Oct. 29, 1929. P. L. CROWE 1,733,683

ELECTRICALLY DRIVEN COAL PULVERIZER AND FIRE FEEDER

Filed Aug. 13, 1927

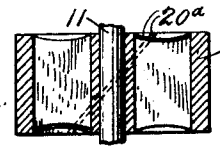



Fig. 2.

Fig. 1.

Fig. 5.

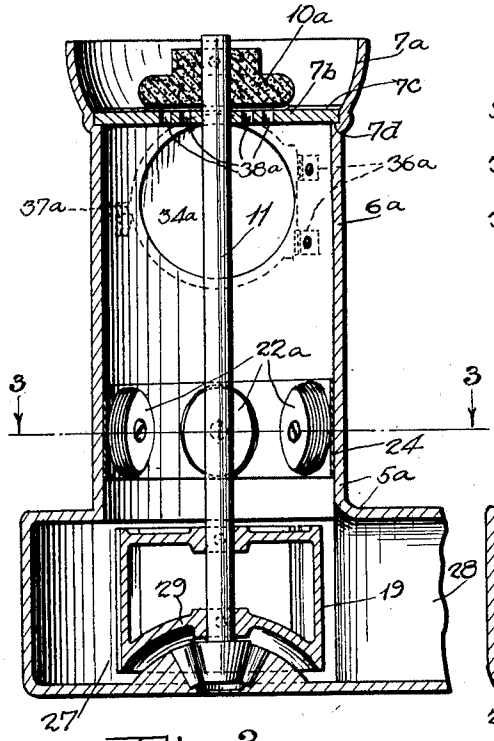



Fig. 3.

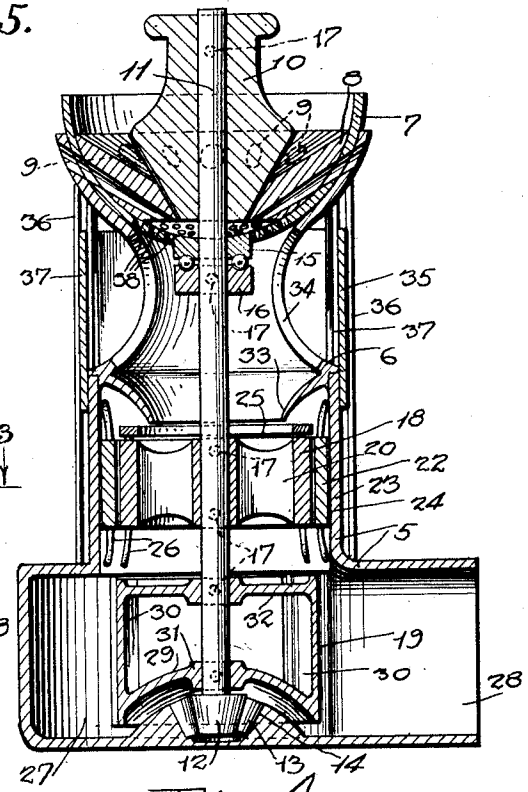
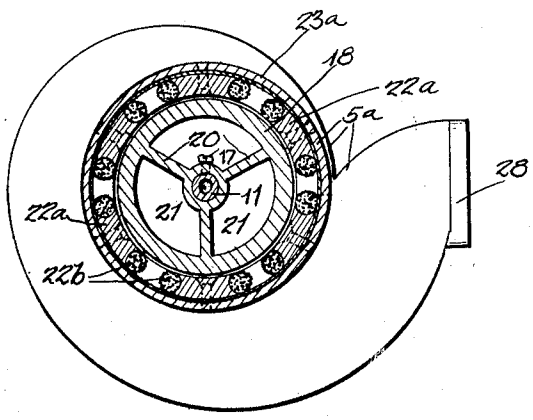
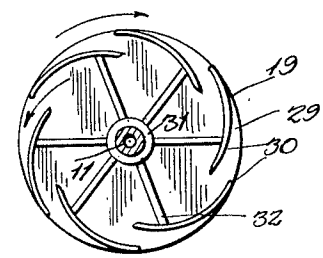



Fig. 4.




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# UNITED STATES PATENT OFFICE

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## ELECTRICALLY-DRIVEN COAL PULVERIZER AND FIRE FEEDER

Application filed August 13, 1927. Serial No. 212,668.

This invention relates to pulverizers, and especially to an improved electrically driven coal pulverizer and fire feeder.

The main object of this invention is to combine in a compact, exceedingly simple and thoroughly practical unitary structure, all the essential members for containing lump coal, pulverizing the same, thoroughly mixing the pulverized coal with an air current, producing the necessary air current for keeping the pulverized coal in suspension, carrying this current of air and suspended pulverized coal into a furnace or the like, and at the same time using the force of gravity in cooperation with the said air current for conveying the pulverized coal and air through the machine.

A further object is to combine, within a single casing and on a single vertical shaft, a pulverizing member, an air current producing member, and a power-generating member, all in such relation that the pulverized coal can pass down from the top to the bottom of said casing, through said power-generating member while the latter operates to generate the power for driving the shaft and the members carried thereby.

A further object of the invention is to provide a machine of this character whose vertical shaft rotates on roller bearings, and to utilize the air current producer to shelter the roller bearings from the descending pulverized coal.

A further object is to provide a machine of this character whose vertical shaft is hollow from end to end so the shaft can be utilized as an oil-duct for applying oil or other lubricant to the bearings in the bottom of the casing.

A further object is to provide a machine of this kind with air inlets and with closures to regulate the capacity of the air inlets.

Other objects and important features are pointed out or implied in the following details of description in connection with accompanying drawings in which:

Fig. 1 is a vertical sectional view through one form of machine constructed in accordance with this invention.

Fig. 2 is a similar view of a different form of the same invention, a part of the outlet portion being broken off, the rotor of the electric motor also being omitted.

Fig. 3 is a sectional view along the line 3—3 of Fig. 2.

Fig. 4 is a plan view of the fan used in both forms of the invention, this view also showing the vertical hollow shaft in horizontal section.

Figure 5 is a vertical detail sectional view showing a modified form in which the spokes or webs of the rotor constitute fan blades, so the rotor serves the dual purpose of generating power and creating a draft of air through the power generator.

Referring to these drawings in detail, in which similar reference characters correspond to similar parts in the several views; but first referring particularly to Figures 1 and 4; the casing is shown composed of three separately formed sections fitted together in superposed relation and secured in place by any appropriate means (not shown), that is, a base section 5, an intermediate section 6, and an upper section 7, the latter forming a hopper in which is contained an annular stationary abrading member 8 of any appropriate material and formed with an annular series of air-passages or air inlets 9. The periphery of the member 8 fits snugly in the hopper 7; but the bottom thereof is spaced from the bottom of the hopper to provide an air chamber in which the air from the passages 9 commingles with the pulverized coal that passes down between the conical hollow of the member 8 and a rotary abrading member 10 which has a conical or downwardly tapering lower end which is only slightly spaced from the inner wall of the abrading member 8.

A hollow vertical shaft 11 carries the rotary abrading member 10, this shaft having its lower end provided with a conical member 12 which is rotatably supported by conical bearing members 13 in a bearing-seat 14, such bearing-seat being formed or secured in the bottom of the base member 5. A ball bearing-seat 15 is formed or secured on the hopper member 7 and cooperates with a bearing-collar 16 to form a thrust bearing to prevent the abrading member 10 from being raised by

action of the coal being pulverized. In this connection, it should be understood that the members 10 and 16 are adjustably secured to the shaft 11 by means of set screws 17, and that similar set screws are employed for securing a rotor 18 and a fan 19 on the shaft 10.

Referring again to the rotor 18, it should be understood that this is the rotary element of an electric motor which drives the abrading member 10 and fan 19, through the medium of the shaft 11, and that it is substantially of the same form as the one shown in Figure 3, that is, having broad flat spokes or webs 20 connecting its annular outer portion to its hub, and provided with through openings 21 which constitute passages through which air and suspended particles of coal are drawn downward by the force of gravity and the fan 19. The stator of the motor is shown at 22, this being secured to the annular wall 23 of the base member 5 by any appropriate means, suitable insulating material being provided at 24 so as to insulate the stator from the wall 23. A commutator or collecting ring 25 is mounted on and suitably insulated from the top of the rotor 18, and any suitable form of brush (not shown) may be mounted at any suitable place and in any suitable way. This commutator is hollow so the air and pulverized coal can pass therethrough. This motor is shown somewhat conventionally, and its windings 26 may be of any appropriate type, it being understood that this is an A. C. motor, but that a D. C. motor or other power may be substituted therefor, according to the conditions under which this machine is to be operated.

The base 5 is preferably of substantially convolute form or outline, and the shaft 11 is mounted eccentrically therein, as shown in Figure 3, thus providing an outwardly diverging air passage 27 which terminates in an outlet or discharge opening 28 which is intended to be directly or indirectly connected to a furnace or the like for feeding pulverized coal and air for combustion.

The fan 19 is preferably of the form shown in Figure 4, and includes a lower disk 28, arcuate blades 30, and one or more hubs 31 secured to the shaft 11. Spokes 32 may also be provided, although they are not strictly essential, for the blades 30 are rigidly united with the disk 29. The upper part of the fan is open, as shown in Figure 4, so the air and suspended coal particles can move downward thereinto, but the disk 29, being imperforate, and also being concaved at its under side, effectually shields the conical bearings against the entrance of the pulverized coal into the bearing-seat 14. A fan can also be located in the interior of the motor, as shown in Figure 5. This view shows the spokes or webs $20^a$ inclined in such direction that when the shaft 11 is turned clockwise, these webs $20^a$ constitute fan blades which draw the air downward through the combined fan and generating element shown in this Figure 5.

For the purpose of shielding the ring 25 and the air-gap of the motor, I provide the intermediate casing section or portion 6 with a funnel which projects over the ring 25 and outer annulus of the rotor so the air draught is directed through the openings in the members 25, 19 and 18.

The member 6 is provided with hand-holes 34 through which access may be had to the interior of the casing for any desirable purpose, these openings also serving as additional air inlets. They are provided with a closure member 35 which extends around the parts 5 and 6 and is adapted to be slid up for closing or partly closing the openings 34, thereby regulating the amount of air fed into the machine. Vertical guides or bars 36 and 37 may be secured in place by any appropriate means, and the closure member or cylinder 35 may be guided thereby while being raised or lowered. Any appropriate means (not shown) may be provided to hold the cylinder 35 in its different vertical adjustments.

The hopper is perforated or foraminated at 38 to permit the mixture of pulverized coal and air to pass therethrough under the force of gravity and the urge or suction produced by the fan 19.

The operation is as follows:

Assuming the shaft 11 to be carrying the united parts in the clockwise direction indicated by the arrow above Fig. 4, it is evident that the inner ends of the blades 30 will be cutting the internal volume of air and forcing it outward in the direction of the arrow on the disk 29, thereby tending to create a vacuum in the space surrounded by the blades 30, and thus drawing the mixture of air and coal-dust down into the fan, then discharging it into the outwardly converging channel 27 and through the furnace-feeding outlet 28.

The form shown in Fig. 3 illustrates how the invention can be utilized in connection with shoes $22^a$ provided with windings $22^b$ of connecting wire, so as to combine with a rotor (such as shown in Fig. 3) to form a D. C. motor for driving the shaft 11 and thereby driving the fan 19 and abrading member or wheel $10^a$ which may be of carborundum or other suitable material. In this form of the invention, the wall of the hopper $7^a$ is formed integrally with the base member $5^a$, but the bottom $7^b$ of the hopper is separately formed, provided with retaining ribs $7^c$ to prevent the lumps of coal from sliding while being abraded, and seated on a shoulder $7^d$ where it is secured by any appropriate means (not shown). This disk or hopper-bottom $7^b$ is provided with perforations or foraminations $38^a$ to permit the air to carry the pulverized coal therethrough in conse-

quence of the fan 19 and the force of gravity.

The cylindrical part 6ª of the casing is provided with air inlet openings 36ª, one of which is shown, and the other omitted with the missing section of this form of the invention. The openings 34ª are provided with doors 35ª, each having hinges 36ª and latches 37ª, so they can be opened or partly opened for regulating the quantity of air to be passed through the machine.

Although I have described these embodiments of my invention specifically, I do not intend to limit my patent protection to the exact details of construction and arrangement here shown; but changes may be made within the scope of the inventive ideas as implied and claimed.

What I claim as my invention is:

1. In a machine of the character described, the combination of a casing including a hopper at its upper end, an outlet opening at its lower end, and air inlet openings at the lower end of the hopper; a shaft mounted vertically for rotation in said casing; a motor in said casing and having its rotor secured on said shaft; a rotary pulverizing member in said hopper and carried by said shaft; and a fan on the lower end of said shaft and rotatable therewith; said motor having passages therethrough and being effective to turn said shaft together with said pulverizing member and fan; said fan being effective to create an air draft downward through said casing and thereby discharge the air and the pulverized material from said casing.

2. In a device of the character described, the combination of a casing which includes a hopper, air inlets, and an air outlet at its lower end, said lower end having a bearing-seat therein, said hopper having an annular abrading member non-rotatably mounted therein; a shaft mounted vertically for rotation in said casing and provided with roller bearings in said bearing-seat; a disk mounted on said shaft immediately above said bearing-seat and adapted to shelter the latter; fan blades united with said disk and extending upward therefrom and being spaced from one another so as to discharge air and pulverized material between them; an abrading member on the upper end of said shaft and extending into said annular member and being rotatable with said shaft for pulverizing coal or the like, and a motor in said casing and operable to turn said shaft and thereby rotate said abrading member and fan.

3. In a device of the character described, the combination of a casing which includes a substantially convolute base provided with a fan and with an outwardly diverging air passage which terminates in an outlet opening, said casing including a cylindrical part extending up from said convolute base, and also including a hopper at its upper end, the casing also being provided with air inlets adjacent to the lower end of said hopper; a shaft extending vertically through the center of said cylindrical part and hopper and carrying said fan; an abrading member in said hopper and carried by said shaft; and a motor having its stator secured in the cylindrical part of said casing, and its rotor secured on said shaft and operable to rotate the latter so as to rotate said abrading member and said fan, substantially as described, for the purposes specified.

4. In a device of the character described, the combination of a casing provided with a hopper, air inlets at the lower part of the hopper, a bearing-seat in its lower end, and an outlet opening horizontally disposed from said bearing-seat; a fan carried thereby, a vertically disposed shaft rotatably mounted in said bearing-seat; a motor above said fan and having its rotor mounted on said shaft while its stator is secured to said casing; an abrading member carried by said shaft in said hopper; and means for regulating the capacity of said air inlets, substantially as shown.

5. In a device of the character described, the combination of a casing including a hopper, air inlets at the lower part of the hopper, and an air outlet at the lower part of the casing; a shaft mounted vertically for rotation in said casing; a fan on said shaft and rotatable therewith in the lower part of the casing; a pulverizing member on said shaft in said hopper; a motor in said casing and having its rotor on said shaft and adapted to rotate the latter and thereby rotate said fan and pulverizing member, said rotor being provided with openings therethrough; and a funnel which shelters said stator and the periphery of said rotor and directs air and pulverized material through said rotor under the urge of said fan, substantially as shown and specified.

6. In a machine of the character described, the combination of a casing including a hopper at its upper end, an outlet opening at its lower end, and air inlet openings at the lower end of the hopper; a shaft mounted vertically for rotation in said casing; a motor in said casing and having its rotor secured on said shaft; a rotary pulverized member in said hopper and carried by said shaft; and a fan on said shaft and rotatable therewith; said motor being between said pulverizing member and fan and having passages therethrough and being effective to turn said shaft together with said pulverizing member and fan; said fan being effective to create an air draft downward through said casing and thereby discharge the air and the pulverized material from said casing.

In testimony whereof I affix my signature.

PAUL L. CROWE.