J. M. SCHUTZ.

FUEL FEEDER.

APPLICATION FILED FEB. 19, 1917.

1,319,119.

Patented Oct. 21, 1919.

2 SHEETS—SHEET 1.

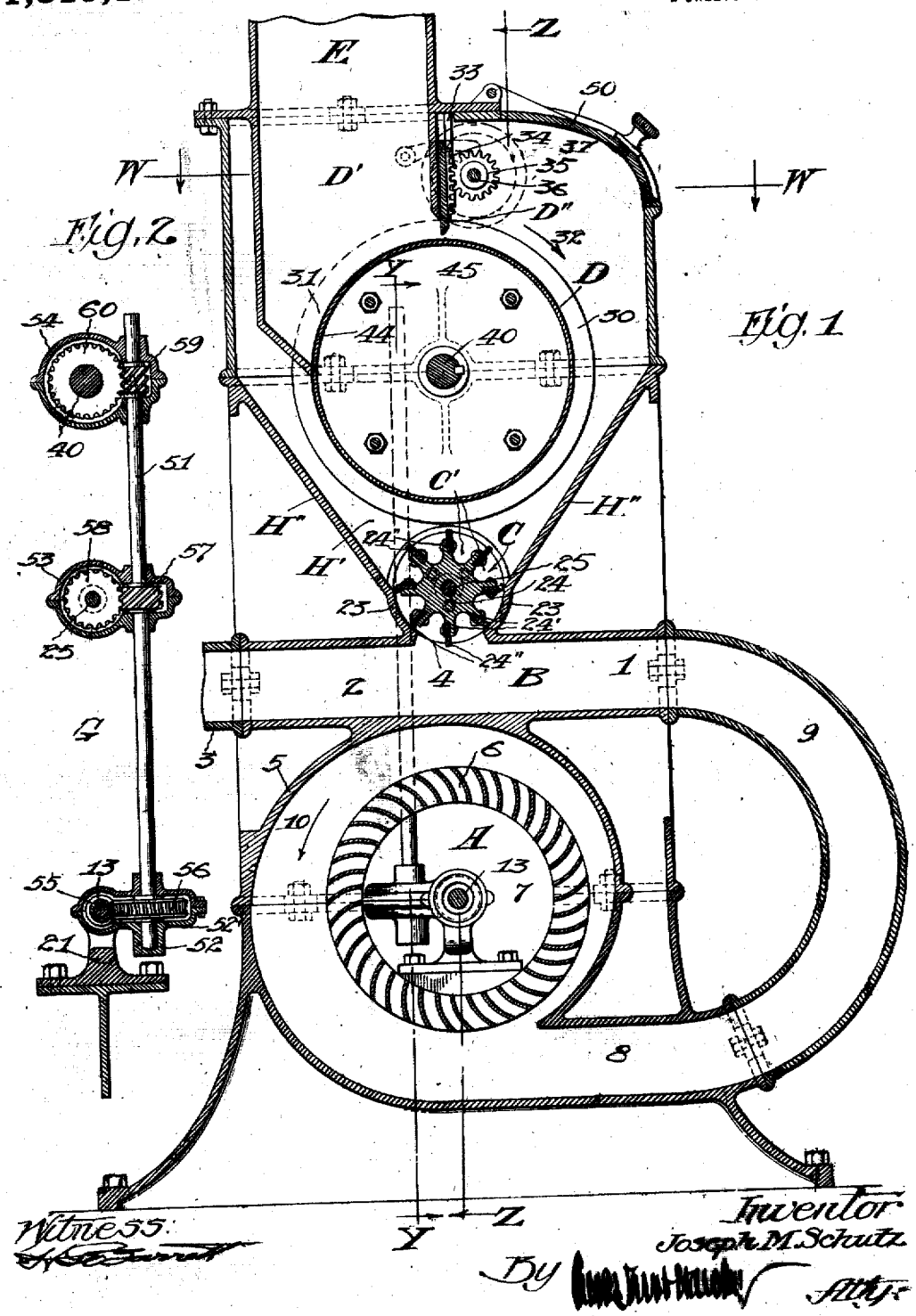


Fig. 2

Fig. 1

Witnesses:

Inventor
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By

Atty.

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Fig 4

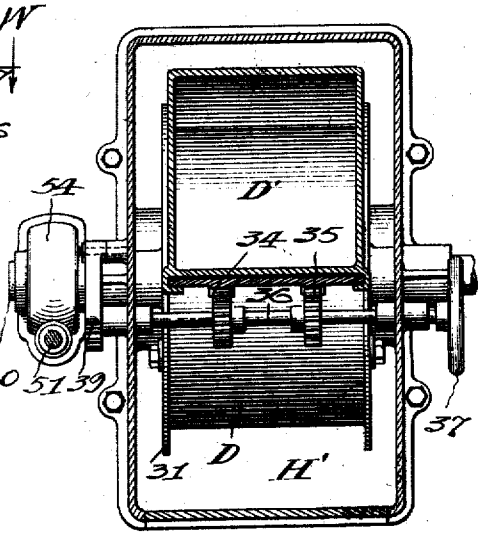


Fig. 3

Witness.

Inventor
Joseph M. Schutz
By Atty.

UNITED STATES PATENT OFFICE.

JOSEPH MARTIN SCHUTZ, OF CHICAGO, ILLINOIS, ASSIGNOR TO SCHUTZ HAWLEY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

FUEL-FEEDER.

1,319,119. Specification of Letters Patent. Patented Oct. 21, 1919.

Application filed February 19, 1917. Serial No. 149,561.

To all whom it may concern:

Be it known that I, JOSEPH MARTIN SCHUTZ, a citizen of the United States, and residing at Chicago, Cook county, Illinois, have invented certain new and useful Improvements in and for Fuel-Feeders, of which the following is a specification.

My invention relates to improvements in machines for feeding more or less pulverized substances and granular substances and for mixing such substances with streams of air, gas, and the like. The invention has special reference to means for feeding mixtures of air and fuel to furnaces. The feeder herein shown first appeared somewhat diagrammatically in my pending application, No. 147,759, series of 1915.

The general object of the invention is to provide means for the reliable and uniform feeding of dry substances from a hopper or the like. A further object is to provide for the mixing of such substances with other substances in measured or predetermined proportions. Another object is to make it possible to mechanically feed dry substances into a space wherein the pressure is either more or less than in the feed hopper or the compartment containing the feeding device. And the particular object of the invention is to provide an easily regulable and complete unit mechanism for variably forming and feeding a stream of air and crushed or pulverized coal to an introgenerative furnace such as I have described and claimed in my said application, Ser. No. 147,759.

In its best and most complete form my invention consists in a mixing duct, to be connected with the furnace or like to be supplied, in combination with a variable blower for supplying air or like to said duct, a feeder proper for the dry substance, and a feed valve or conveyer interposed between said duct and said feeder, and acting to discharge the substance into said duct while preventing the escape of air or like from said duct into the space containing the feeder. The invention also consists in novel constructions of the several elements named; and in combinations thereof; all as hereinafter described and particularly pointed out in the appended claims.

My invention will be readily understood on reference to the accompanying drawings which form part of this specification and in which: Figure 1 is a vertical section of a feeder embodying my invention, especially adapted for use with an introgenerative furnace of the construction shown in said application, Ser. No. 147,759, the section being on the line X—X of Fig. 3; Fig. 2 is a vertical sectional detail of the driving coupler which connects the blower shaft with the feed roll and the rotary valve, the section being on the line Y—Y of Fig. 1; Fig. 3 is a vertical section on the line Z—Z of Fig. 1; and Fig. 4 is a horizontal section on the line W—W of Figs. 1 and 3.

The machine herein shown is a unit which is complete in itself. I intend that one such unit shall be used for each furnace, or the like, requiring a mixture of the kind which it is adapted to make. But it is obvious that under some conditions one unit or feeder may be used to simultaneously supply several furnaces or other devices.

Most conveniently, the device is built upon the plan shown in the drawings, with the blower, A, at the bottom; with the mixing duct, B, next above; with a valve like unto or equivalent to the valve, C, above the duct; and, with the feed roll, D, and fuel trunk, E, at the top. The motor, F, whatever its kind, is preferably an element of the unit, though obviously the blower may be operated in ways other than shown. When used, the individual motor is placed on a base extension, F″, of the frame or casing of the unit. I prefer that the motor shall be at the level of the blower, A, rather than elevated to a point where it would make the unit top heavy. The rotor of the blower, the valve, C, and the feed roll, D, are interconnected or coupled by means of a coupler, G, at the side of the unit.

The details of construction and operation are as follows:—The mixing duct, B, is preferably rectangular in cross section, as shown in Fig. 3. Its receiving end, 1, is connected with the discharge of the blower, A. Its discharge end, 2, is connected with the extension, 3, which leads to the furnace or other device (not shown) to be supplied with the mixture. The valve opening, 4, in the top of the duct, B, is the opening through which the fuel or other material is delivered to said duct, and will be referred to in connection with the feeding valve, C, which occupies said opening, 4. The cross sectional size or capacity of the mixing duct is determined by the volume of air or other

gas to be forced or drawn through it in a given time. In practice this volume and the velocity of the air is always sufficient to carry away the solid material fed into the duct through the opening, 4. When the feeder is used with my introgenerative furnace, the volume of air passed through the duct, B, is that particular volume which is required for the first stage combustion of the fuel. The blower, A, occupies the space beneath the duct or trunk, B, and comprises the scroll-like casing or housing, 5, and the rotor, 6. The air enters the scroll through openings, 7, in the ends of the main housing or casing, H, of the unit. The discharge outlet, 8, of the blower is preferably positioned at the bottom and by means of the properly curved sweep or elbow, 9, is connected with the duct, B. As shown, the elbow, 9, is preferably disposed on the exterior of the unit. The discharge, 8, and the elbow, 9, are preferably rectangular in cross section, corresponding to the duct, B. The rotor, 6, preferably, is of the mulitple-vane type and it rotates in the direction indicated by the arrow, 10, in Fig. 1. As shown in Fig. 3, the vanes are attached to the central disk, 11, and the latter by means of a hub, 12, is fixed on the blower shaft, 13. As shown in Fig. 3, the blower shaft is directly connected to the shaft, 14, of the motor or engine, F. A flexible coupling, 15, is preferably interposed. The speed of the rotor is the same as the speed of the motor, F, and therefore may be regulated through the medium thereof, as by means of the usual regulator, 16, belonging to the motor, F. Inasmuch as the rotor shaft rotates at high speed I prefer to mount it in anti-friction bearings, 17, 18 and 19, the latter being a thrust bearing. The bearings described are mounted in pillow blocks, 20, and 21, secured on the frame, H.

Those who are familiar with blowers of the kind shown will understand that the volume and velocity of the air delivered to the trunk, B, will vary in direct proportion to the speed of the rotor. The performance therefore is easy of regulation.

Above the mixing trunk, B, is a hopper, H′, formed by the sides of the frame, H, together with the inclined walls, H″. This hopper has cylindrical openings, 22, in its ends and is provided with partial cylindrical side walls, 23, the latter being parts of the walls, H″, and terminating at the opening, 4. The upper part of the hopper is occupied by the feed roll, D, and the trunk, D′, which supplies said roll. The lower part of the hopper is occupied by the valve, C. The chief member of the valve is a hub, 24, fixed on a shaft, 25. The latter is carried in central bearings, 26; which, preferably are integral with the cylindrical heads, 27, secured in, and closing, the cylindrical openings, 22. Said openings, 22, are of such size as to permit the valve to be passed endwise therethrough. The hub, 24, instead of being plainly cylindrical, is provided with parallel ribs, 24′, too short to reach the walls, 23. Flexible packing strips, 24″, are attached to the ribs, 24′, and sweep the walls, 23, as the valve is rotated. In this manner tight joints are preserved between the valve and the walls, 23, while the valve is in rotation. The purpose of this packing is to prevent air from blowing or drawing through the opening, 4. Either an upward blast or a downward draft within the hopper, H′, would tend to disturb the regularity of the operation of the feeder. I complete the packing of the valve by equipping its ends with plates, 28, and by placing soft packing disks, 29, preferably of oily felt, between the plates, 28, and the heads, 27. A further advantage of the packing, 29, is that it serves to exclude grit from the bearings, 26.

It should be observed that the rotary valve, C, as here illustrated, is essentially a cylindrical device containing a plurality of pockets, C′. These successively receive the material from the feed roll and convey the same to the mixing duct, B. The pockets, C′, are more than large enough to contain the maximum quantity of material which they may receive from the feed roll, D, at maximum speeds of operation. It may here be explained that ordinarily the valve, C, operates at a speed of from 25 to 30 revolutions per minute. This is sufficient to carry away the material delivered by the slowly rotated roll, D, and is fast enough to prevent noticeable fluctuations in the mixture discharged from the duct, B. Under some conditions the pocket valve, C, may be used as the primary feeder, but in most cases its chief function is that of a closure between the duct, B, and the hopper, H′.

The large feed roll, D, the feed trunk, D′, and the adjustable feed controlling gate, D″, in themselves constitute a combination which is new in itself and is capable of separate use. But as here shown, I prefer this combination as an auxiliary to the feeding or pocket valve, C. The roll is provided with side flanges, 30, which embrace the sides of the trunk, D′. The bottom, 31, of said trunk conforms to the cylindrical surface of the roll. The gate, D″, as shown, is slightly elevated above the surface of the roll and as the roll rotates, in the direction of the arrow, 32, it withdraws material from the trunk, D′, the thickness of the layer withdrawn being determined by the elevation of the gate, D″. Said gate is held by guides, 33, and, most conveniently, is raised and lowered by means of the racks and pinions, 34, 35. The pin-

ions are fixed on a shaft, 36, which may be turned by means of the hand wheel, 37. A pinion, 38, on the other end of the shaft, 36, coacts with a detent, 39, to hold the gate in any position to which it is adjusted by means of the hand wheel, 37. Obviously its position may be thereby changed at will; and thus the quantity of material fed by the roll, D, may be varied without changing the rotative speed of said roll, D. On the other hand, every change of feed roll speed results in varying the feed, assuming that the gate D'' remains fixed. Presently it will be seen that this variation of feed by the roll (independent of the gate) is accomplished automatically with every change of rotor speed in the blower, A. It should be noted that I position the gate, D'', directly above, and parallel to, the axis of the roll, D. In this position the gate coacts with the almost flat top of the roll and prevents the gravity flow of the material from the trunk, D'. At the same time it offers a minimum resistance to the positive feeding action of the feed roll. The roll, D, is keyed on a shaft, 40, which has bearings, 41, in the frame, H, and is held against longitudinal movement by the collars, 42, 43.

Most conveniently the feed roll, D, comprises a hollow cylinder, 44, and two end disks, 45, 45, the edges of which form the flanges, 30. The cylinder, 44, is centered by the internal flanges, 46, on the disks, 45. The hubs, 47, of the disks are keyed to the shaft, 40, as before explained; and the disks are held together by cross bolts, 48, completing a rigid structure.

As shown, I prefer that the feed roll, D, the valve, C, the duct, B, and the blower casing shall all be of the same width, but obviously this is not strictly essential. Greater capacity is provided by increasing this width.

The top of the casing, H, is preferably closed by a plate or flange on the base of the trunk, D', together with a door, 50, through which the feeding surface of the roll may be reached. This inclosing of the feeder makes the unit dustless, a very desirable feature.

The rotor of the blower, A, operates at high speed; the speed range, in practice, being from 1000 to 3000 revolutions per minute. The pocket valve operates at about fifteen revolutions per minute, for the low speed of the rotor; and at proportionately increased speeds for the higher speeds of the rotor. As explained, the feed roll operates in consonance with the blower and the valve, but at very much lower speed.

As the most convenient, economical and durable means of driving the valve, C, and the roll, D, in the manner stated, I employ a mechanism or coupler, of which the vertical shaft, 51, is the chief element. A housing, 52, is provided on the bearing block, 21. Other housings, 53 and 54, are provided on the ends of respective shafts, 25 and 40. These housings provide bearings for the vertical shaft, 51. The lower end bearing of the shaft is a step, 52'. Within the housing, 52, I provide the worm, 55, and the worm gear, 56, the former being fixed on the shaft, 13, and the latter keyed to shaft, 51. Similarly there is a worm, 57, on the shaft, 51, and a worm gear, 58, on the shaft, 25. A smaller worm, 59, and a larger worm gear, 60, are provided in the housing, 54. The rotative directions of the blower, A, the valve, C, and the roll, D, are indicated by arrows in Fig. 1. It will be clear from the drawings that the high speed of the shaft, 13, is reduced in the shaft, 51, through the agency of the worm, 55, and gear, 56. It will also be clear that the worm gears belonging to the valve and to the feed roll are so proportioned as to the proper relation between the peripheral speeds of those elements.

The several housings and bearings depicted are filled with grease and the unit is capable of operating continuously for long periods without attention, other than that required to regulate the feed.

I have not attempted to show the switches and starting box belonging to the motor, they being of common construction.

Every variation of speed in the motor, F, causes corresponding variations in the rotor, the valve and the feed roll. It follows that the operation of the unit is conveniently controlled by means of the regulator, 16, belonging to the motor, and by means of the gate adjusting device, 37. By increasing the speed of the motor the delivery of mixture may be increased. By adjusting the gate, D'', the proportions of air and solid material may be varied as desired.

The feeder unit herein described is used in connection with means (not shown) adapted to keep the trunk, D', full of coal or other material at all times. To start the operation it is only necessary to start the motor and raise the gate, D''. Thereupon air will be forced through the mixing duct, B, and simultaneously material will be withdrawn from the trunk, D', by the feed roll. Falling into the hopper, H', the material is received by the rotating pocket valve and is thereby discharged into the current of air moving through the duct, B. The elongation of the feed valve to substantially the full width of the duct, B, insures the even distribution of the material therein. Unless the regulators, 16 and 37, are adjusted the unit continues to operate without variation.

It will be obvious that instead of making the casing, 5, of the blower integral with

the unit frame, said casing may be separate and may be put into the frame through the open bottom thereof.

As depicted, I prefer to make the unit frame in three sections, which are parted on the planes of the shafts, 13 and 40.

Various structural modifications, all within the intent and scope of the invention, will suggest themselves to those who are skilled in the art.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:—

1. The feeder herein described, comprising a mixing duct having an opening in its top, in combination with a blower beneath said duct and having its outlet connected therewith, a rotary pocket valve closing said opening, but serving as a conveyer to discharge material into said duct, a hopper from which said pocket valve is fed, a feed roll positioned to feed material to said hopper, a feed trunk positioned to feed said roll, an adjustable gate for regulating the feed from said trunk, and means for driving said blower, said valve and said roll at different but proportionately fixed speeds.

2. The feeder herein described, comprising a mixing duct having an opening in its top, in combination with a blower for moving air or like through said duct, a rotary pocket valve closing said opening but serving as a conveyer to discharge material into said duct, a hopper from which said pocket valve is fed, a feed roll positioned to feed material to said hopper, a feed trunk positioned to feed said roll and an adjustable gate for regulating the feed from said trunk.

3. A feeder comprising a receiving duct having a receiving opening in its top, in combination with a hopper rising from said opening, a rotary feeding valve positioned in said opening, a feed trunk, a feed roll, forming the bottom of said trunk, and positioned in said hopper, and a feed regulating gate coacting with said trunk and roll.

4. A feeder comprising a receiving duct having a receiving opening in its top, in combination with a hopper rising from said opening, a rotary feeding valve positioned in said opening, a feed trunk, a feed roll forming the bottom of said trunk, and positioned to deliver material therefrom into said hopper, a fuel feed regulating gate coacting with said trunk and roll, and means for driving said valve and said roll at a proportionally fixed speed.

5. The feeder herein described, comprising a mixing duct having an opening in its top, in combination with a rotary blower for moving air or like through said duct, a rotary pocket valve closing said opening, but serving as a conveyer to discharge material into said duct, a feed roll positioned to feed material to said valve, a feed trunk positioned to feed said roll, an adjustable gate for regulating the feed from said trunk, means for driving said blower at high speed, and a speed reducing positive drive coupler whereby rotation is imparted from said blower to said roll and valve.

6. The feeder herein described, comprising a mixing duct having an opening in its top, in combination with a rotary blower for moving air or like through said duct, a rotary pocket valve closing said opening but serving as a conveyer to discharge material into said duct, a feed roll positioned to feed material to said valve, a feed trunk positioned to feed said roll, an adjustable gate for regulating the feed from said trunk, means for driving said blower at high speed and a speed reducing positive drive coupler whereby rotation is imparted from said blower to said roll and valve.

7. The feeder herein described comprising a mixing duct having an opening in its top, in combination with means for moving air or the like through said duct, a rotary pocket valve closing said opening but serving as a conveyer to discharge material into said duct, a hopper from which said pocket valve is fed, a feed roll positioned to feed material to said hopper, a feed trunk positioned to feed said roll, and a feed regulating gate co-acting with said duct and roll.

In testimony whereof, I have hereunto set my hand this 17th day of February, 1917.

JOSEPH MARTIN SCHUTZ.