

J. U. McDONALD.
FEEDER FOR POWDERED FUEL.
APPLICATION FILED OCT. 11, 1919.

1,386,009.

Patented Aug. 2, 1921.

3 SHEETS—SHEET 1.

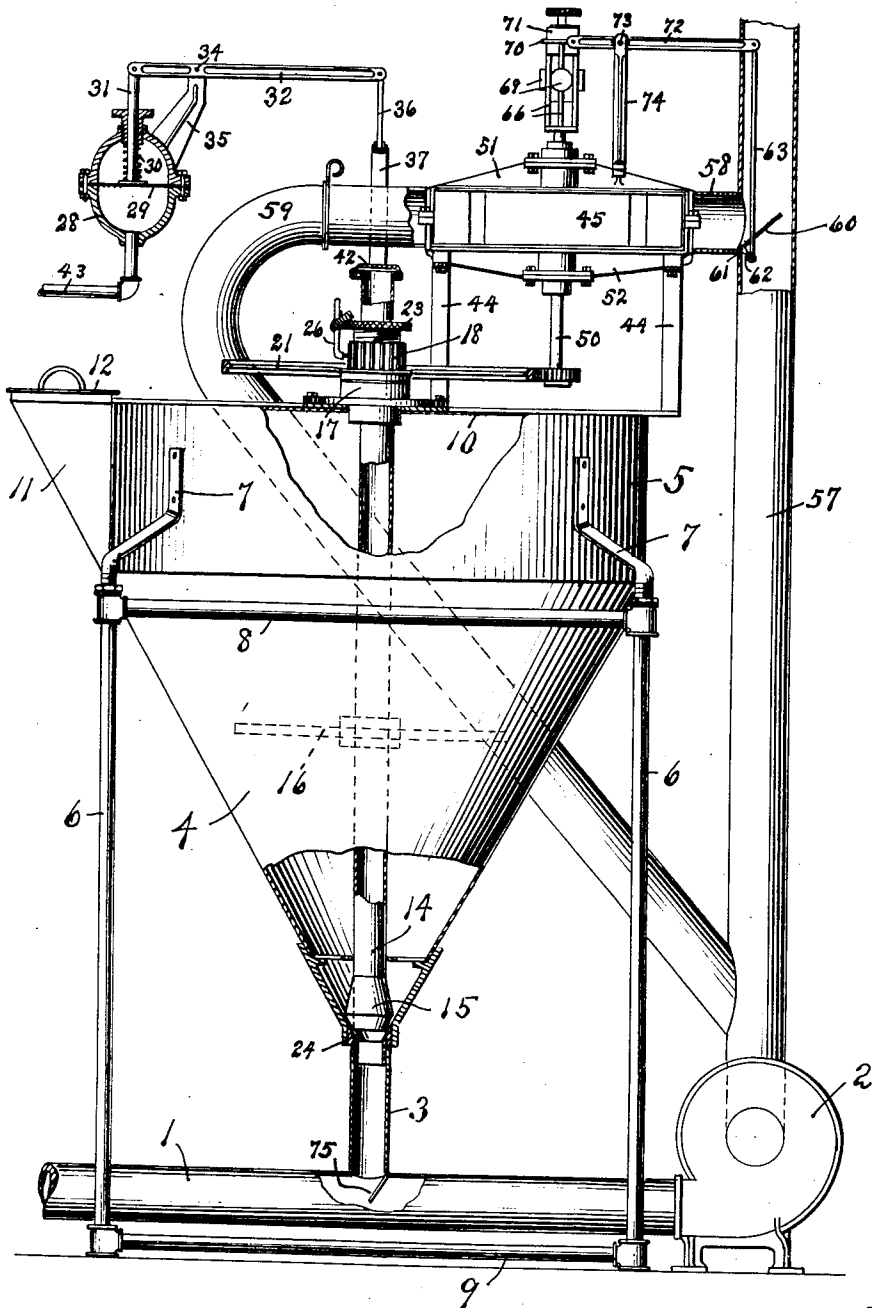


Fig. 1

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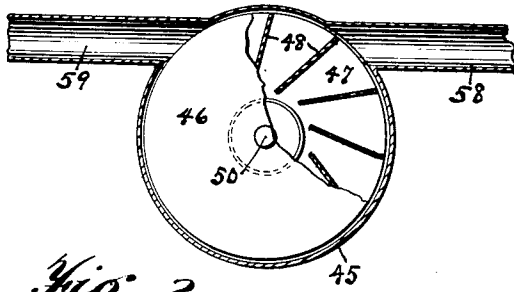


Fig. 2

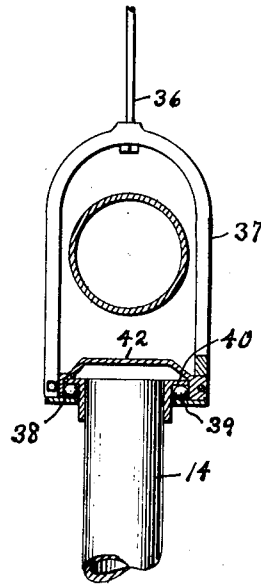


Fig. 3

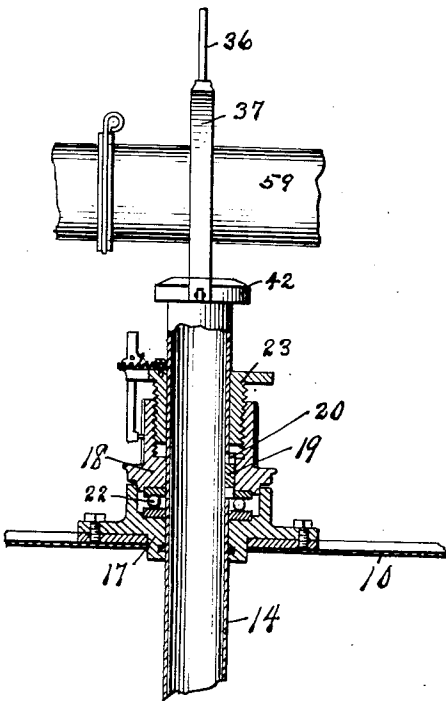


Fig. 4

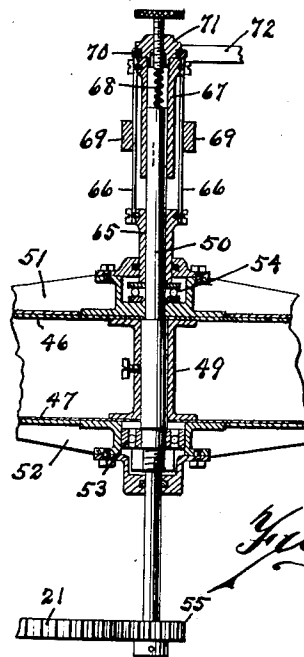


Fig. 5

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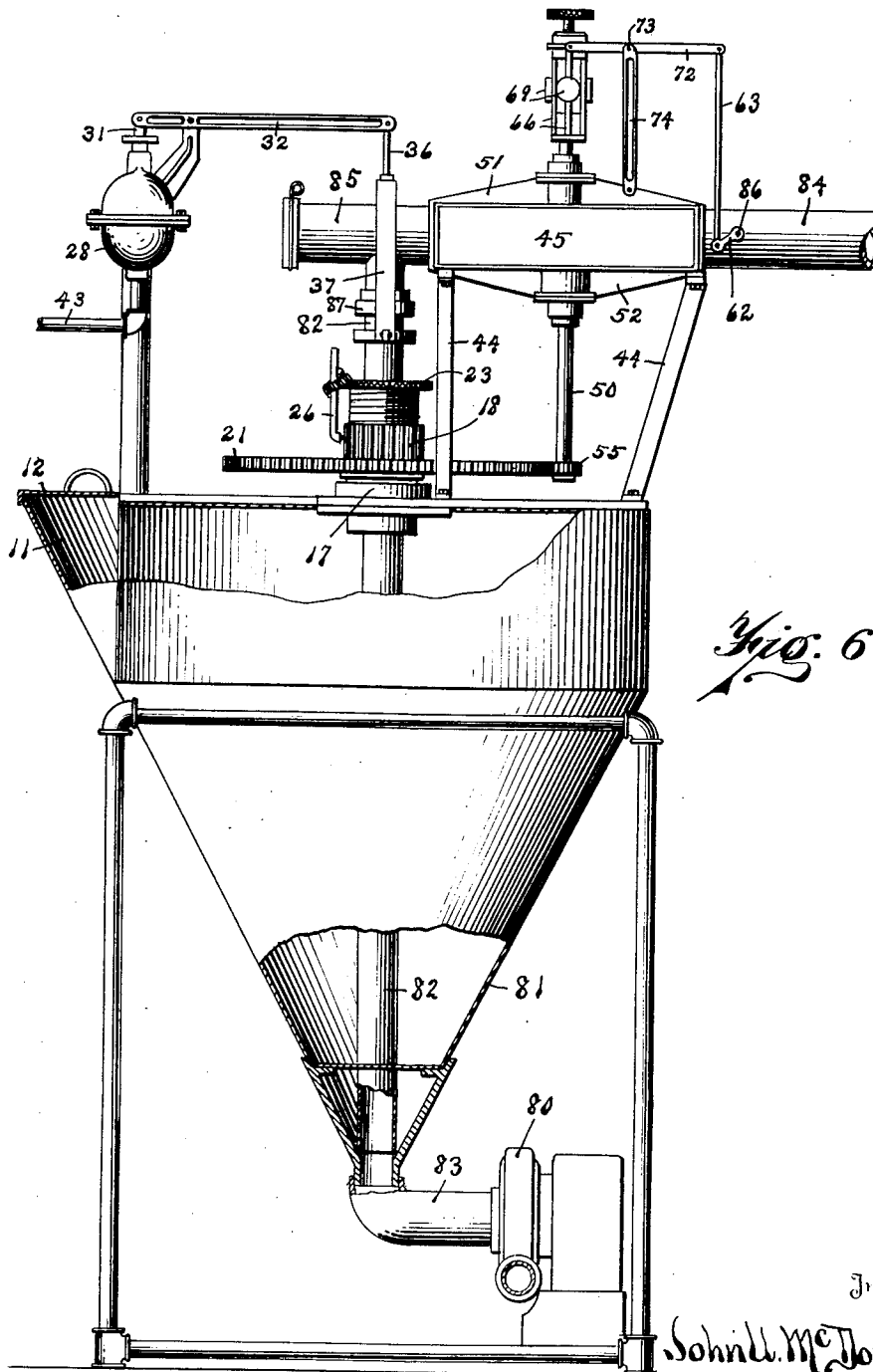


Fig. 6

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UNITED STATES PATENT OFFICE.

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FEEDER FOR POWDERED FUEL.

1,386,009.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JOHN URBAN McDONALD, a citizen of the United States, and residing at Decatur, in the county of Macon and State of Illinois, have invented a new and Improved Feeder for Powdered Fuel, of which the following is a specification.

This invention relates to means for intimately mixing powdered fuel with a current of air passing from a blower to the place where the fuel is to be burned, and its object is to provide means for accurately controlling the fuel feed.

This invention consists in combination with a hopper and a pipe connecting to the bottom thereof, of a vertically movable valve-tube in this hopper, of means for moving the valve up and down according to the feed desired, of a blower which actuates the current of air for carrying the powdered fuel, and an air motor for turning the valve-tube to prevent the powdered fuel from arching within the hopper. It also consists in connecting the intake opening of the blower to this motor so that the blower will cause the operation of the motor. It further consists in the details illustrated in the accompanying drawings and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is an elevation of this improved fuel storage and feeding apparatus. Fig. 2 is a plan of the air-motor for turning the valve-tube. Fig. 3 is a detail of the mechanism for supporting the valve-tube. Fig. 4 is a vertical sectional detail of the mounting for the upper end of the valve-tube. Fig. 5 is a vertical sectional detail of the air motor. Fig. 6 is an elevation of a modified embodiment of this invention.

Similar reference characters refer to like parts throughout the several views.

The fuel which is used in connection with this improved feeding mechanism is preferably finely powdered coal but ground wood may be used with similar effect. It is blown into a furnace through the pipe 1 being carried along by a current of air from the blower 2, driven in any desired manner. Connecting into the pipe 1 is a pipe 3 which constitutes the discharge pipe of the conical hopper 4 which has a cylindrical upper extension 5 supported by the posts 6 and brackets 7. Braces 8 and 9 may be between the posts. The hopper is formed with a

cover 10 and may have a charging spout 11 closed by a cover 12.

Within the hopper is vertically movable and rotatable the valve-tube 14, formed with an enlargement 15 at its lower end if desired. On this tube may be secured the arms 16 whereby the contents of the hopper may be agitated. As indicated in Fig. 4, this tube is guided in a bearing 17 on the hopper cover 10 and the tube is provided with a key 19 slidable in a slot 20 in the hub 18 of the gear 21. Balls 22 may support this gear on the bearing 17.

A collar 23 may be secured to the tube 14 and the height of the tube may be adjusted relative to the valve seat 24 at the lower end of this tube by screw-threading this collar and the upper end of the hub 18 of the gear. The collar may be prevented from turning by the spring pressed finger 26 pivotally mounted on the collar which may engage in vertical flutings in the hub 18. When this collar is employed to adjust the valve-tube, the discharge of fuel will be fairly constant, depending upon the rotation of the valve-tube to keep the fuel from arching.

In Figs. 1 and 6 are shown a two-part shell 28 having a diaphragm 29 normally held down by means of a spring 30. A rod 31 connects to a lever 32, pivoted at 34 on the arm 35 and connecting at its outer end to a rod 36 that carries a stirrup 37 at its outer end. A ring or collar 38 at the lower end of this stirrup carries the balls 39 on which rests the flange 40 secured to the upper end of the tube 14. A cap 42 is preferably placed over this bearing.

So long as pressure in the pipe 43 is below normal, the diaphragm will be held down by the spring 30 but when the desired pressure is reached the rod 31 will be forced up, the rod 36 and the tube 14 will descend and the discharge of the hopper will be reduced.

Supported by the posts 44 on the cover of the hopper is a shell 45 of an air motor having a rotor composed of the top 46, bottom 47, vanes 48, spool 49 and shaft 50. Spiders 51 and 52 at the top and bottom of the shell 45 support bearings 53 and 54 respectively for the motor shaft, and a pinion 55 on the lower end of this shaft meshes with and drives the gear 21.

The air pipe 57 extends down to the blower 2 from a convenient heater (not

shown) and to it connects the branch pipe 58 leading to the air motor. A third pipe 59 connects to the air motor and to the air pipe 57. When the blower is operating air will flow down these pipes 57 and 59, depending on the position of the valve 60 on the shaft 61 which is controlled by the arm 62 and the link 63. Any desired means may be employed to position this valve 60 but I prefer a governor connected to the motor shaft so that the speed of the motor and of the valve-tube shall be constant.

The governor shown in Fig. 5 is of well known construction, being composed of a sleeve 65 secured to the motor shaft and flat springs 66 extending therefrom to the upper end of a sleeve 67 slidable on the shaft and normally held up by the compression spring 68. Weights 69 on these springs fly out when the governor is turned and pull down the sleeve 67 and the ring 70 and the plug 71 at its upper end and with them the adjacent end of the lever 72 which connects to this ring 70. The lever is pivoted at 73 on the post 74 and connects at its outer end to the link 63. As the speed of the motor increases the weights 69 move out, causing the link 63 to be pulled up and the valve 60 to reduce the flow of air through the pipe 58 leading to this motor.

It will therefore be seen that when the blower is operated, the suction thereof will drive the motor and cause the valve-tube 14 to be turned to agitate the fuel and cause it to discharge from the hopper, the small baffle 75 preventing the blast from the blower turning up into the hopper. The rate of feed of the fuel is independent of the blower but depends upon the speed of the air-motor and may also depend upon the pressure of steam in the pipe 43.

The structure shown in Fig. 6 differs from that just described in that the blower 80 connects to the bottom of the hopper 81 and that all the air passing to the blower is drawn through the valve-tube 82, excepting that minor amount which passes through the hopper down around the lower end of the valve-tube into the discharge pipe 83 of the hopper 81 together with the powdered fuel. The vertical movement of the valve-tube may be controlled, the tube may be turned and the passage of air through the pipes 84 and 85 to the valve-tube will actuate the motor in the same manner as in the mechanism shown in Fig. 1. The amount of air passing to the motor may be controlled by a valve (not shown) on the shaft 86, similar to the valve 60 in Fig. 1, through the action of a governor as previously described. The upper end of the valve-tube 82 may slide in a fitting 87 on the pipe 85. In this case, the fuel is conveyed to a furnace or other place of consumption (not shown) through the pipe 88 by the current

of air drawn by the blower 80 through the pipe 84, motor 45, valve tube 82, and discharge pipe 83.

Many changes in the details and proportions of the various parts of this fuel feeder may be made by those skilled in the art without departing from the spirit of my invention as set forth in the following claims. Thus the vertical tube 14 may be driven by any other mechanical means and be raised and lowered by other than fluid pressure.

I claim:—

1. In a feeder for powdered fuel, the combination of a conical hopper, a vertically movable and rotatable valve tube in said hopper, means controlled by fluid pressure to move the valve tube vertically, a discharge pipe at the lower end of the hopper to receive the powdered fuel, the flow of the fuel being controlled by the valve tube, a blower to actuate a current of air to carry the fuel from said discharge pipe, and an air motor and gearing connecting the motor to the valve tube whereby the latter may be turned.

2. In a feeder for powdered fuel, the combination of a conical hopper, a vertically movable and rotatable valve tube in said hopper, means controlled by fluid pressure to move the valve tube vertically, a discharge pipe at the lower end of the hopper to receive the powdered fuel, the flow of the fuel being controlled by the valve tube, a blower to actuate a current of air to carry the fuel from said discharge pipe, an air motor, gearing connecting the motor to the valve tube whereby the latter may be turned, a governor connected to said motor, and means operated by the governor for controlling the rate of flow of air to said motor.

3. In a feeder for powdered fuel, the combination of a hopper, a rotatable valve tube in said hopper, a discharge pipe at the lower end of the hopper to receive the powdered fuel, the flow of the fuel being controlled by the height of the valve tube, means for moving the valve tube up and down, a blower to actuate a current of air to carry the fuel from said discharge pipe, a motor operated by the air carrying the fuel, and gearing connecting the motor to the valve tube whereby the latter may be turned.

4. In a feeder for powdered fuel, the combination of a hopper, a vertically movable valve tube in said hopper, means controlled by fluid pressure to move the valve tube vertically, a discharge pipe at the lower end of the hopper to receive the powdered fuel, the flow of the fuel being controlled by the height of the valve tube, and a blower to actuate a current of air to carry the fuel from said discharge pipe.

5. In a feeder for powdered fuel, the combination of a hopper, a rotatable valve in said hopper, a discharge pipe at the lower

end of the hopper to receive the powdered fuel, a blower to actuate a current of air to carry the fuel from said discharge pipe, a motor operated by the air flowing through said blower, and gearing connecting the motor to the valve tube whereby the latter may be turned to prevent the clogging of the discharge through the arching of the fuel.

6. In a feeder for powdered fuel, the combination of a hopper, a rotatable valve in said hopper, a discharge pipe at the lower end of the hopper to receive the powdered fuel, a blower to actuate a current of air to carry the fuel from said discharge pipe, a motor operated by the air flowing through said blower, gearing connecting the motor to the valve tube whereby the latter may be turned to prevent the clogging of the discharge through the arching of the fuel, a governor connected to said motor, and means operated by the governor for controlling the rate of flow of air to said motor.

7. In a feeder for powdered fuel, the combination of a hopper, a rotatable valve tube in said hopper, a discharge pipe at the lower end of the hopper to receive the powdered

fuel, a blower connected to said discharge pipe which constitutes the suction pipe of said blower, the current of air actuated by said blower being adapted to carry the fuel from the hopper, a motor operated by the air flowing through said valve tube, and gearing connecting the motor to the valve tube whereby the tube may be turned by the motor.

8. In a feeder for powdered fuel, the combination of a hopper, a rotatable valve tube in said hopper, a discharge pipe at the lower end of the hopper to receive the powdered fuel, a blower connected to said discharge pipe which constitutes the suction pipe of said blower, the current of air actuated by said blower being adapted to carry the fuel from the hopper, a motor operated by the air flowing through said valve tube, gearing connecting the motor to the valve tube whereby the tube may be turned by the motor, a governor connected to said motor, and means operated by the governor for controlling the flow of air to said motor.

JOHN URBAN McDONALD.