

1,365,663.

2 SHEETS—SHEET 1.



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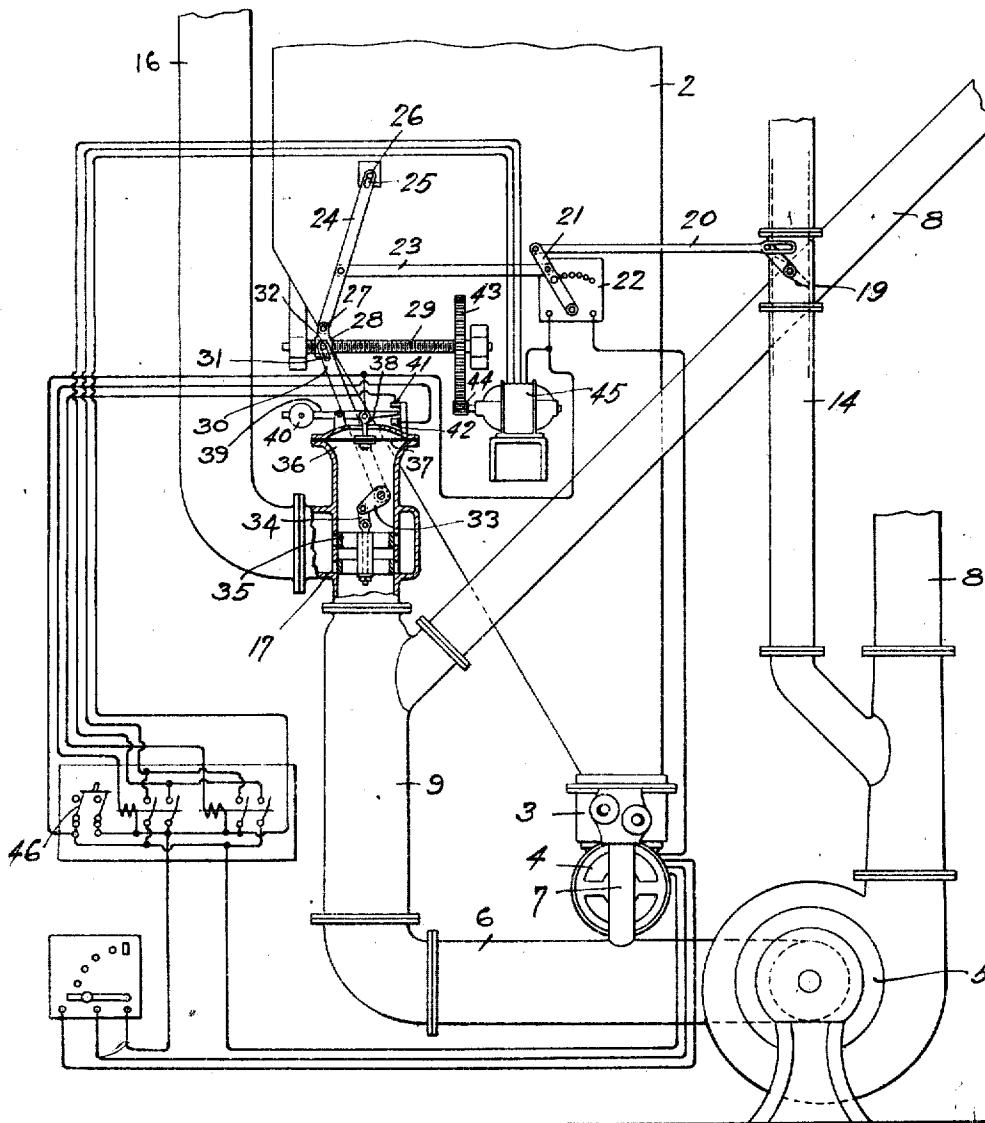
E. C. COVERT.
 APPARATUS FOR FEEDING PULVERIZED FUEL.
 APPLICATION FILED MAY 31, 1919.

1,365,663.

Patented Jan. 18, 1921.

2 SHEETS—SHEET 2.

FIG. 2



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UNITED STATES PATENT OFFICE.

EDSON C. COVERT, OF AVALON, PENNSYLVANIA, ASSIGNOR TO HEYL & PATTERSON, INC., OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

APPARATUS FOR FEEDING PULVERIZED FUEL.

1,365,663.

Specification of Letters Patent.

Patented Jan. 18, 1921.

Application filed May 31, 1919. Serial No. 300,881

To all whom it may concern:

Be it known that I, EDSON C. COVERT, a citizen of the United States, and resident of Avalon, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for Feeding Pulverized Fuel; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to apparatus for feeding pulverized fuel.

The object of my invention is to provide an efficient and simple means of supplying fuel and air in the proper proportion that the mixture will be uniform to the suction side of a fan or circulating medium and to provide means for the delivery of said fuel and air mixture to a single furnace with a number of burners or to a number of furnaces, thereby dispensing with a separate fuel storage and feeding device at each furnace.

Generally stated I employ a closed pipe circuit beginning at the discharge of the fan and terminating at the suction side of the fan. The pipes composing the circuit are of such size that there will be sufficient of a mixture being returned to the fan at all times so that the velocity in any path of the circuit will never be below that required to keep the fuel in the mixture in suspension, and to overcome the inability of securing an adjustable speed power unit to supply the proper proportion of fuel to the system I employ a variable or adjustable speed motor for a minimum and maximum speed with a number of equal intermediate speeds, and by means of a by-pass pipe from the pipe circuit adjacent to the discharge side of the fan I am enabled to release and give amount of fuel from the pipe circuit equal to that fuel being supplied by the feeder driven by an adjustable speed motor at its minimum speed.

In the accompanying drawings, Figure 1 is a side elevation of my improved apparatus, one of the furnaces being shown partly in section; Fig. 2 is an enlarged side elevation of the supply hopper, the feeder, fan, etc., the pipe circuit being broken away and the diaphragm and air valve operated thereby being shown in section; and Fig. 3 is a view of one of the furnaces partly in section showing one of the pipes for delivering the fuel to the furnace.

Referring to the drawings the numeral 2 designates a suitable storage-hopper for containing the pulverized fuel. At the discharge end of said hopper is the feeding mechanism 3 which it has not been deemed necessary to illustrate in detail, the same being a form of feeding mechanism for which Letters Patent of the United States #1197799 were issued to me on the 12th day of September 1916.

A shunt-wound motor 4 is provided for driving the screws of the feeder 3.

A suitable fan 5 driven by a motor (not shown) provides the air for mixing with the fuel delivered to the suction pipe 6 by the pipe 7, and the combined air and fuel is forced by said fan through the pipe circuit 8 making a complete circuit with the air pipe 9.

Branch pipes 10 connect with the pipe circuit 8 at different points and said pipes lead to fuel burning devices or furnaces 11.

Valves 12 are provided for controlling the supply of fuel to the side pipes 10. These valves are operated by the chains 13.

Leading from the pipe circuit 8 just beyond the fan 5 is the by-pass pipe 14 which communicates with a suitable centrifugal separator 15, where practically all the fuel entering said separator from the by-pass pipe is separated from the air and the air passes by the pipe 16 through the valve 17 to the air pipe 9 where it is again combined with the fuel delivered by the feeder 3 to be carried by the fan through the pipe circuit.

A vent 18 is provided for supplying air to the pipe 16 and eventually to the pipe circuit.

Located in the by-pass pipe 14 is a suitable valve 19 connected by the rod 20 to the lever-arm 21 of the field rheostat 22. A rod 23 connects said lever 21 to the lever-arm 24, said arm having the slot 25 which engages the pin 26 on the hopper 2. The opposite end of the lever 24 is pivotally connected at 27 to the nut 28 on the screw-shaft 29. A lever 30 has the slot 31 which engages the pin 32 on the nut 28 and the opposite end of said lever is connected to the crank 33 connected by the link 34 to the air valve 35.

A diaphragm chamber 36 has the diaphragm 37 which is connected by the link 38 to the switch arm 39 carrying the weight 40. The inner end of the switch arm 39 when in

neutral position lies between the contacts 41 and 42.

The screw-shaft 29 has the large gear wheel 43 which meshes with the pinion 44 on the shaft of the air valve motor 45.

In the operation of my improved feeder the circulating fan is first started which will continue to circulate the mixture entrapped in the pipe line and at the same time draw in sufficient new air through pipe 16 and valve 17 to make up for that being dispelled through pipe 14 and valve 19. The valve 19 always being open when the total amount of air escaping through valves 12 in pipes 10 is less than that being expelled through valve 19 in pipe 14.

The feed motor 4 is then started by closing the knife switch 46 which causes current to flow through the field rheostat 22 which is shown in minimum speed position, to the motor, causing feed screws in feeder 3 to revolve, thereby feeding fuel from the storage hopper 2 through pipe 7 to fan suction pipe 6 when fuel is mixed with the incoming air from valve 17 and pipe 16 and that mixture being returned from pipe circuit 8.

The fan will continue to circulate this mixture through circuit 8, with an amount of fuel and air equal to that fed to the system by feeder 4 and through valve 17 and pipe 16 being fed to separator 15.

As it is desired to place fuel consuming devices 11 in operation valves 12 in branch pipes 10 are opened by means of chains 13 which causes a rush of the fuel mixture in pipe circuit 8 to enter fuel consuming device 11, and also causes a vacuum in pipe 9 thereby causing diaphragm 37 which is attached to lever 39 to descend making an electric contact at 42 causing motor 45 to revolve screw 29 causing feed nut on screw to travel toward gears.

This movement of the nut 28 will act to move the lever 30 and will open the air valve 35 to a point that will admit sufficient air to replace that going together with the fuel to fuel consuming devices. As soon as this point is reached air pressure in pipe 9 and valve 35 will again become normal and diaphragm will again ascend to normal position breaking electric contact at 42 causing motor to stop.

As the air valve 35 was being opened in the manner above set forth the lever 24 was moved and through the lever rod 23 the lever 21 of the field rheostat 22 was moved over causing motor 4 to revolve faster and feeder 3 to convey more fuel to pipe circuit, the speed of feeder 3 and the fuel fed by same being in synchrony with the opening of air valve 35 and air entering circuit through same.

The motor 45 will continue to operate, thereby causing air valve 35 to open and motor 4 to speed up as additional valves 12

on pipes 10 to fuel consuming devices are opened, until field rheostat lever 21 causes slotted lever 20 to close by-pass valve 19 which will immediately cause system to readjust itself to the new conditions.

The diaphragm valve will ascend making electric contact 41 causing motor 45 to revolve in opposite direction, and through gears 44 and 43 revolve screw 29 causing nut 28 to travel away on drawing, causing valve 35 to close and through levers 23 and 24 return handle control of field rheostat toward minimum speed position causing motor 4 and feeder 3 to slow down and feed an amount of fuel equal to that required for the volume of air entering through valve 35. When pressure again becomes normal in pipe 9, diaphragm 39 will descend breaking electric contact 41 and causing motor 45 to stop.

The placing in operation of additional fuel consuming devices will again cause diaphragm to descend making electric contact at 42, thereby opening valve 35 and speeding up feeder motor 4 and the shutting down of fuel consuming devices will make electric contact at 41 reversing the operation.

The arrangement as above described will continue to readjust itself to demands, the excess fuel and air mixture passing the valve openings 12 to fuel consuming devices being returned to fan and again circulated through pipe circuit.

There will be no fuel and air mixture escape to separator 15 through valve 19 and pipe 14 until such time as the amount of fuel being consumed is less than that being fed at minimum speed of feeder 4, when valve 19 through connection 20 and by reason of position of lever 21 on field rheostat 22 automatically opens valve 19, which will again cause a readjustment of apparatus to suit new conditions. The valve 19 remaining open and an amount of the fuel and air mixture equal to that fed by the minimum speed of feeder 3 going to separator 15.

As the valves 12 to fuel consuming devices 11 are closed the diaphragm will continue to descend, motor 45 rotate closing valve through feed screw 29 and nut 28 motor 4 slow down to its minimum feed position.

When fuel consuming devices are no longer in operation knife switch 46 may be pulled stopping motor 4.

A continual swing of the fan will draw a sufficient amount of air through pipe 16 to make up for the mixture being dispelled through pipe 14 to separator 15 which can continue until fuel mixture is entirely eliminated from pipe circuit and same contains only air, when fan can be shut down.

What I claim is:—

1. In apparatus for feeding pulverized fuel, the combination of a storage hopper, 130

a fan, an endless pipe circuit, valve controlled outlets from said circuit leading to fuel consuming devices, a by-pass pipe connected to said pipe circuit, an automatically operating valve in said by-pass, said
 5 by-pass pipe communicating with said storage-hopper, means for supplying air to said fan, means for feeding fuel to said pipe circuit at the suction side of said fan, and
 10 means operated by the vacuum on the suction side of said fan for automatically controlling the amount of fuel and air admitted to said fan.

2. In apparatus for feeding pulverized
 15 fuel, the combination of a storage-hopper, a fan, an endless pipe circuit, valve controlled outlets from said pipe circuit to fuel consuming devices, a by-pass pipe communicating with said pipe circuit and with said
 20 storage-hopper, an automatically operating valve in said by-pass pipe, means for supplying air to said fan, means for feeding fuel to said pipe circuit, a diaphragm on the suction side of said fan, a valve for controlling the supply of air to said fan, a motor
 25 operated by the movement of said diaphragm, connections between said air valve and said motor, connections between said last named connections and said fuel feeding means whereby the fuel and air to the
 30 pipe circuit is automatically controlled.

3. In apparatus for feeding pulverized fuel, the combination of a storage-hopper, a
 35 continuous pipe circuit, a fan in said circuit, means for feeding varying amounts of fuel to the suction side of said fan, a by-pass pipe communicating with said pipe circuit and with said hopper, means for supplying air to the suction side of said fan,
 40 and means for varying the supply of air, and for simultaneously varying the amount of fuel fed to said pipe circuit.

4. In apparatus for feeding pulverized fuel, the combination of a storage-hopper,

a continuous pipe circuit, valve controlled connections from said pipe circuit to fuel consuming devices, means for delivering fuel to said pipe circuit, a variable speed motor operating said feeding means, a by-pass pipe communicating with said pipe
 50 circuit and with said storage-hopper, an automatically operating valve in said by-pass pipe, an air pipe communicating with said pipe circuit, a fan in said pipe circuit, an air valve on the suction side of said fan,
 55 a diaphragm on the suction side of said fan, an electric switch operated by said diaphragm, a motor, connections between said motor and said air valve, a rheostat operated by said last named motor, and
 60 connections between said rheostat and said variable speed motor whereby the speed of the fuel feeding means is varied and the air supply to the fan is properly proportioned.

5. In apparatus for feeding pulverized
 65 fuel, the combination of a storage-hopper, a continuous pipe circuit, a fuel feeder, a variable speed motor connected to said feeder, a fan in said pipe circuit, a by-pass pipe communicating with said pipe circuit and
 70 with said storage-hopper, an automatically operating valve in said by-pass pipe, an air intake pipe, a valve in said pipe, a diaphragm, an electric motor operated by the movement of said diaphragm, connections
 75 between said motor and said air valve, and means operated by the movement of said air valve for changing the speed of said variable speed motor, whereby the movement of said air valve and the variation of speed of said
 80 feeding device takes place simultaneously.

In testimony whereof, I, the said Edson C. Covert, have hereunto set my hand.

EDSON C. COVERT.

Witnesses:

ROBT. D. TOTTEN,
 JOHN F. WILL.