

June 17, 1930.

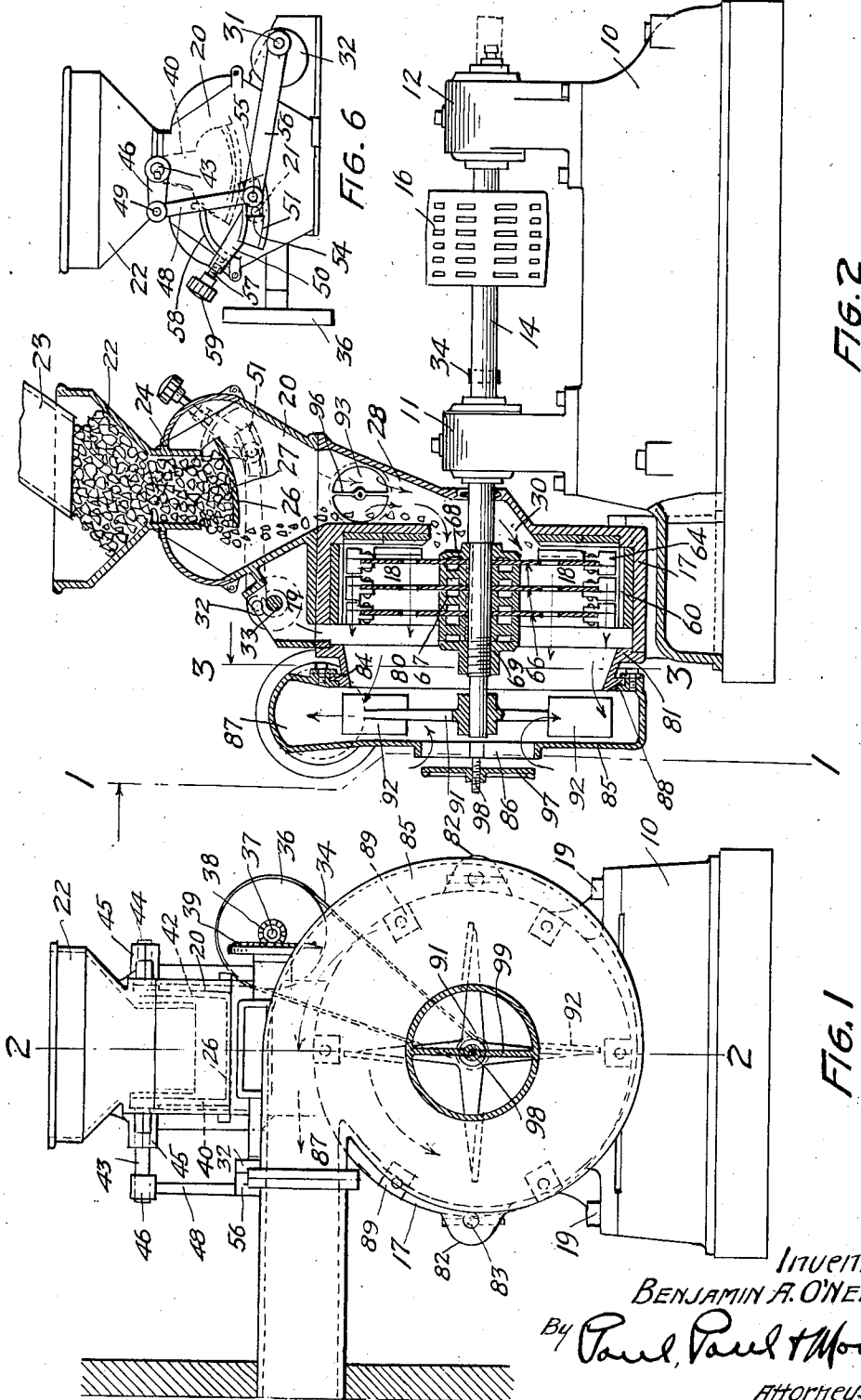
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1,765,309

PULVERIZING MACHINE

Filed Sept. 28, 1923

2 Sheets-Sheet 1



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FIG. 3

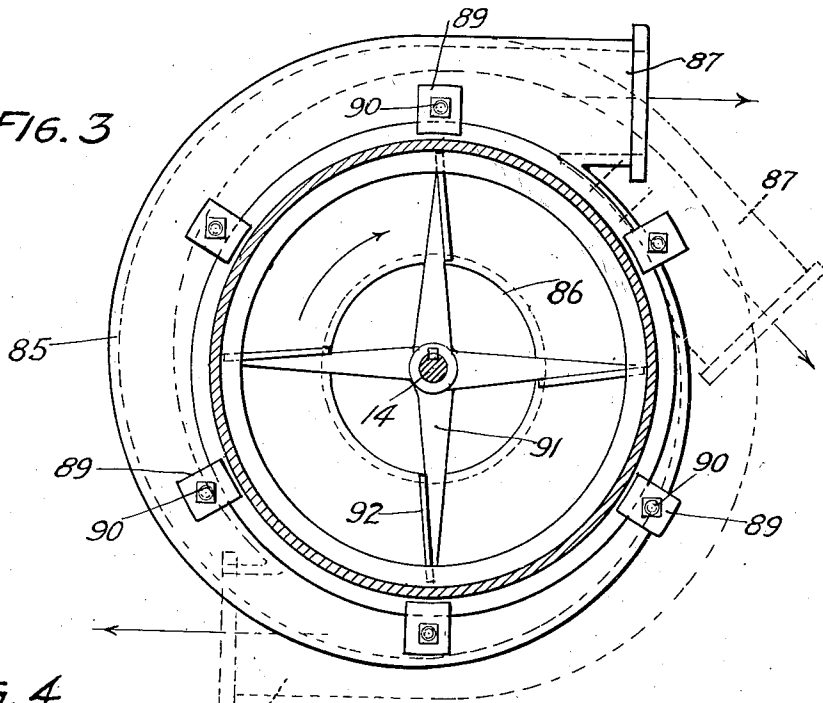


FIG. 4

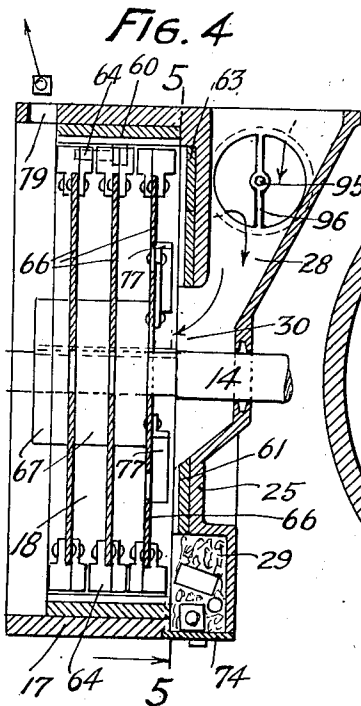
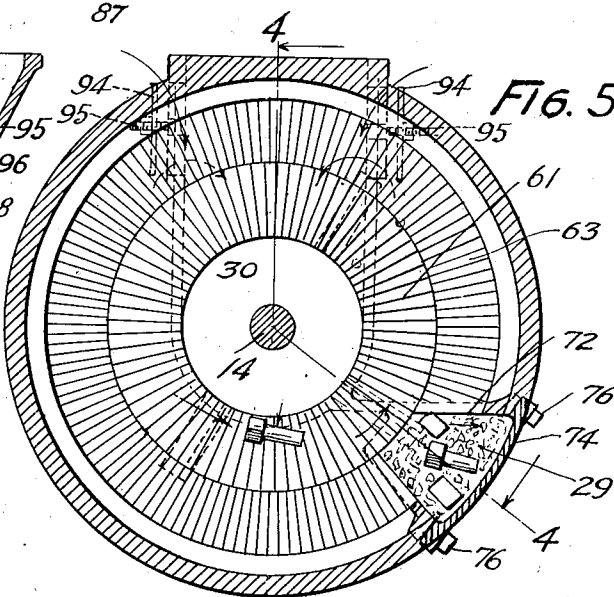


FIG. 5



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PULVERIZING MACHINE

Application filed September 28, 1923. Serial No. 665,386.

My invention relates to machines for reducing various solid or fibrous material in a coarse or lumpy condition, to a fine impalpable pulver or powder and is an improvement on machines shown and disclosed in Letters Patents No. 619,353, and 619,354, granted February 14, 1899 and No. 1,081,860 granted February 23, 1912.

The present invention relates more particularly to machines for pulverizing fuel products, such as coal, coke, tar pitch, or lignite or other similar substances, and the general object of the invention is to provide a machine capable of delivering the pulverized fuel, thoroughly and uniformly mixed with the required amount of air for efficient combustion, directly from the machine, into the combustion chamber of steam boilers, metallurgical furnaces, kilns and other heat using apparatus without storing and subsequent handling of the fuel.

More specific objects of the invention are to provide a machine wherein the air used for separating the fine and coarse fuel within the pulverizing chamber, is directly used for combustion by being delivered, mixed with powdered fuel into the combustion chamber, and wherein auxiliary means are provided for admitting additional air to the fuel and air mixture from the pulverizing chamber before the combined mixture is inducted into the combustion chamber.

A further object is to provide means in the machine for controlling the passage of separating air through the pulverizing chamber for the purpose of regulating the fineness of the powdered fuel and independent means for controlling the auxiliary amount of air required for efficient combustion.

Other objects are to provide a machine of the class described, in which the mixing and delivering mechanism is accessibly mounted upon the outer end of the main pulverizing shaft or axis at the discharge end of the pulverizing chamber, making the pulverizing

chamber easily accessible, and to, provide means whereby this mechanism may be adjusted to deliver the combustible mixture in any desired direction radial to the axis. Means are also provided for automatically ejecting foreign, non-reducible substances from the pulverizing chamber to prevent injury to the machine.

To these ends my invention consists in certain constructions and combinations, as hereinafter described in the specification and particularly pointed out in the claims, with reference to the accompanying drawings, forming a part of the specification in which

Figure 1 is an end elevation partly in section on the line 1—1 of Figure 2, of a machine embodying my invention;

Figure 2 is a vertical longitudinal section on the line 2—2 of Figure 1 of the pulverizing chamber, feeder and air delivering member or fan, illustrating the feed and air control and the relative position of the fan to the pulverizing chamber.

Figure 3 is a vertical cross section on the line 3—3 of Figure 1 on a larger scale, illustrating the method of adjusting the fuel mixture outlet from the machine to varying positions and angles.

Figure 4 is a section on the line 4—4 of Figure 5, illustrating the air control and the method of ejecting metallic or other ungrindable substance from the pulverizing chamber.

Figure 5 is a section on the line 5—5 of Figure 4;

Figure 6 is a side elevation of the feeder. Referring to Figs. 1 and 2 of the drawings, 10 is the base of the machine provided with bearings 11 and 12, preferably of the ball bearing type, in which the main pulverizing shaft 14 is journaled. This shaft is shown provided with a driving pulley 16, but is preferably extended beyond the bearing 11 as indicated by dotted lines in Figure 2 and driven by direct connection with a motor

not shown. The casing 17 enclosing the pulverizing chamber 18, is mounted on the forward end of the base 10 and is preferably secured thereto by screws 19. The feeder 20 is shown arranged on top of the casing 17, and is provided with a hopper 22 into which the coal or other fuel may be delivered by a spout 23 or other suitable devices for the purpose. The fuel fills the downwardly projecting hopper outlet 24 and normally rests on a feed plate 26, that is capable of a variable reciprocating or vibrative movement. A stationary bar 27 prevents the fuel particles from moving with the feed plate and as the plate is reciprocated the fuel pieces drop from opposite ends of the plate into the inlet chute 28 and through the opening 30 into the pulverizing chamber 18. The vibrations of the feed plate 26 are induced by a crank pin 31 (Figure 6) connected to a disc 32 on a shaft 33. This shaft is driven from the main shaft 14 by a belt 34 over a pulley 36 arranged on a shaft 37 and driving the shaft 33 through bevel gears 38 and 39. It will be noted that the shaft 14 at one end projects a considerable distance beyond the bearing 11 to allow the mechanisms supported by this projecting end to be removed whenever desired without disturbing the bearings of the shaft on the base.

The feed plate is provided with upwardly extending rocker arms 40 and 42, having projecting shafts 43 and 44 arranged in bearings 45. The arm 40 is keyed to the shaft 43 which extends through its bearing and carries on its outer end an arm 46, to which is pivoted a link 48 at 49. A lever 50, having a curved slot or recess 51, is pivoted to the feeder casing 20 at 21 and when this lever is in the position shown in Figure 6, the center of curvature for the recess 51 corresponds to the pivot point 49 of the link 48. A segmental slide 54 is fitted to move in the recess 51 and is provided with a pin 55 to which the lower end of the link is pivoted and to which is also pivotally connected a connecting rod 56 journaled to the crank pin 31. As will be seen when the shaft 33 is rotated the curved slide 54 will be given a reciprocating movement in the recess 51 and when the lever 50 is in a position as in Figure 1, the center of curvature for the recess 51 will be thrown to one side of the pivot point 49 of the link 48 and the reciprocating movement of the slide 54 will result in a rocking movement of the shaft 43 and a vibrating movement of the feed plate 26.

When, however, the lever is adjusted as in Figure 6, no vibration of the feed plate will be induced from the movement of the curved slide 54, as the link 48 will then swing from the center of curvature of the recess 51. The stroke of the feed plate can thus be adjusted to any desired degree from zero to maximum by moving the lever 50 and the curved recess

to any angle giving the desired stroke and the lever may be secured in any position preferably as shown, by a screw 57 threaded in a lug of the lever and adapted to be screwed tightly against a quadrant 58 by means of a hand wheel 59. Thus by gaging and adjusting the lever 50 any desired amount of fuel from zero to maximum may be fed to the pulverizing chamber 18 of the machine for powdering and subsequent induction into a combustion chamber after being mixed with air in the proper proportion.

The powdering mechanism in the chamber 18 comprises a hard metal, circular shell 60 corrugated internally and arranged in the chamber concentric to the main shaft 14, a pair of circular, hard metal flat rings 61 and 63, corrugated radially and arranged in the front wall 25 of the chamber and a series of beaters 64 secured at intervals around the outer edges of high speed rotating circular discs 66, spaced and secured to the main shaft 14 by splined collars 67 and 68 and a clamping nut 69 threaded on the shaft 14. The construction and operation of the pulverizing and feed mechanisms are substantially identical with that shown and described in my patents of record, except for a few details hereinafter described. A recess 29 (Figs. 4 and 5) is formed in the front wall 25 of the pulverizing chamber 18, preferably at a point spaced radially some distance away from the lower wall of the inlet chute 28 in the direction of disc rotation as shown in Figure 5. The upper edge 72 of the recess is preferably arranged at an angle to the radial line 4—4. The recess has an opening through the casing 17, and a removable cover 74, fastened by screws 76, normally closes this opening.

The first of the circular beater discs 66 is provided with breaking or crushing lugs 77, radially secured to the front side of the disc and projecting close to the corrugated surface of the flat, circular rings 61 and 63. As the fuel pieces are fed into the chamber 18 through the opening 30, they are caught by the crushing lugs 77 on the revolving discs 65, which crush the fuel pieces against the corrugated surface of the rings 61 and 63 and reduce these to small sizes. If a metallic or other unbreakable substance should enter through the opening 30, it will be caught by the projecting rotating plates 77 and will be thrown outwards and upwards opposite the recess and will be forced by the lugs 77 and beaters 64 into the recess as indicated in Figures 4 and 5, from whence they may be removed by the operator by taking off the cover. It has been found that metallic substances, if permitted to enter the pulverizing chamber, will not be caught in the narrow space between the beaters and corrugated shell, but will pass across the chamber between the beaters and between the periphery

of the discs and the corrugated shell, and may be automatically ejected through an opening 79 in the casing 17 as indicated particularly in Figure 4.

5 The most essential novel features of the invention are, however, the fuel mixture controlling and delivering mechanism, which will now be described.

Referring again to Figures 1 and 2, a suction chamber 80, preferably formed of a cone member 81 as shown in Figure 1, is removably secured to the casing by means of lugs 82 and pins 83 in any suitable manner now shown in detail. The cone member 81 is provided with an annular external flange 84, upon which is mounted a scroll-formed fuel mixing casing 85, having a central circular air inlet port 86, on its outer side a tangential mixture discharge 87 on its periphery and an opening to the suction chamber 80 on the inner side. An internal annular flange 88 adjoins the external flange 84 of the cone member 81. Clamping plates 89 are secured by screws 90 to the internal flange 88 of the blower casing 85 and project over the external flange 84 of the member 81. By loosening these screws, the casing 85 may be swung around to any position to adapt it to direct its outlet in any desired direction for different varieties of combustion chambers and may then be clamped in the desired position by tightening the screws 90.

Within the blower casing 85, and mounted on the overhanging end 15 of the shaft 14, is the mixture delivering blower or fan 91 having fan blades 92. In the feed chute 28 are arranged the air inlet openings 93 (Figs. 2 and 5) for the admittance of separating air to the pulverizing chamber 18. These air inlets are controlled by circular disc valves 94, having threaded hubs mounted on threaded rods 95, fast to cross bars 96 preferably cast integral with the casing. By turning one or both of these valves in either one or the other direction, the opening for the admission of air to the pulverizing chamber may be varied to control the strength of the air current passing through the pulverizing chamber caused by the vacuum in the suction chamber 80 induced by the rotating fan as indicated by arrows in Figures 2 and 4.

As the feeder 20 in operation, is substantially air tight, the air passed by the valves controls the strength of the sideways pull toward the fan on the fuel in the pulverizing chamber. The centrifugal force induced by the rotating beaters and acting on the rotating fuel particles opposes this sideways pull and is of course greatest on the heavier fuel particles. The finest powdered fuel particles, proportional to the strength of the air current, will therefore be drawn toward and into the fan casing through the suction chamber 80. The fuel fed to the pulverizing chamber from the feeder, is adjusted for the heat re-

quirements of the combustion chamber, and as the air admitted to the pulverizing chamber is adjusted to produce the required fineness of pulverized fuel it is generally insufficient for efficient combustion of the fuel. The necessary auxiliary air is therefore admitted to the blower, through the outer inlet port 86.

The admittance of air through this port to the fan is controlled by a disc valve 97, threaded upon a stationary stud 98, fastened in a rib 99 of the casing. The construction and operation of this valve is similar to the valves 94 and auxiliary air may be admitted to the mixing fan casing to any required amount for efficient complete combustion by adjusting this valve. The entrance of the auxiliary air to the mixing chamber is central to the axis of the blower and equal in quantity around the periphery of the disc valve at all adjustments. This air control construction thereby insures a uniform thorough mixture and discharge of the combustion mixture by the rotating fan blades under all adjusted conditions.

I claim as my invention:

1. A grinding mill comprising a base having bearings thereon, a shaft mounted in said bearings and having an end extending outwardly therefrom, a fan mounted on the extended end of said shaft, a housing for said fan having an air trunk and mounted for rotary adjustment to change the position of said trunk with respect to said fan, an internal annular flange on the fan housing an external annular flange on the housing of the grinders, one lapping the other, and a releasable clamping ring for holding the fan housing to its adjustment, grinders mounted on said shaft between said fan and bearings, a housing for said grinders and a feed hopper therefor said fan and grinders being removable from said shaft without disturbing its bearings.

2. In a grinding mill, a base, a shaft journaled in bearings at two points thereon and having an end projecting beyond one of said bearings, grinders mounted on said projecting end, a fan mounted on said projecting end outside of the grinding-chamber adjacent to said grinders and operative to draw air and the material to be ground through said grinders, and a scroll shaped housing for said fan having a peripherally located tangentially disposed discharge trunk and separable from the grinding-chamber; said fan and grinders being detachable from the shaft without disturbing the bearings of the shaft.

3. In a grinding mill, a grinding chamber having a corrugated inside facing at the inlet for material into the chamber, a chute for conducting material to the chamber inlet, a rotatable shaft carrying beater-disks, the disk next to the chamber inlet being formed with face-plates for breaking-up material as

it enters the grinding chamber, the front wall of the chamber being formed with an off-set recess spaced radially from the lower part of the inlet for material into the chamber and positioned to receive unbreakable substances impelled by the projecting plates of the adjacent disk, and an exhaust fan at the discharge end of the grinding chamber for withdrawing crushed material from the chamber by exhaust-suction.

In witness whereof, I have hereunto set my hand this 18th day of September, 1923.

BENJAMIN A. O'NEILL.

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