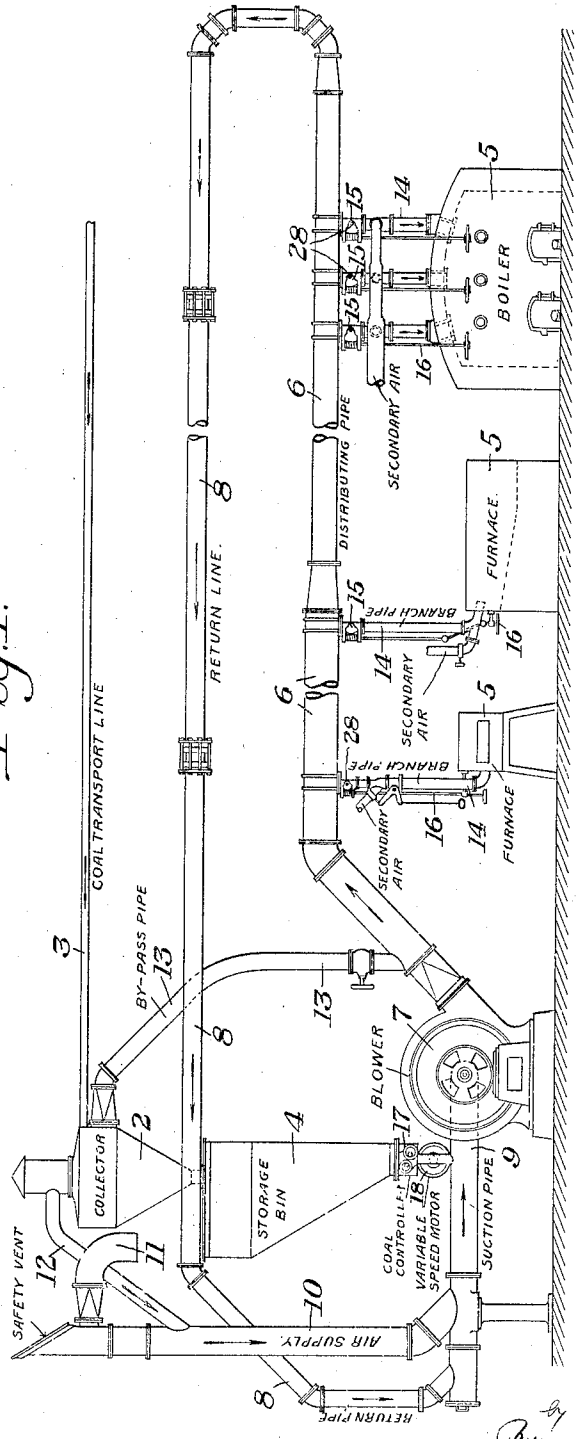
Sept. 25, 1923. 1,468,966

C. F. HERINGTON

PULVERIZED FUEL FEEDING AND DISTRIBUTING APPARATUS

Filed Sept. 14, 1922 2 Sheets-Sheet 1

Fig. 1.



INVENTOR

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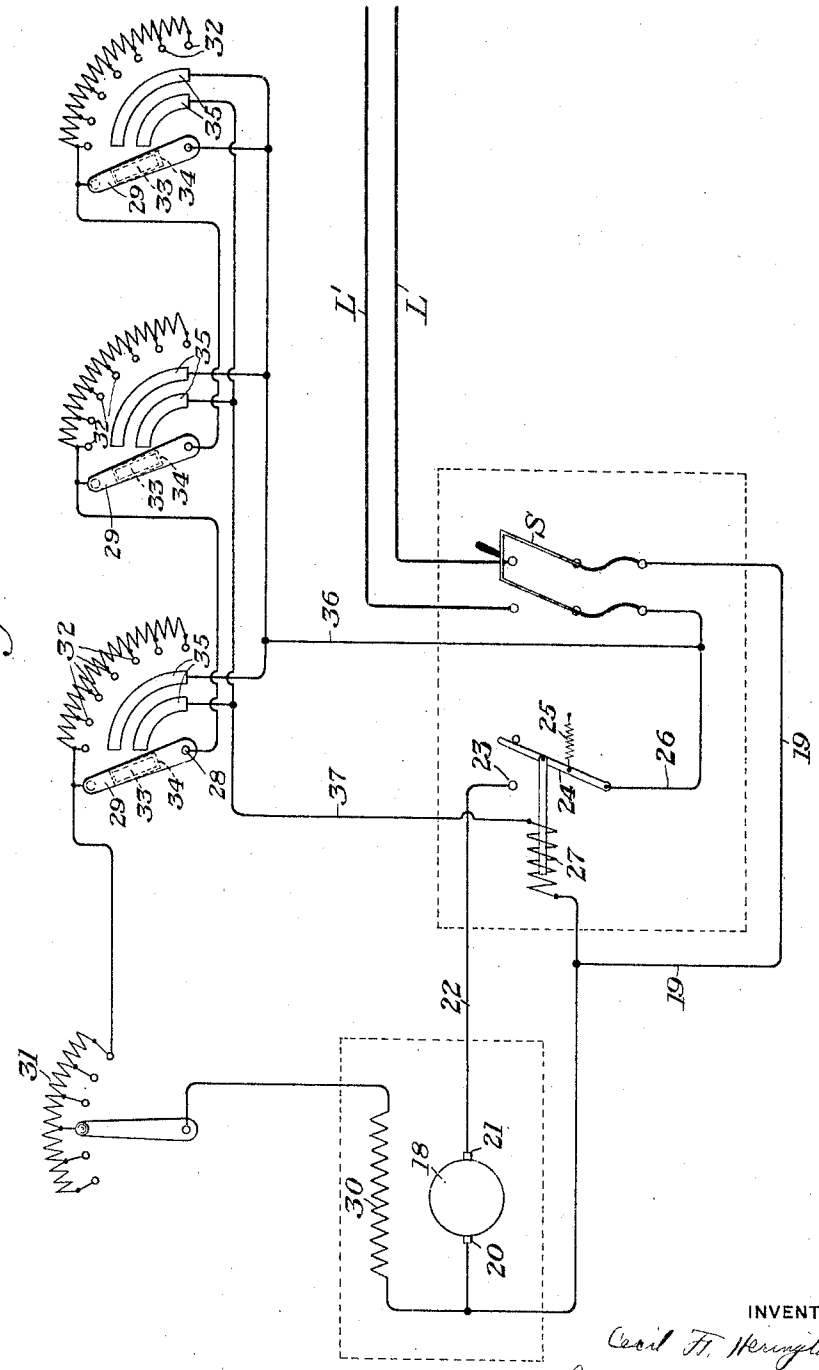
Fig. 2.



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UNITED STATES PATENT OFFICE.

CECIL F. HERINGTON, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO HEYL & PATTERSON, INC., OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

PULVERIZED-FUEL FEEDING AND DISTRIBUTING APPARATUS.

Application filed September 14, 1922. Serial No. 588,217.

To all whom it may concern:

Be it known that I, CECIL F. HERINGTON, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Pulverized-Fuel Feeding and Distributing Apparatus, of which the following is a full, clear, and exact description.

The present invention relates broadly to pulverized fuel handling systems, and more particularly to means for effecting with such systems a fuel feed regulated in accordance with demands upon the system.

It has heretofore been proposed to provide systems of this character having a main circulating or distributing and return line adapted to supply a plurality of different fuel-consuming devices with a mixture of pulverized fuel and air. In certain of these systems there has been provided means dependent upon variations in the density of the fluid and fuel within such line for effecting a regulation of the amount fuel fed to the line whereby the feed is proportional to the demands upon the system. This has been accomplished in some cases by the use of a body of water and a float, changes in the density within the line producing changes in the water level which were in turn transmitted by the float to an electric controller of suitable construction. Such systems have been objectionable not only by reason of the lack of positive control, but also on account of the length of time frequently required to effect the desired change and upon the sucking into the system of water or moisture vapor.

By the present invention these objections are entirely obviated and there is provided a pulverized fuel handling system in which an immediate and positive control of the fuel feed is easily and accurately obtained in accordance with the demands upon the system.

In the accompanying drawings there is shown more or less diagrammatically, and for purposes of illustration only, one embodiment of the present invention, it being understood that the drawings do not define the limits of this invention and that changes may be made in the construction and operation disclosed therein without departing from the spirit or scope of my broader claims.

In the drawings,—

Figure 1 is a diagrammatic view illustrating one form of pulverized fuel handling system; and

Figure 2 is a diagrammatic view illustrating the electrical connections for controlling the fuel feed.

In systems of this nature it is desirable during operation to maintain substantially constant velocity of air for propelling the pulverized fuel. This is necessary in order to maintain the fuel in suspension. Ordinarily this is accomplished by providing a fan or blower having the desired characteristics. It is also advantageous to effect a positive regulation of the fuel fed to the system whereby the amount of fuel will vary as the number or capacity of the fuel-consuming devices varies.

Referring more particularly to Figure 1 of the drawings there is illustrated one embodiment of the present invention. This may comprise a collector 2 of suitable construction supplied with pulverized fuel through a coal transport line 3 as is customary in the art. The collector 2 has its outlet operatively connected with a storage bin 4 for supplying the same with the necessary quantity of pulverized fuel.

Located at any desired point with respect to the storage bin 4 are a plurality of fuel-consuming devices 5. It will be obvious that the character, number and arrangement of these devices may vary considerably and the term is used as definitive of any type of burner, boiler, furnace or the like adapted to be supplied with pulverized fuel. For delivering the fuel to the fuel-consuming devices there is provided a distributing pipe 6 which is operatively connected at one end directly to the outlet of a suitable blower 7. At its opposite end it is connected by a return line 8 with the suction pipe 9 leading to the suction side of the blower. The blower may be operated in any desired manner to maintain a constant circulation of air at a definite velocity within the distributing pie. The necessary air may be supplied to the system to meet the demands thereupon through a supply pipe 10 having a goose neck 11 open to the atmosphere and an auxiliary connection 12 leading to the upper part of the collector 2 for withdrawing dust-laden air therefrom.

In order to keep from overloading the system with pulverized fuel, fed thereto as pointed out in detail hereinafter, under certain conditions of operation, there is provided a by-pass pipe 13 leading from the distributing pipe to the collector. This by-pass pipe may be opened to permit a continuous circulation therethrough.

Directly connecting each of the fuel-consuming devices with the distributing pipe is a branch pipe 14, each of which may have a supply of secondary air. The passage through each of the branch pipes may be controlled by a valve 15 adapted to be opened and closed through a suitable operating mechanism 16 located adjacent the fuel-consuming devices. When it is not desired to operate certain of the fuel-consuming devices, the valves 15 are moved to closed position. If all of the valves 15 are closed it will be obvious that it is unnecessary to feed fuel to the distributing pipe, while if all of the valves 15 are open it will be necessary to feed the maximum amount of fuel to the system

For effecting the fuel feed, the outlet from the storage bin 4 to the suction pipe 9 is provided with a coal controller 17 of well known construction, such for example as illustrated in the patent to Covert 1,197,799 of September 12th, 1916, and comprising two screw feeders combined in such a way that neither can feed independently of the other and that when at rest each seals the other against the passage of any material.

The operation of the screw feeders is adapted to be effected by a variable speed motor 18, as illustrated diagrammatically in Figure 2. This motor is adapted to receive current from the supply line L through one blade of the main switch S and thence through a connection 19 and brush 20. The other brush 21 has a connection 22 with the contact 23 of a suitable contactor switch 24. This switch is normally held in open position by any suitable means, such as a spring 25, and is connected through the wire 26 and the other blade of the switch S with the line wire L'.

The contactor switch 24 is adapted to be moved to closed position by a solenoid 27, the solenoid being energized by the movement of any one of the valves 15 from closed to open position. This operation may be obtained by securing to the pin 28 of each of the valves 15 a contact lever 29. The contact levers 29 for all of the valves are connected in series with each other by suitable connections as illustrated, with the field 30 of the variable speed motor through an adjustable resistance 31 and with the contactor switch 24. When the valves 15 are in closed position the levers 29 are in the position illustrated whereby when the contactor switch 24 is closed there will be a full field on the variable speed motor. With this field the motor will have its minimum speed while as the resistance in series with the field is increased the motor will attain higher speeds. With all of the valves 15 in closed position, the contactor switch 24 will be in open position, whereby no fuel will be fed to the distributing pipe. If, however, one of the valves 15 is moved toward open position, the corresponding contact lever 29 will be moved from the position illustrated in Figure 2 to a position where it will engage one of the contacts 32 of the cooperating resistance units. This will throw increased resistance into the field circuit, the amount of the resistance increasing in proportion as the valve is opened. At the same time, the contact lever 29 so moved will close the circuit to the solenoid 27 by reason of the provision thereon of a conductor 33 carried by an insulating base 34. This conductor 33 will be brought into contact with segmental conductors 35, one of which has an electrical connection 36 with the line wire L', while the other has an electrical connection 37 with one side of the solenoid 27 and thence through the connection 19 to the line wire L. As the segmental conductors 35 of each of the switches are connected in parallel with the corresponding conductors of the other switches, it will be apparent that movement of any of the valves 15 toward open position will close the contactor switch 24 and will throw into series with the field an amount of resistance proportional to the opening movement of the valve. As each additional valve is opened, additional resistance will be thrown into series with the field of the variable speed motor and the speed of rotation thereof will be correspondingly increased. This in turn will increase the speed of rotation of the screw feeders in such manner that an additional amount of fuel will be fed from the storage bin 4 into the distributing pipe.

It will be apparent that with a system of this chacter the total amount of resistance in all of the valve regulators when added together will be such as to give the maximum speed desired from the variable speed motor. In this manner the variable speed motor may be caused to rotate from minimum speed to maximum speed in accordance with the position of the valves 15 for thereby feeding an amount of fuel which is exactly proportional to the demands upon the system as determined by the operation of the fuel-consuming devices. This effects a positive control of the variable speed motor, the change in speed occurring concomitantly with the change in the position of the valve or valves, thereby effecting an immediate change in the fuel feed.

In placing a system of this character in

operation, the valves 15 will normally all be in closed position. There will, therefore, be no fuel required in the distributing pipe. The blower 7, however, will be started to produce the desired circulation of air, so that upon the opening of any valve 15 the fuel fed by the controller 17 will be carried in suspension. As additional fuel-consuming devices are placed in operation, additional air required to satisfy the demands of the blower will be sucked in through the air supply pipe 10 and combine with the air and fuel returning through the return line 8.

The provision of the independent field rheostat 31 enables the speed of the variable speed motor 18 to be varied within certain limits irrespective of the positions of the contact levers 29, to thereby more accurately proportion the amount of fuel to the air.

I claim:

1. In a fuel handling system, a distributing pipe, a branch pipe fed therefrom, mechanism for supplying fuel to said distributing pipe proportional to the demands on the system, movable means in said branch pipe for varying the demands upon said system, and means automatically operable with said movable means irrespective of the pressure in the system for varying the amount of fuel fed by said mechanism, substantially as described.

2. In a fuel handling system, a distributing pipe, a branch pipe fed therefrom, mechanism for supplying fuel to said distributing pipe proportional to the demands on the system, movable means in said branch pipe for varying the demands upon said system, means operable with said movable means irrespective of the pressure in the system for varying the amount of fuel fed by said mechanism, and means operable upon movement of said movable means in one direction for rendering said mechanism operative, substantially as described.

3. In a fuel handling system, a distributing pipe, a branch pipe fed therefrom, mechanism for supplying fuel to said distributing pipe proportional to the demands on the system, movable means in said branch pipe for varying the demands upon said system, means operable with said movable means irrespective of the pressure in the system for varying the amount of fuel fed by said mechanism, and means operable upon movement of said movable means in one direction for rendering said mechanism inoperative, substantially as described.

4. In a fuel handling system, a distributing pipe, a branch pipe fed therefrom, mechanism for supplying fuel to said distributing pipe proportional to the demands on the system, movable means in said branch pipe for varying the demands upon said system, means operable with said movable means irrespective of the pressure in the system for varying the amount of fuel fed by said mechanism, and means operable upon movement of said movable means for rendering said mechanism operative or inoperative, substantially as described.

5. In a fuel handling system, a distributing pipe, a branch pipe fed therefrom, a normally inoperative mechanism effective when operative for supplying fuel to said distributing pipe, movable means controlling the passage of fuel through the branch pipe, and actuating connections between said mechanism and the movable means for rendering said mechanism operative upon movement of the movable means to permit passage of fuel through said branch pipe, substantially as described.

6. In a fuel handling system, a distributing pipe, a branch pipe fed therefrom, a normally inoperative mechanism effective when operative for supplying fuel to said distributing pipe, movable means controlling the passage of fuel through the branch pipe, actuating connections between said mechanism and the movable means for rendering said mechanism operative upon movement of the movable means to permit passage of fuel through said branch pipe, and means for varying the amount of fuel fed by said mechanism in accordance with the position of said movable means, substantially as described.

7. In a fuel handling system, a distributing pipe, a branch pipe fed therefrom, mechanism for supplying fuel to said distributing pipe, movable means controlling the passage of fuel through the branch pipe, and means electrically connecting said movable means with said mechanism for varying the supply of fuel in accordance with the movement of said movable means, substantially as described.

8. In a fuel handling system, a distributing pipe, a branch pipe fed therefrom, a normally inoperative mechanism effective when operative for supplying fuel to said distributing pipe, movable means controlling the passage of fuel through the branch pipe, means electrically connecting said movable means with said mechanism for rendering the same operative concomitantly with the movement of said movable means, and means electrically connecting said movable means and said mechanism for rendering the mechanism operative to feed an amount of fuel proportional to the movement of the movable means, substantially as described.

9. In a fuel handling system, a distributing pipe, a branch pipe fed therefrom, mechanism for feeding fuel to the distributing pipe, a variable speed motor for operating said mechanism, a valve controlling the flow of fuel through the branch pipe, and a resistance regulator directly operated by said valve for controlling the speed of rotation

of the variable speed motor, substantially as described.

10. In a fuel handling system, a distributing pipe, a branch pipe fed therefrom, mechanism for feeding fuel to the distributing pipe, a variable speed motor for operating said mechanism, a valve controlling the flow of fuel through the branch pipe, a resistance regulator directly operated by said valve for controlling the speed of rotation of the variable speed motor, and means for rendering said motor operative automatically upon movement of the valve from closed position, substantially as described.

11. In a pulverized fuel handling system, a distributing pipe, a plurality of branch pipes adapted to be supplied thereby, mechanism effective for feeding fuel to the distributing pipe, independently movable means controlling the passage of fuel through each of said branch pipes, and means operatively connecting each of said means and said mechanism for varying the amount of fuel fed by said mechanism in accordance with the demands upon the system, substantially as described.

12. In a pulverized fuel handling system, a distributing pipe, a plurality of branch pipes adapted to be supplied thereby, mechanism effective for feeding fuel to the distributing pipe, independently movable means controlling the passage of fuel through each of said branch pipes, and means electrically connecting each of said means and said mechanism for varying the amount of fuel fed by said mechanism in accordance with the demands upon the system, substantially as described.

13. In a pulverized fuel handling system, a distributing pipe, a plurality of branch pipes adapted to be supplied thereby, mechanism effective for feeding fuel to the distributing pipe, independently movable means controlling the passage of fuel through each of said branch pipes, and means automatically operable with the movement of any of said movable means irrespective of the pressure in the system for varying the amount of fuel fed by said mechanism, substantially as described.

14. In a pulverized fuel handling system, a distributing line, a plurality of fuel-consuming devices fed thereby, independently movable means controlling the supply of fuel to each of said devices, a circulating blower, a fuel feeding mechanism, and means operatively connecting each of said independently movable means with said mechanism for varying the fuel fed by said mechanism in accordance with the fuel consumed by said devices, substantially as described.

15. In a pulverized fuel handling system, a distributing line, a plurality of fuel-consuming devices fed thereby, independently movable means controlling the supply of fuel to each of said devices, a circulating blower, a fuel feeding mechanism, means operatively connecting each of said independently movable means with said mechanism for varying the fuel fed by said mechanism in accordance with the fuel consumed by said devices, and means for independently controlling the amount of fuel fed by said mechanism, substantially as described.

16. In a pulverized fuel handling system, an endless circulating line, a branch pipe fed therefrom, mechanism for supplying pulverized fuel to said line proportional to the demands upon the system, movable means in said branch pipe for varying the demands upon the system, and means directly controlled by said movable means for varying the amount of fuel fed by said mechanism, substantially as described.

17. In a pulverized fuel handling system, an endless circulating line, a branch pipe fed therefrom, a normally inoperative mechanism effective when operative for supplying pulverized fuel to said line, movable means controlling the passage of fuel through the branch pipe, and means connecting said mechanism and movable means for rendering said mechanism operative upon movement of the movable means to permit passage of fuel through said branch pipe, substantially as described.

18. A fuel feeding system having a continuous circuit through which fuel and air are circulated, a delivery pipe leading from said circuit, valve means for varying the delivery of air and fuel through the delivery pipe, means for causing the air and fuel to circulate at substantially a constant velocity through the circuit, means for admitting air to the circuit to compensate for the air passing through the delivery pipe, means for feeding fuel to said circuit, and control means connected to the valve means for varying the fuel feed in accordance with variations in the valve means, substantially as described.

19. A fuel feeding system having a continuous circuit through which fuel and air are circulated, a plurality of delivery pipes leading from said circuit, valve means associated with each delivery pipe for varying the delivery of air and fuel through said delivery pipe, means for causing the air and fuel to circulate at substantially a constant velocity through the circuit, means for admitting air to the circuit to compensate for the air passing through the delivery pipes, means for feeding fuel to said circuit, and control means connected to each valve means for varying the fuel feed in accordance with the variations in the valve means, substantially as described.

20. An apparatus for feeding a constant

mixture of fuel and air to a furnace whose consumption varies, comprising an endless circulating line, means for circulating the mixture through the endless circulating line at a sufficient velocity to hold the fuel in suspension, means for passing some of the mixture from the endless circulating line to the furnace, means for controlling the flow of mixture from the endless circulating line to the furnace, means for feeding fuel to the endless circulating line, and connections between the means for controlling the flow of mixture to the furnace and the means for feeding fuel to the endless circulating line, whereby the feed of the fuel to the endless circulating line is directly varied by the variation in the feed to the furnace and independent of the velocity of the flow or pressure of the mixture in any portion of the endless circulating line, there being means for supplying air to the endless circulating line at the rate it passes to the furnace, whereby a constant mix is maintained for supplying the furnace.

In testimony whereof I have hereunto set my hand.

CECIL F. HERINGTON.