

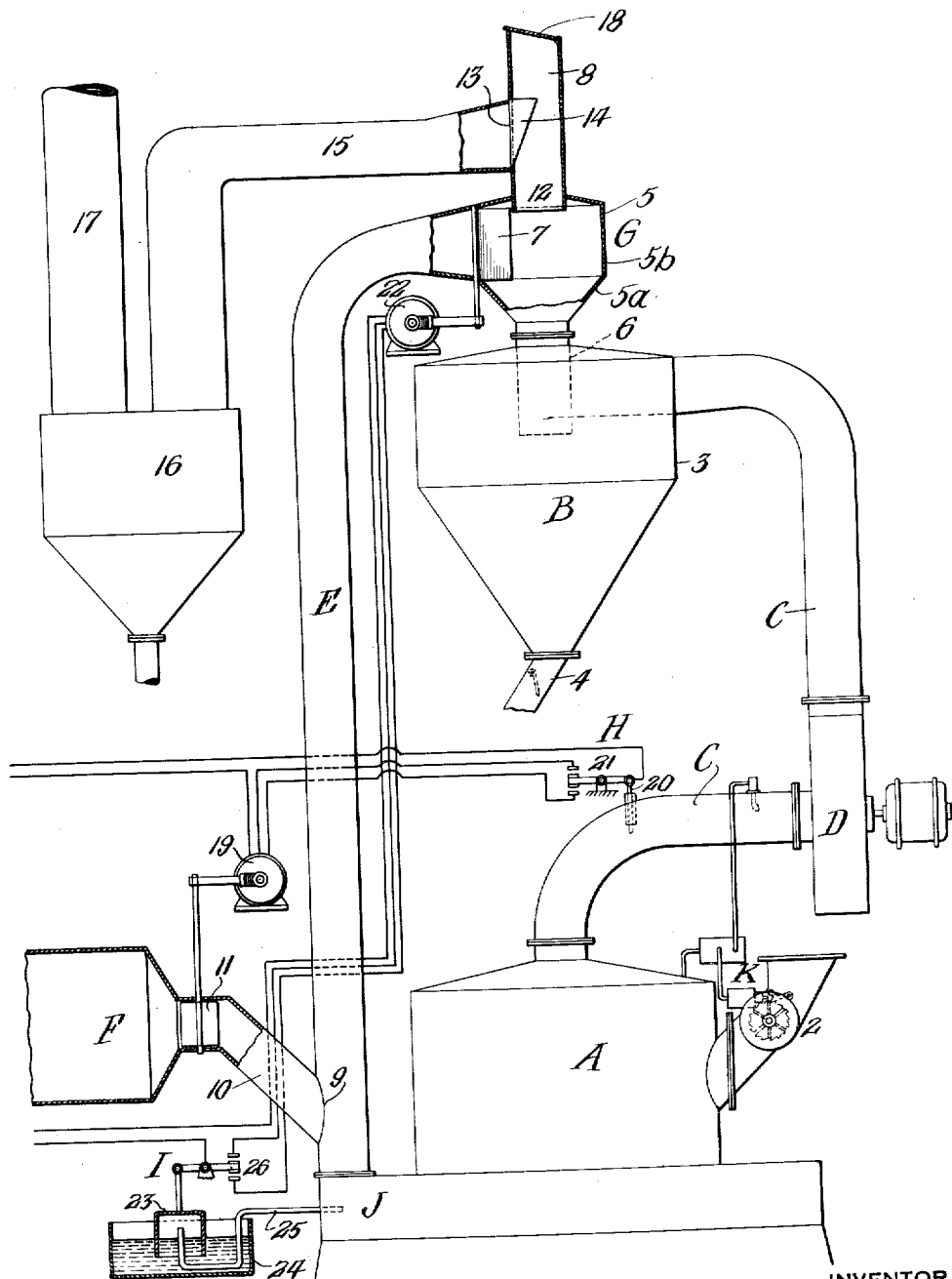
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FUEL PREPARING AND HANDLING SYSTEM

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FUEL PREPARING AND HANDLING SYSTEM

Application filed January 23, 1929. Serial No. 334,590.

This invention relates to fuel preparing and handling systems and is particularly useful in the preparation and handling of coal to be burned in suspension.

5 More specifically the invention is useful in fuel preparing and handling systems into which heat is introduced to dry the fuel.

One of the primary objects of the invention is the provision of a system in which 10 the moisture in the fuel is reduced to a predetermined percentage of the moisture carried into the system.

A more specific object of the invention is to automatically control the admission of 15 heat into the system.

Another object of the invention is to automatically control the pressure in the system.

A further object of the invention is to provide a fuel preparing and handling system 20 employing heat to dry the fuel in the system in which the pressure and temperature are controlled in a manner so that substantially constant predetermined pressures and temperatures are maintained.

25 How the foregoing, together with such other objects and advantages as may hereinafter appear, or are incident to the invention, are realized, is illustrated in preferred form in the accompanying drawing, 30 wherein:

The figure is a more or less diagrammatic layout of a fuel preparing and handling system embodying the invention.

35 The system comprises, in general, a pulverizer mill A, a separator device B, a delivery line C leading from the mill to the separator device, a blower D located in the line C, a return line E leading from the separator device to the mill, and means F for 40 supplying heat to the system.

A feeder 2 is provided for introducing the material to be pulverized into the mill and when the system is to be used in connection 45 with pulverized coal burning installations, the material would be raw coal drawn from a suitable source of supply such as a bunker or bin.

50 The coal pulverized in the mill is carried to the separator device B through the line C, by a current of gas set up by the blower

D. The separator device includes a cyclone chamber 3 into which the mixture from the mill is tangentially delivered and in which the coal and gas are separated, the coal discharging through a check valve controlled 55 outlet 4 preferably to a bin or conveyor and the gas passing to the return line E.

In this instance an auxiliary cyclone separator G is provided which comprises a chamber 5, a neck 6 extending into the separator 60 3, an adjustable damper or vane 7 controlling the flow from the auxiliary cyclone into the return line, and a vent pipe 8. The damper or vane 7 is preferably curved with a curvature the same as the cylindrical surface 65 of the chamber 5.

The return line E discharges into the lower portion of the mill A. Adjacent the point where the return air enters the mill a hot 70 air or gas inlet 9 is provided in the return line through which inlet heat is introduced into the system. In this instance the heat is provided by means of an air heater F which may be of any suitable type. A pipe 75 10 connects the air heater with the return line, and in order to control the amount of heat introduced into the system an adjustable damper 11 is provided, which damper 80 may be located at any suitable point between the heater and the return line.

85 The air which leaves the main cyclone chamber 3 carries with it a certain amount of fine dust, and as this air and dust is rotating, due to the action of the cyclone, there is a tendency for dust to concentrate 90 toward the wall of the neck. In its upward movement the dust slips along the lower conical surface 5a of the chamber 5 and finally rotates on the cylindrical surface 5b of the chamber 5 and discharges into the 95 return line E through the damper controlled return line inlet. The damper 7 may be adjusted to let any amount of the air return to the mill and thus the pressure within the system may be controlled. It is pointed out 100 that when the damper 7 is partly open it will scrape off, so to speak, from the rotating air the part which has the highest concentration of dust and will return it through the return pipe to the mill. 105

Comparatively clean air leaves the auxiliary cyclone G through the upper central outlet 12 and enters the vent pipe or cylindrical duct 8. The duct 8 is provided with a side outlet 13 in which is located a vane 14 preferably triangular in shape adapted to guide the rotating gas into a duct or line 15. This line 15 is shown as leading to an air washer 16 where remaining dust may be removed from the air prior to its discharge, for example, discharge through a stack 17. The vane 14 changes the rotation of the gases into a straight line motion so that most of the energy in the rotation of the gas is converted into static pressure in the duct 15. While the duct 15 is described as leading to an air washer, it is to be understood that it is contemplated to lead it to a primary air blower or an air filter.

It is preferable to extend the cylindrical duct 8 through the roof of the building and to provide it with a suitable relief valve as indicated diagrammatically at 18. Thus a puff vent is provided which, owing to its location in a direct line with the axis of the main and auxiliary cyclone separators, is very advantageous because any pressure suddenly developed in the main cyclone is relieved by the straight line vent. The damper 7 and the vane 14 only expose their edges to the gases to be relieved through the vent and, therefore, they are no obstruction in the venting of gases in case of a puff.

From the above it will be seen that the air with the highest concentration of dust is returned to the mill, while the air with the least concentration of dust is sent to the air washers, filters, primary air fans, or the like. It is obvious, therefore, that very little dust escapes from the system. The device also converts rotary motion into straight line motion in the two outlets so that very little energy in the rotating air is wasted.

Reverting now to the damper 7 for controlling the flow through the return line and to the damper 11 for controlling the admission of heat into the system, it will be seen from the following that they are controlled in a manner to automatically regulate the temperature and pressure in the system so that a predetermined nearly constant temperature and also constant pressure are maintained.

The constant temperature is maintained by means of a device H which controls the operation of a motor 19 or the like, which motor is connected to the damper 11 to move it to opening or closing positions, the connection in this instance being a worm drive.

The device H includes a thermostat 20 located in that portion of the delivery line C where the mixture of coal and air from the mill enters it. The thermostat operates a switch device 21 for controlling the supply of electric current to the motor 19, which

switch device, as diagrammatically shown, comprises a pivoted arm connected to the thermostat 20 having a central position in which it is out of contact with an upper and a lower contact, a position in which it contacts with the upper contact and a position in which it contacts with the lower contact. In the central position of the switch no current is supplied to the motor, in its upper position, i. e., the position in which contact is made with the upper contact, current is supplied to the motor to rotate it in one direction and in its lower position current is supplied to rotate the motor in the opposite direction.

Assuming now, that the temperature of the mixture is too low, the thermostat 20 will move the lever to close the circuit which will operate the motor in a direction to open the damper more widely to admit more heated air from the air heater F. Should the temperature be too high the thermostat will move the lever to close the other circuit, thus causing the motor to rotate in a direction to move the damper towards its closed position, thus admitting less heated air. When the mixture leaving the mill arrives at the desired temperature, the switch will assume its neutral position. Instead of controlling the temperature by means of damper control, it may be controlled by regulating the speed of a blower adapted to push air through the air heater F.

As the admission of more or less heated air into the system changes the pressure of the mixture returning to the mill and also the pressure of the heated air introduced for drying purposes, it is proposed to control the pressure in the following manner so that constant pressure will be maintained.

The volume of air returning to the mill is controlled by the damper 7 which is automatically regulated by a pressure regulating device I adapted to control the operation of a motor 22 connected to the damper as by means of a worm drive.

The device I comprises a bell 23 floating in a liquid in the vessel 24, a tube 25 establishing communication between the inside of the bell and the mill at a point where the mixture of heated air and the returning air enters the mill, and a switch device 26 for controlling the supply of electric current to the motor 22. The switch device comprises a pivoted arm connected to the bell 23 having a central position in which it is out of contact with an upper and a lower contact, a position in which it contacts with the upper contact and a position in which it contacts with the lower contact. In the central position of the switch no current is supplied to the motor, in its upper position, i. e., the position in which contact is made with the upper contact, current is supplied to the motor to operate it in a direction to open

the damper 7, and in its lower position current is supplied to the motor to operate it in the opposite direction, thus moving the damper toward closed position.

5 For example, if the pressure at J is too low the bell 23 will drop, because of the low pressure inside thereof, and the lever arm of the switch device will be brought in contact with the upper contact which closes a
10 circuit to operate the motor in the direction for opening the damper, thus allowing a larger volume of air to return to the mill. On the other hand, if the pressure is too high, the bell 23 will be raised due to the
15 increase in pressure inside thereof and the lever arm of the switch device will be brought in contact with the lower contact which closes the other circuit of the motor and operates it in the opposite direction,
20 thus moving the damper toward closed position and reducing the volume of air returning to the mill, with consequent reduction in pressure.

The coal feeder 2 above referred to may
25 also be automatically controlled as by means of a suitable regulator device K, for example, such as disclosed in the patent to F. I. Raymond, No. 1,541,848, dated June 16, 1925. This device regulates the introduction
30 of material into the mill in response to fluctuations in the vacuum therein so that in case the mill becomes overloaded or tends to become overloaded, the feed will be interrupted or diminished in quantity; in the
35 first instance, to allow the mill to clear, and, in the second place, to counteract the tendency to overload and thereby maintain proper balance between feed and discharge.

From the foregoing it will be seen that
40 the system in one sense is a closed one in that there is a circulation of air to and from the mill back to the mill. There is, however, a continuous admission of hot air or gas into the circuit and a continuous exhaust of air
45 or gas from the circuit, the quantities of the latter two being determined by the automatic control features described. It will be seen that the system is thus caused to operate under the most favorable predetermined
50 conditions.

No specific claim is made herein to the particular separator construction and arrangement disclosed, as claims directed thereto have been made part of the subject
55 matter of my co-pending applications, Serial Numbers 334,591 filed January 23, 1929, 334,592 filed January 23, 1929, 519,798 filed March 3, 1931.

I claim:

60 1. In a fuel preparing and handling system, the combination of a pulverizer mill, separator means, a delivery line from the mill to the separating means, a return line from the separating means to the mill,
65 means for setting up an air current in the

system, means for introducing heat into the system, means for controlling the introduction of the heat, means responsive to the temperature in the system for effecting such control and thereby maintaining a predetermined
70 temperature in the system and means responsive to the pressure in the system for maintaining a predetermined pressure in the system.

2. In a fuel preparing and handling system, the combination of a pulverizer mill, separator means, a delivery line from the mill to the separating means, a return line from the separating means to the mill,
75 means for setting up an air current in the system, means for introducing heat into the system, a damper controlling the flow through the return line, a damper controlling the introduction of heat into the system,
80 means for operating the first mentioned damper, means for operating the second mentioned damper, a thermostat subject to heat in the system, means operated by said thermostat for controlling the operation of
85 the second mentioned damper operating means, and a pressure operated device for controlling the operation of the first mentioned damper operating means, said device receiving its operating pressure from the
90 system.

3. Fuel preparing and handling apparatus comprising, in combination, a pulverizer mill, separating means, a delivery line from the mill to the separating means,
95 a blower in said line, a return line from the separating means to the mill, a damper controlled inlet for admitting hot air to the mill, damper means for controlling flow through the return line, means for controlling the hot air inlet damper by the temperature in the system, and means for controlling the return line damper by the pressure
100 in the system.

4. Fuel preparing and handling apparatus comprising, in combination, a pulverizer mill, separating means, a delivery line from the mill to the separating means, a blower in said line, a return line from the separating means to the mill, a damper controlled inlet for admitting hot air to the mill,
105 damper means for controlling flow through the return line, thermostatically controlled means for controlling the hot air inlet damper, and pressure controlled means for controlling the return line damper.
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5. In a fuel preparing and handling system, the combination of a pulverizer mill, separator means, a delivery line from the mill to the separating means, a return line from the separating means to the mill,
115 means for setting up an air current in the system, means for introducing heat into the system, and means for controlling the temperature and pressure in the system including thermostatically controlled means for
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controlling the introduction of heat into the system and pressure controlled means for controlling the air current in the system.

6. In a fuel preparing and handling system, the combination of a pulverizer mill, separator means, a delivery line from the mill to the separating means, a return line from the separating means to the mill, means for setting up an air current in the system, means for introducing heat into the system, and means for maintaining a predetermined temperature in the system including a thermostat subject to heat in the system, a damper controlling the admission of heat into the system, motor means for operating said damper, switch means for controlling the motor operated by the thermostat, said switch means having a position to cause operation of the motor to move the damper in a closing direction and having a position to cause operation of the motor to move the damper in an opening direction, and an operative connection between the switch means and the thermostat whereby the switch means is moved to the first mentioned position when the temperature in the system tends to exceed the predetermined temperature desired, and whereby the switch means is moved to the second mentioned position when the temperature in the system tends to fall below the predetermined temperature desired.

7. In a fuel preparing and handling system, the combination of a pulverizer mill, separating means, a delivering line from the mill to the separating means, a return line from the separating means to the mill, means for setting up an air current in the system, a hot air inlet for the system, an air heater device associated with said inlet for introducing heated air into the system, a damper controlling said inlet, a motor for operating said damper, a switch for controlling said motor, a thermostat controlling said switch, said thermostat being located in the system at the delivery side of the mill, a damper controlling the flow through the return line, a motor controlling said last mentioned damper, a switch for controlling said last mentioned motor, and a pressure operated device for controlling said last mentioned switch, said pressure device receiving its pressure from the system at the air intake side of the mill.

8. In a fuel preparing and handling system, the combination of a pulverizer mill, separating means, a delivering line from the mill to the separating means, a return line from the separating means to the mill, means for setting up an air current in the system, a hot air inlet for the system, an air heater device for introducing heated air into the system, an air outlet for the system, an air washer associated with said outlet, means responsive to the temperature in the

system, for controlling the introduction of heat by the air heater device, means for regulating the pressure in the system and means responsive to the pressure in the system for controlling said pressure regulating means.

9. In a fuel preparing and handling system, the combination of a pulverizer mill, separator means, a delivery line for the mill to the separating means, a return line from the separating means to the mill, means for setting up an air current in the system, means for feeding material to the mill, means for controlling the same operated by the current in the system, means for controlling the introduction of the heat, means for introducing heat into the system, means responsive to the temperature in the system for effecting such control and thereby maintaining a predetermined temperature in the system and means responsive to the pressure in the system for maintaining a predetermined pressure in the system.

10. In a fuel preparing and handling system, the combination of a pulverizer mill; separator means; a delivery line from the mill to the separating means; a return line from the separating means to the mill; means for setting up an air current in the system; means for introducing hot gases into the system at the return side thereof; means for controlling the admission of the hot gases into the system including thermostat operated damper means, the thermostat of which is located in the delivery side of the system and adjacent the mill; a vent for the system; and means for controlling the pressure in the system including damper means controlling the flow through the return line, and a pressure actuated device for operating said damper means located to receive its pressure from the mill of the system.

11. In a fuel preparing and handling system, the combination of a pulverizer mill having a return air inlet and an outlet for the fuel and air being handled; a delivery line from the mill outlet to the separating means; a return line from the separating means to the mill inlet, said return line having an inlet for hot air adjacent its point of connection to the mill inlet; means for introducing hot air into the system through said hot air inlet; means for setting up an air current in the system; a damper for controlling flow through the return line; a damper for controlling flow of hot air into the system; motor means for operating the first mentioned damper, motor means for operating the second mentioned damper; a pressure operated device for controlling the motor means of the first damper, said device being responsive to pressure conditions at the milling section of

the system; and a thermostat operated device for controlling the motor means of the second damper, the thermostat of said device being located in the delivery line of the system adjacent the mill outlet.

6 In testimony whereof I have hereunto signed my name.

HENRY KREISINGER.

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CERTIFICATE OF CORRECTION.

Patent No. 1,814,560.

Granted July 14, 1931, to

HENRY KREISINGER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, line 74, claim 9, for the word "for" read from; same page and claim, lines 80 to 82, strike out the words "controlling the introduction of the heat, means for introducing heat into the system" and insert instead means for introducing heat into the system, means for controlling the introduction of the heat; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of September, A. D. 1931.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.

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