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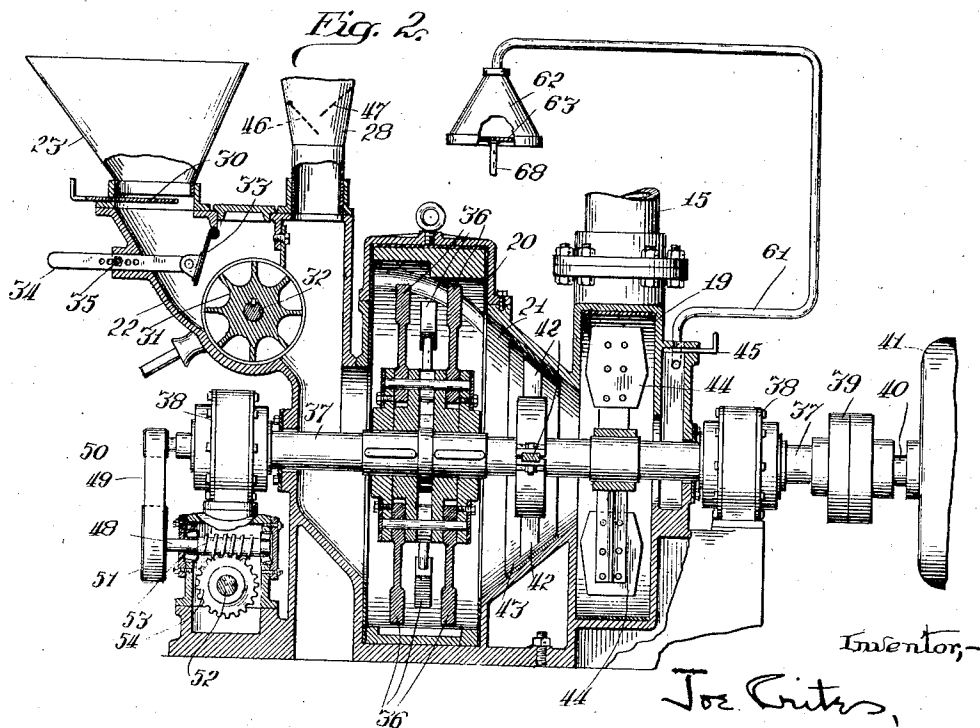
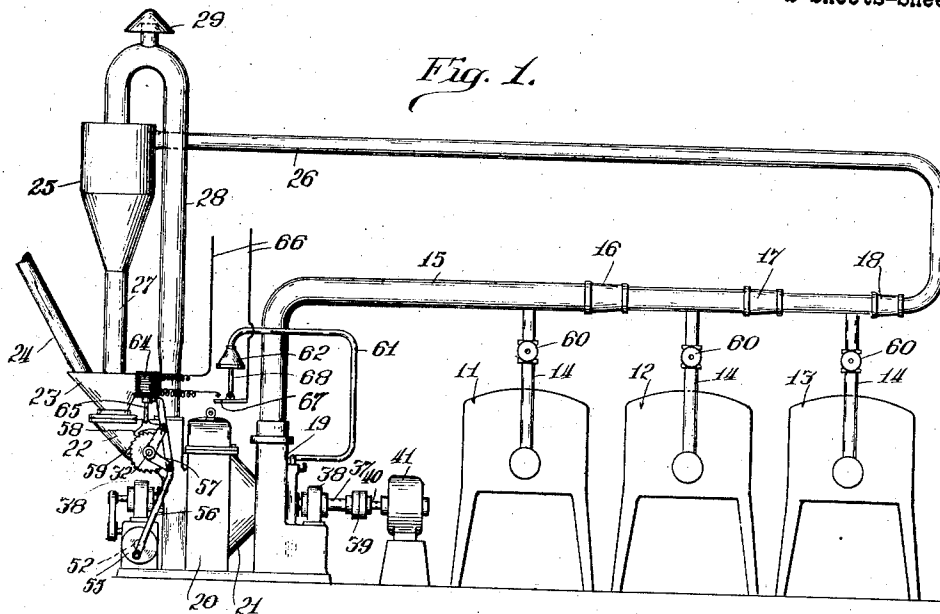
J. CRITES

1,541,903

MEANS FOR PULVERIZING, FEEDING, AND BURNING FUEL

Filed April 25, 1924

2 Sheets-Sheet 1



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Fig. 3.

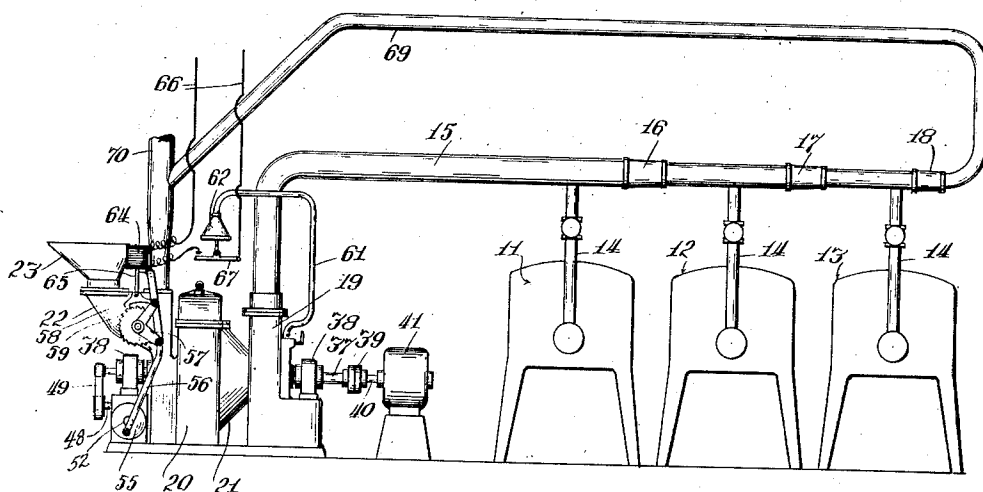
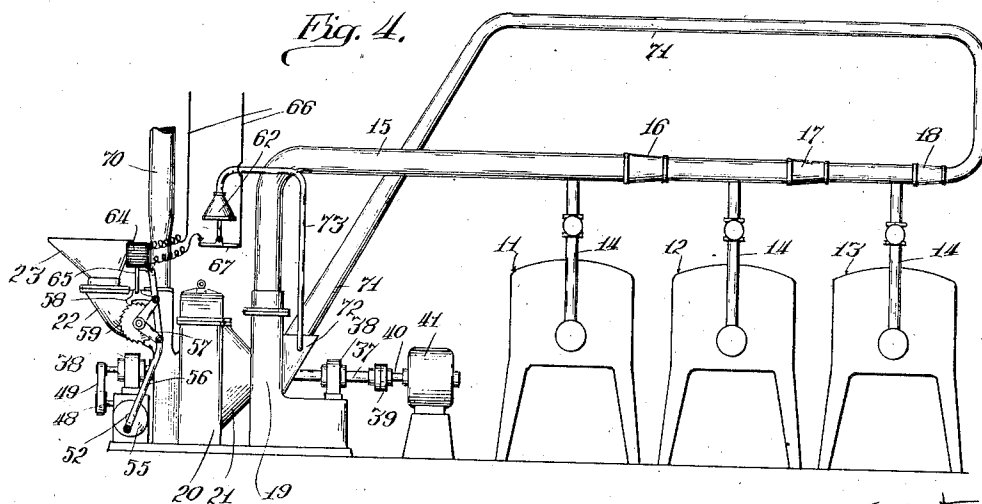


Fig. 4.



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UNITED STATES PATENT OFFICE.

JOE CRITES, OF EVANSTON, ILLINOIS, ASSIGNOR TO RAYMOND BROTHERS IMPACT PULVERIZER CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

MEANS FOR PULVERIZING, FEEDING, AND BURNING FUEL.

Application filed April 25, 1924. Serial No. 708,908.

To all whom it may concern:

Be it known that I, JOE CRITES, a citizen of the United States, residing at Evanston, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Means for Pulverizing, Feeding, and Burning Fuel, of which the following is a specification.

My invention relates to means for pulverizing, feeding and burning fuel, and particularly to a means of this type in which the fuel is pulverized by a suitable mill and fed directly to a furnace or to a plurality of furnaces.

It is the principal object of my invention to provide a new and improved arrangement of parts for pulverizing fuel, conducting the fuel to a furnace through a pipe upon a stream of air, and then bringing back for delivery again to the pipe any surplus of fuel and air.

It is another object of my invention to provide a construction of this type in which the surplus fuel brought back is delivered in position to pass again through the feeding mechanism of the mill so as to be subject to regulation in the same manner as is the fresh fuel fed to the mill.

It is another object of my invention to provide a new and improved form and arrangement of regulation means for a pulverizing mill of the impact type, and still another object to improve pulverizing and feeding mechanism in sundry details hereinafter pointed out.

The preferred means by which I have accomplished my several objects are illustrated in the accompanying drawings and are hereinafter specifically described. That which I believe to be new and desire to cover by this application is set forth in the claims.

In the drawing

Fig. 1 is a side elevation of a pulverizing mill, shown more or less diagrammatically, and connected up with a series of furnaces so as to embody my improved construction.

Fig. 2 is a central vertical section through the mill of Fig. 1.

Figs. 3 and 4 are views similar to Fig. 1, but showing modified forms of constructions.

Referring now to Figs. 1 and 2, in which corresponding parts are indicated by the

same reference characters, 11, 12 and 13 indicate furnaces of any approved type to which pulverized fuel is carried, as hereinafter described, through pipes 14 branching from a main conduit 15, reductions being provided in the size of the conduit 15 at the points 16, 17 and 18 for forcing into the respective furnaces the desired portions of the fuel coming through the conduit 15. The rear end of the conduit 15 is connected with a fan-chamber 19 forming part of the pulverizing mill unit, the chamber 19 being connected with the beater chamber 20 of the mill, by means of a conical extension 21. A feeding chamber 22 communicates with the chamber 20, being provided with a hopper 23 to which fuel is delivered from any suitable source through a pipe 24. A collector 25, or separator, as it is sometimes called, is also located above the hopper 23, the device 25 being preferably of the cyclone collector type adapted to separate the pulverized material from the air of a stream delivered thereto through a pipe 26, and being adapted to deliver such pulverized material to the hopper 23 through a pipe 27, while the air is permitted to pass out through a pipe 28. An air inlet device 29 of any approved type is connected at a point above the collector 25 with the pipe 28 for admitting the desired amount of atmospheric air. The rear end of the pipe 26, in the construction shown, is connected with the forward end of the conduit 15 beyond the last one of the three furnaces shown, so as to carry back to the collector 25 the surplus air and fuel not entering the furnace 13.

Referring now particularly to Fig. 2 for a description of the pulverizing mill, 30 indicates a slide valve for regulating the admission of fuel from the hopper 23 to the feeding chamber 22. A pocketed feed wheel 31 is mounted upon a shaft 32 within the feeding chamber 22, means being provided as hereinafter described for rotating the feed wheel in clockwise direction in Fig. 2. For regulating the amount of material fed to the wheel 31, I have provided a flap 33 pivotally mounted adjacent to the wheel 31, the position of the flap being regulated by a rod or link 34 pivotally connected with the flap and held in adjusted position by a pin 35.

Within the beater chamber 20 I have pro-

vided a plurality of swing hammers or beaters 36 pivotally mounted upon a shaft 37 extending longitudinally through the mill and being supported by bearings 38.

5 The shaft 37 is connected by means of a coupling 39 of any suitable type, with the shaft 40 of an electric motor 41 for driving the shaft 37 at the desired high speed of rotation for carrying the beaters 36 about the
10 chamber 20, as is well understood in mills of this type.

Within the tapered extension 21 of the chamber 20 I have provided a regulating device comprising radially adjustable plates
15 42 carried around by the shaft 37 so as to cooperate with a tapered sleeve 43 for controlling the escape of the pulverized material from the chamber 20 to the fan chamber 19. Within the chamber 19, I have provided
20 a fan comprising blades 44 adapted to rotate with the shaft 37 and adapted, upon such rotation, to cause a current of air to pass upwardly through the conduit 15. The entrance of air into the mill is controlled
25 by a slide 45 adjacent to the fan chamber 19, and by a damper 46 in the pipe 28, the damper 46 being adapted to be adjusted toward and from a baffle plate 47 within the pipe 28.

30 For driving the feed wheel 31, I have provided a train of mechanism comprising a shaft 48, connected by means of a belt 49 and pulleys 50 and 51 with the shaft 37 for rotation thereby. A second shaft 52 is connected by means of a worm 53 and a worm
35 gear 54 with the shaft 48, so as to be driven by the shaft 48 at a greatly reduced speed of rotation. As is best shown in Fig. 1, the shaft 52 is provided with a plate 55 serving
40 as a crank head for reciprocating a link 56, which in turn is connected with a bell crank lever 57 carrying a pawl 58 in position to engage the teeth of a ratchet wheel 59 on the outer end of the shaft 32 for driving
45 the shaft in clockwise direction in Fig. 1 for giving the desired rotation to the feed wheel 31.

In operation, fuel to be pulverized is to be fed to the hopper 23, from which in turn
50 it is fed in measured quantities by the feed wheel 31 to the pulverizing chamber 20, the amount of fuel fed being dependent, of course, upon the rate of rotation of the shaft 32, as it is driven by the pawl or dog
55 58. With the fan 44 rotating at a high speed, a current of air is forced out through the conduit 15, serving to reduce the air pressure within the chamber 20 and consequently within the pipe 28 so as to cause a
60 current of air to flow downwardly through the pipe 28, a portion of such air being drawn from the collector 25, and the remainder being drawn in through the air entrance device 29. If it is deemed desirable,
65 additional air also may be admitted to the

fan chamber 19 at the slide plate 45. As is well understood in devices of this type, with a current of air being drawn through the mill and forced out through the conduit
15, and with the fuel being pulverized by 70 impact of the hammers or beaters 36, and also by the action of the regulating device 42, the stream of air passing upwardly through the conduit 15 carries with it by flotation thereon a quantity of the pulver- 75 ized fuel. The amount of pulverized fuel to be forced out through the conduit 15 is controlled by the regulation of the speed of the feed wheel 31, as is well understood in connection with devices of this character. 80

The stream of air and fuel passing outwardly through the conduit 15 is divided and a portion thereof forced downwardly through each of the pipes 14 in succession to one of the furnaces for consumption. The
85 surplus air and fuel is forced back to the mill through the pipe 26, the air and fuel being separated from each other within the collector 25, the fuel being delivered to the hopper 23 and the air being drawn back 90 into the mill through the pipe 28, as above described.

As is shown in Fig. 1, each of the pipes 14 is provided with a valve 60 of any suitable type so as to provide for the use of 95 one, two or three of the furnaces, as may be desired.

As will be readily understood, as the beater chamber 20 becomes filled more or less with partially pulverized fuel, the pas- 100 sage for the air through the chamber 20 becomes more or less restricted, with the result that the air pressure within the fan chamber 19 is reduced. To express the idea in a different manner, as the chamber 20 105 becomes filled with fuel, the force of the suction produced by the fan 44 within the fan chamber 19 and the extension 21 is increased.

In order to utilize this increase in the 110 force of suction within the fan chamber 19 for assisting in controlling the feed of material to the mill, I have connected a pipe 61 with the fan chamber 19 upon the suction side of the fan 44, the outer end of the
115 pipe 61 being connected with a casing 62, provided with a flexible diaphragm 63 which will be drawn upwardly by the force of the suction. A solenoid 64 is provided above the pawl 58, the core of the solenoid 120 being connected by a link 65 with the pawl 58 in such a manner that when the solenoid is energized the pawl 58 will be lifted out of engagement with the ratchet wheel 59. The solenoid 64 is connected by a circuit 66 125 with any suitable source of electrical energy, the circuit 66 comprising a switch 67 connected by means of a link 68 with the diaphragm 63. The arrangement is thus seen to be such that when the pressure within 130

the chamber 19 is sufficiently reduced for drawing the diaphragm 63 upwardly to such an extent as to cause a closure of the switch 67, the solenoid 64 is energized for drawing the pawl 58 upwardly for discontinuing the effective operation of the feed wheel 31. It is thus apparent that when the amount of fuel within the chamber 20 is abnormally increased, the regulating means comprising the diaphragm 63 and the solenoid 64 serves to prevent further feed of the fuel to the chamber 20 until the pressure within the chamber 19 is increased due to a reduction of the force of the suction within the chamber by reason of a partial clearing of the unpulverized fuel from the chamber 20.

The construction illustrated in Fig. 3 is similar to that above described, except that the separator or collector 25 is eliminated, and the surplus air and fuel from the conduit 15 are carried back by a pipe 69 directly to the mill, in the construction shown opening directly into the pipe 70 through which the air supply enters the beater chamber.

The construction of Fig. 4 differs from that shown in Fig. 1 in that the surplus air and fuel in this construction are conducted by a return pipe 71 directly to the fan chamber 19, the chamber 19 being provided with a side extension 72 for that purpose, the extension 72 being connected by means of a pipe 73 with the casing 62 for controlling the operation of the feeding mechanism.

While I prefer to use the construction as illustrated in the drawings, and as above described, it will be understood that I do not desire to limit myself to the use of the detailed forms of construction precisely as set forth, except so far as the same may be specifically claimed, inasmuch as it is evident that changes may well be made in the construction without departing from the spirit of my invention.

I claim:

1. A system of the class described, comprising a pulverizing mill, a conduit leading directly from the mill to a furnace for carrying pulverized fuel to the furnace by air flotation, means for conducting back to the mill the surplus air and fuel, and means controlled by the air pressure in the mill for regulating the feed of fuel to the mill.

2. A system of the class described comprising a chamber, pulverizing means in said chamber, means for feeding fuel to said chamber, a plurality of furnaces, a conduit leading from the chamber to said furnaces, means for creating a draft of air through the chamber and conduit for carrying the pulverized fuel from the chamber to the furnaces, cooperating means for conducting back to the mouth of the conduit the surplus air and fuel, and means con-

trolled by the air pressure in the chamber for regulating the feed of fuel to the chamber.

3. A system of the class described comprising a chamber, pulverizing means in said chamber, means for feeding a measured amount of fuel to said chamber, a furnace, a conduit leading from the chamber to said furnace, a fan in the chamber for creating a draft of air through the chamber and conduit, a continuation of said conduit leading from the furnace back to the feeding and measuring means for delivering thereto the surplus fuel, and means controlled by the air pressure in the chamber as reduced by the suction of said fan for regulating the operation of the feeding mechanism.

4. A system of the class described comprising a pulverizing mill, a furnace, a conduit leading directly from the mill to the furnace for carrying the pulverized fuel to the furnace by air flotation, and means for separating the surplus air and the surplus fuel coming from the conduit and delivering the same in separated condition to the mill.

5. A system of the class described, comprising a pulverizing mill, a furnace, a conduit leading directly from the mill to the furnace for carrying the pulverized fuel to the furnace by air flotation, a separator, means for conducting to the separator the surplus air and fuel from the conduit, and means for delivering the fuel from the separator to the mill.

6. A system of the class described, comprising a pulverizing mill, a furnace, a conduit leading directly from the mill to the furnace for carrying the pulverized fuel to the furnace by air flotation, a separator, means for conducting to the separator the surplus air and fuel from the conduit, means for delivering the fuel from the separator to the fuel entrance of the mill, and means for delivering the surplus air from the separator to the air entrance of the mill.

7. A system of the class described comprising a chamber, pulverizing means in said chamber, a hopper above said chamber, means for measuring and feeding fuel from said hopper to said chamber, a furnace, a conduit leading from the chamber to said furnace, a fan for creating a draft of air through said chamber and said conduit for delivering the pulverized fuel to the furnace, and means for separating the surplus air and fuel coming from the conduit and delivering the fuel to the hopper and the air to the chamber.

8. A system of the class described comprising a chamber, pulverizing means in said chamber, a hopper above said chamber, means for measuring and feeding fuel from said hopper to said chamber, a fur-

nace, a conduit leading from the chamber to said furnace, a fan for creating a draft of air through said chamber and said conduit for delivering the pulverized fuel to the furnace, a separator, means for conducting to the separator the surplus air and fuel from the conduit, means for delivering the fuel from the separator to the hopper, and means for delivering the air from the separator to the chamber.

9. A system of the class described, comprising a chamber, means for feeding fuel to said chamber, means adapted by impact to pulverize the fuel in said chamber, means for creating a draft of air through said chamber for delivering the pulverized fuel by air flotation therefrom, and means controlled by the air pressure in said chamber for regulating the feeding of the fuel through the chamber.

10. A system of the class described, comprising a chamber, means for feeding fuel to said chamber, means adapted by impact to pulverize the fuel in said chamber, a fan adapted by suction to cause a current of air to flow through the chamber for delivering the pulverized fuel therefrom, and means controlled by the air pressure as reduced by the suction of the fan for regulating the operation of the feeding means.

11. A system of the class described, comprising a chamber, means for feeding fuel

to said chamber, means adapted by impact to pulverize the fuel in said chamber, a fan in an extension of the chamber adapted by suction to cause a current of air to flow through the chamber for delivering the pulverized fuel therefrom and adapted to increase the force of the suction in the chamber when the amount of unpulverized fuel in the chamber is increased, and means controlled by the increased force of the suction in the chamber to reduce the amount of fuel fed to the chamber.

12. A system of the class described, comprising a chamber, means for feeding fuel to said chamber, means adapted by impact to pulverize the fuel in said chamber, a fan adapted by suction to cause a current of air to flow through the chamber for delivering the pulverized fuel therefrom and adapted to increase the force of the suction in the chamber when the amount of unpulverized fuel in the chamber is increased, a pressure controlled device connected with said chamber so as to be actuated by the air pressure in the chamber, an electric switch operated by said device, a solenoid, a circuit comprising said switch connecting said solenoid with a source of electrical energy, and means controlled by the solenoid for regulating the operation of the feeding means.

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