuel and connected at its opposite end to the intake of the casing, the container having an air inlet adjacent said intake, and a conduit connecting the container adjacent the fuel inlet thereof to the transverse chamber in the casing.

8. The process of handling and pulverizing solid fuel which consists in retarding and breaking up the larger particles, subjecting the smaller particles to less retardation, diverting the finer particles by stream flow, then re-intermingling the stream flow and subjecting to final pulverization, all of said particles after the preliminary breaking up process has been completed.

In testimony that I claim the foregoing as my invention, I have signed my name hereto.

JOHN C. CHAPPLE.