

April 27, 1926.

H. D. BOWMAN

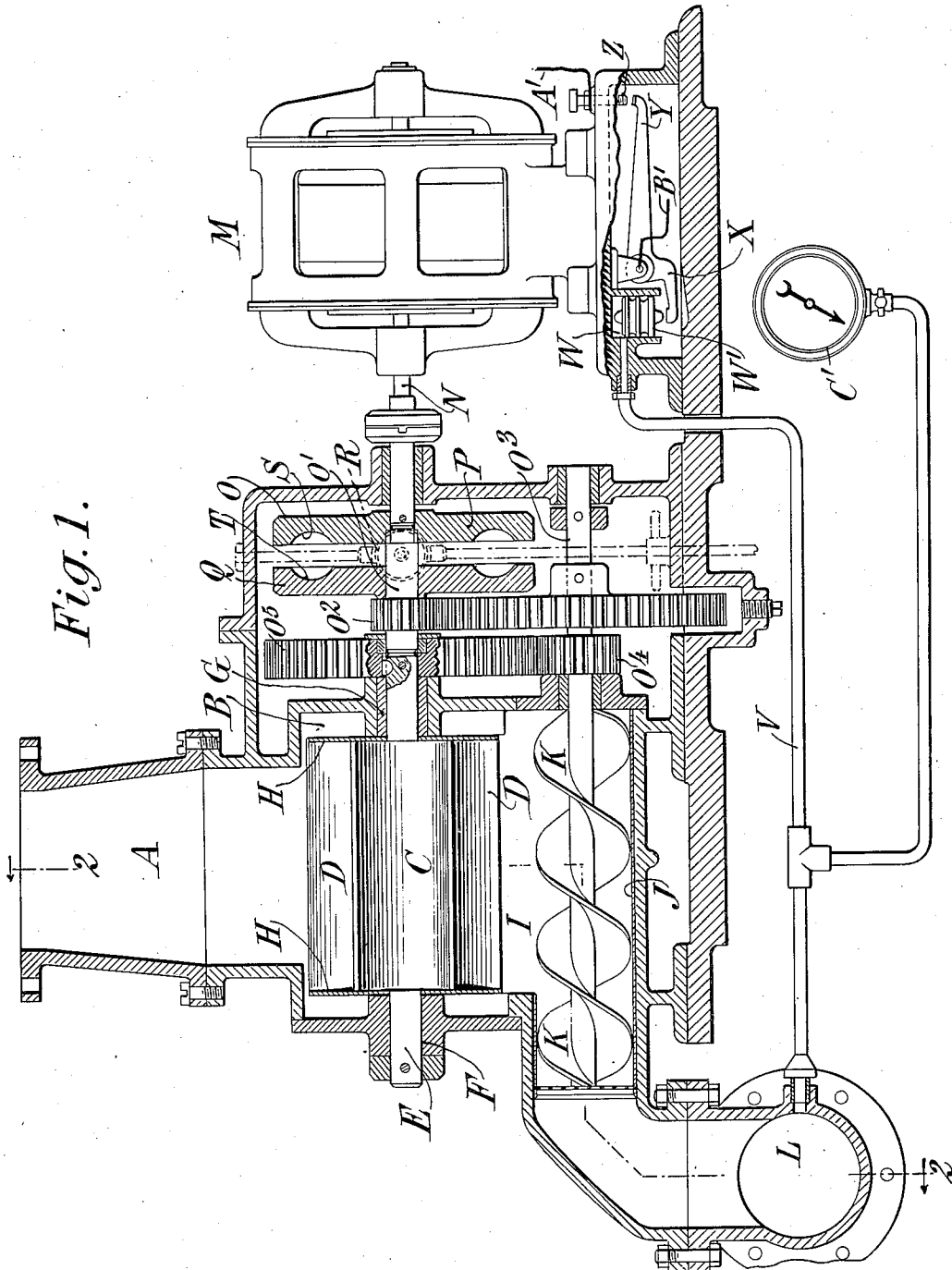
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FEEDING APPARATUS FOR PULVERIZED FUEL

Filed Dec. 22, 1922

2 Sheets-Sheet 1

Fig. 1.



INVENTOR :

H. D. Bowman

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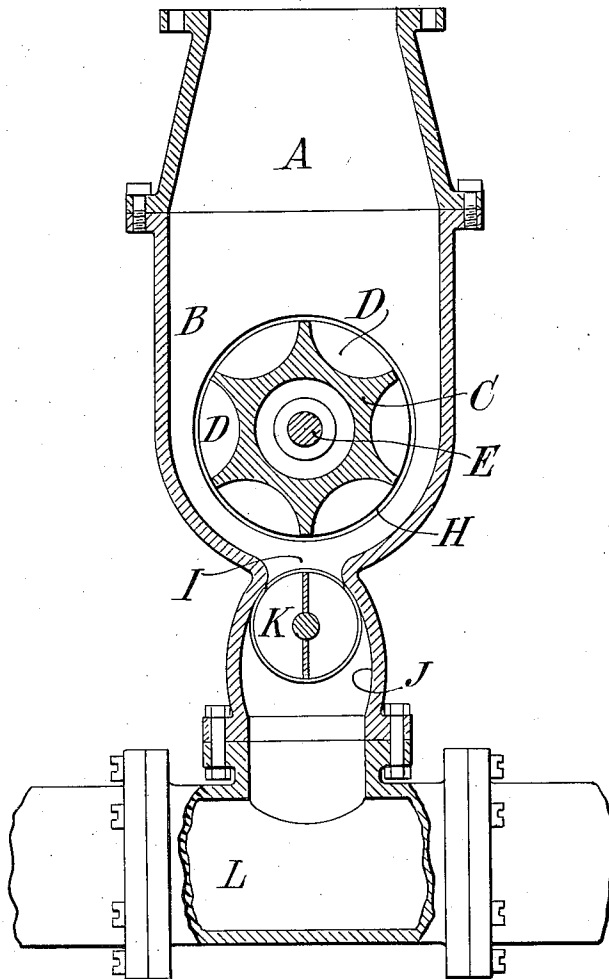
H. D. BOWMAN

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2 Sheets-Sheet 2

Fig. 2.



INVENTOR :

Harry D. Bowman

UNITED STATES PATENT OFFICE.

HARRY D. BOWMAN, OF EAST ORANGE, NEW JERSEY, ASSIGNOR OF ONE-HALF TO
EUGENE V. MYERS, OF EAST ORANGE, NEW JERSEY.

FEEDING APPARATUS FOR PULVERIZED FUEL.

Application filed December 22, 1922. Serial No. 608,437.

To all whom it may concern:

Be it known that I, HARRY D. BOWMAN, a citizen of the United States of America, residing in East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Feeding Apparatus for Pulverized Fuel, of which the following is a specification

Pulverized fuel has recently come into somewhat extended use, particularly in connection with steam boilers, the fuel being fed mechanically into the fire-box and the combustion taking place largely while the fuel is in suspension in the air within the fire zone. The method usually adopted for feeding the fuel consists in mechanically transferring the fuel to a point more or less adjacent to the fire-box, and blowing it into the latter by a current of air, the air serving as a carrier for the fuel and also providing the necessary oxygen to support combustion. Difficulties have sometimes been encountered in the operation of such devices due to the fact that for one reason or another there has been a partial or total failure of the air supply, with the result that the fuel has accumulated within the air pipe, and has become so consolidated or packed that it is difficult to remove it, oftentimes necessitating a shutting down of the boiler for considerable periods of time. Difficulty has also been encountered in proportioning the speed of feed of the fuel to the requirements of the furnace, with the result that there has been an excess or a scarcity of fuel as compared with the steaming requirements, so that irregular or wasteful results have been obtained.

According to the present invention I provide means for automatically controlling the feed of the fuel in relation to the pressure of air within the feed pipe, so that in case of reduction of air current, the feed is either stopped or lessened before the danger point is reached. Furthermore, in the preferred form of the invention, I provide a means whereby the fuel feed cannot be started until the air current has reached the proper proportions. My invention also provides an improved fuel feeder by which the feed is determined with great accuracy so that under given conditions the feed will be uniform to a high degree. The invention also comprises certain other improvements which will be hereinafter more fully described.

Referring to the drawings, which illustrate one form of the invention,—

Figure 1 is a side view, partly in elevation, and partly in longitudinal vertical section.

Fig. 2 is a section on the line 2—2 in Fig. 1.

Referring to the drawings, I will first describe the preferred form of the device for feeding the fuel in measured quantities. In this construction A is a hopper or connecting pipe of suitable dimensions, adapted to be connected with a fuel bin or other source of supply. The hopper leads to a primary feed chamber B, which preferably is circular in form, and within the primary feed chamber B is rotated a cylindrical feed member C which has on its periphery a series of pockets D of any approved form, those shown being circular. The feed cylinder C is best mounted on a shaft E which has bearings F and G in the housing of the machine. The ends of the feed cylinder preferably comprise circular plates, such as H H, a convenient construction being to cast the cylinder in one piece. Below the feed chamber is a passage I, preferably running the full length of the cylinder and being approximately as wide as the pockets D. The result of this construction is that as the feed cylinder is rotated, each of the pockets receives a measured supply of fuel when in its uppermost position, and carries it around until the fuel is dropped through the passage I. This construction prevents any arching of the fuel above the feed cylinder, and operates very efficiently with fuels which are very difficult to handle, such as wet or even partly frozen coal. It also is capable of handling effectively fuels in which because of their fineness and moisture there is a strong tendency for the particles to adhere. It will be understood that as a pocket is filled from the hopper, the excess is wiped off by the hopper wall as the feed cylinder rotates.

The opening I leads to a circular trough J in which rotates a feed screw K, the flights of which preferably run very close to the bottom and side walls of the trough and nearly meet the edges of the feed cylinder between the pockets. At the exit end of the trough, and immediately adjacent the end of the screw I may arrange a grid composed of narrow bars, or adopt any other

construction which will place a slight back-pressure on the fuel and cause the mass to be divided up before it reaches the air pipe L.

5 In the construction shown I have illustrated the feeding device as driven by an electric motor M. As illustrated, the motor shaft N is coupled to a variable speed mechanism O, the driven shaft of which O' carries a pinion O² which drives the shaft 10 O³ of the screw. A pinion O⁴ is also mounted on the screw shaft and turns a gear O⁵ keyed to the cylinder shaft E. This gearing suitably reduces the speed of the motor shaft, and still further reduces the speed of 15 the feed cylinder.

I preferably use some form of a variable speed gearing O of well-known type so as to produce a capacity for at least some variation in relative speeds of the motor and 20 feed mechanism. In the construction shown, which is of a common type, the motor shaft drives a friction gear P, while an opposite gear Q is keyed on the feed cylinder shaft. 25 Between the two gears P and Q are arranged transmission gears R which run in grooves S and T formed in the gears P and Q. By tilting the transmission gears one way or the other, the relative speed of the 30 gear Q relative to gear P is either increased or reduced within limits of twenty or thirty per cent, which is ordinarily sufficient for the purpose. It will be understood that the variable speed mechanism is intended for 35 fine adjustments, and that if adjustments of greater magnitude are required, any of the ordinary variable speed mechanisms may be employed, or if desired, the motor may be provided with a rheostat or other suitable speed control. 40

When the motor is operated, the feed cylinder conveys to the screw certain measured quantities of fuel, which the screw in turn feeds forward into the air pipe L. Assuming 45 a constant flow of air through the feed pipe L which leads to the fire-box which is proportioned to the speed of feed, or vice versa, it is evident that very uniform and regular quantities of fuel in practically a 50 continuous stream will be fed to the furnace.

It frequently happens, however, that because of breakdown of the air system, caused by failure of the compressor or for other reasons, that the current of air either fails 55 entirely, or is insufficient to move the amount of fuel which is being fed. Unless this is very quickly discovered, and the fuel feed stopped, the air pipe will fill up with fuel and become clogged, frequently to such extent 60 that it requires considerable time to remove the fuel and a shut-down of greater or less duration is the result.

According to my invention I provide means for controlling the feed of the fuel 65 which is governed by the air current. I

prefer, however, to use a pressure system which takes its pressure from the air pipe, and maintains a piston in its advanced position, thus holding the motor switch closed. In the drawing, wherein this construction is 70 shown, I utilize an air pipe V which leads to a cylinder W conveniently formed in the motor base, in which moves a piston W', which piston operates one arm X of a switch lever, the other arm of which Y is adapted 75 to make contact with a terminal Z, thus closing the circuit of the motor leads, one of which is shown diagrammatically at A' and the other of which is shown at B'. When 80 the pressure in the pipe V is relieved, the superior weight of the arm Y of the switch lever causes it to drop, thus breaking the circuit. Any other switching device may be employed. Preferably a pressure gauge C' 85 is introduced into the system, so that the pressures may be conveniently read.

The construction thus described stops the entire apparatus when the air pressure in the pipe L falls below the predetermined 90 working pressure. Furthermore, in the absence of a hand control, it is impossible to operate the fuel feeder until the air in the pipe L has reached its proper pressure in initially starting, or until it resumes its 95 proper pressure after an interruption.

It will be understood that various changes may be made in the construction shown without departing from the spirit of the invention.

What I claim is:— 100

1. A fuel feeding apparatus having a fuel feeder, a conduit into which the fuel is fed, an air supply for conveying the fuel through 105 said conduit after it is fed, and means governed by the pressure of the air supply within said conduit for stopping the feeder upon a decrease of the air supply.

2. A fuel feeding apparatus having a fuel feeder, a conduit into which the fuel is fed, an air supply for conveying the fuel 110 through said conduit after it is fed, means governed by the pressure of the air supply within said conduit for stopping the feeder upon a decrease of the air supply, said means 115 including a driving device for the feeder operated when the pressure of the air supply is normal, and means for stopping the operation of said driving device when the pressure of the air becomes reduced.

3. A fuel feeding apparatus having a fuel 120 feeder, a conduit into which the fuel is fed, an air supply for conveying the fuel through said conduit after it is fed, means governed by the pressure of the air supply within said 125 conduit for stopping the feeder upon a decrease of the air supply, said means including a driving device for the feeder operated when the pressure in the air supply is normal, a piston actuated by the rising and fall- 130 ing of pressures in said conduit, and a start-

ing and stopping device for the feeder operated by said piston.

4. An apparatus for feeding fuel, comprising a hopper, a cylinder provided with pockets arranged below said hopper, means for rotating the cylinder, a conveying device arranged to take the discharge of the cylinder and feed it forwardly, a conduit into which said discharge is fed, an air supply for conveying the fuel thus fed along said conduit, and means governed by the pressure of the air supply within the conduit for stopping said conveying device when the pressure of air within the conduit is reduced.
5. An apparatus for feeding fuel, comprising

a hopper, a cylinder provided with pockets arranged below said hopper, means for rotating the cylinder, a conveying screw arranged to take the discharge of the cylinder and feed it forwardly, a motor for driving said cylinder and screw, a conduit into which said discharge is fed, an air supply for conveying the fuel after it is fed, and means governed by the pressure of the air supply within the conduit for stopping said motor when the pressure of air within the conduit is reduced.

In witness whereof, I have hereunto signed my name.

HARRY D. BOWMAN.