No. 789,678. PATENTED MAY 9, 1905.

F. N. SPEAR.

FUEL BURNING APPARATUS.

APPLICATION FILED SEPT. 12, 1901.

2 SHEETS—SHEET 1.

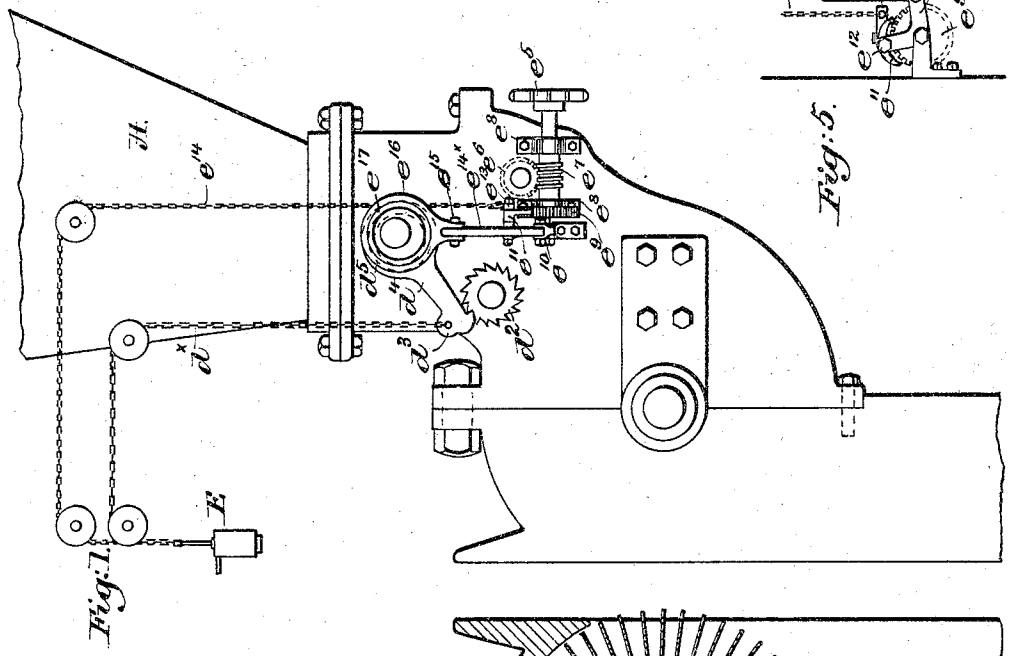


Fig. 1.

Fig. 5.

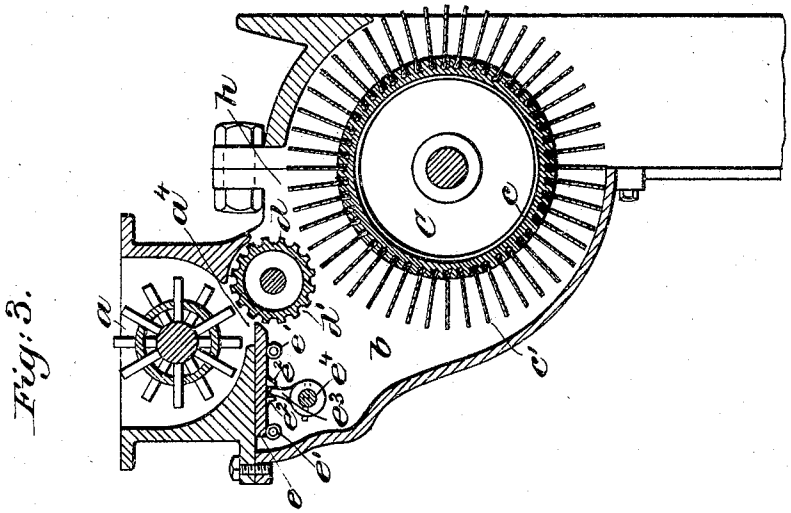


Fig. 3.

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2 SHEETS—SHEET 2.

Fig: 2.

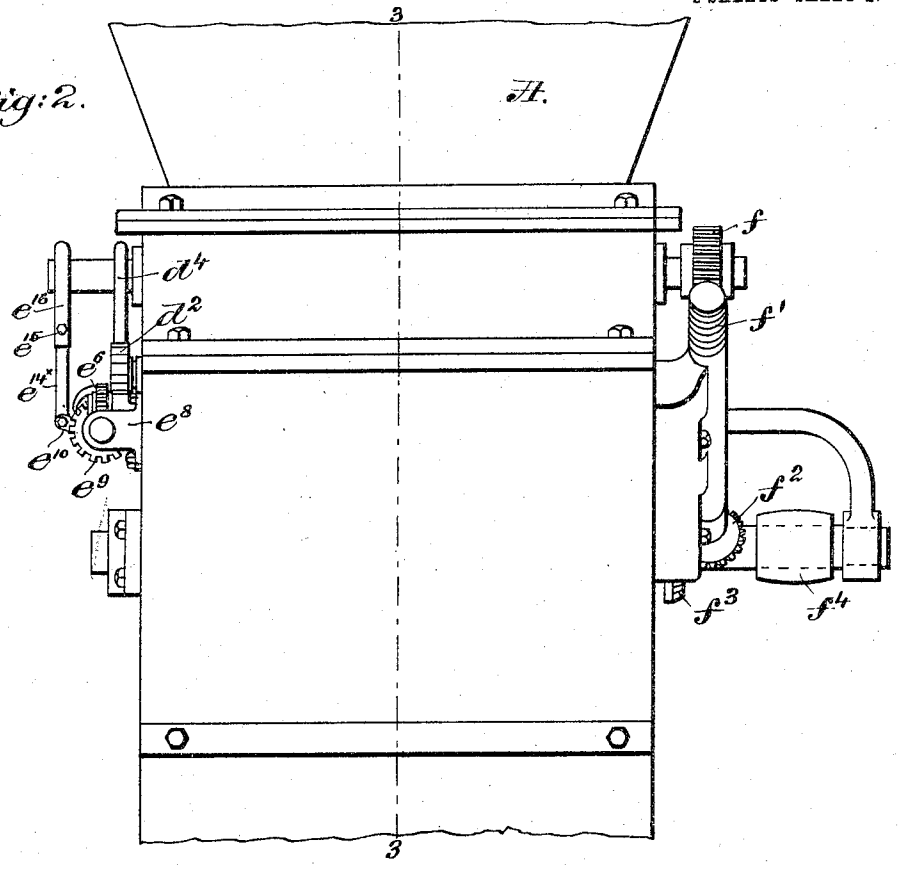
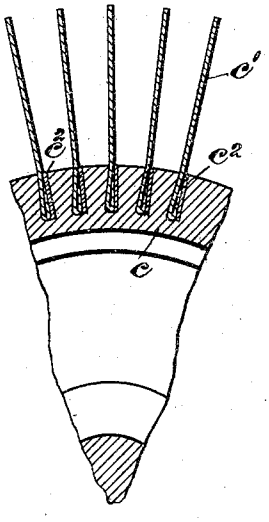


Fig: 4.



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UNITED STATES PATENT OFFICE.

FRANK N. SPEAR, OF LOS ANGELES, CALIFORNIA.

FUEL-BURNING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 789,678, dated May 9, 1905.

Application filed September 12, 1901. Serial No. 75,140.

To all whom it may concern:

Be it known that I, FRANK NORMAN SPEAR, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented an Improvement in Fuel-Burning Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention has for its object to improve apparatus for burning pulverulent or finely-comminuted fuel.

Among other things my invention aims to produce means for more accurate regulation of the feed of the fuel to the devices that deliver the same into the combustion-chamber, whereby the combustion may be more quickly and accurately controlled, and thereby made more sensitive and responsive to the demands upon it and the variance in steam-pressure.

In the accompanying drawings, Figure 1 is a side elevation of an apparatus illustrating one embodiment of my invention; Fig. 2, a front elevation of the apparatus shown in Fig. 1; Fig. 3, a vertical section on the dotted line 3 3, Fig. 2; Fig. 4, a detail, on an enlarged scale, showing a novel construction of a delivery device; and Fig. 5 a detail to be described.

In the particular embodiment of my invention selected for illustration herein and shown in the drawings, A indicates a supply-chamber, which may be the end of a supply-conduit leading from a suitable conveying apparatus or when in the form shown may constitute a hopper into which the pulverulent comminuted fuel is deposited. In the bottom of this chamber there is arranged a feeder and loosener a, shown as rotary and provided with projecting pins or members that act during rotation of the device to loosen the fuel in the vicinity of the bottom of said chamber and also in a measure act to cause positive movement of such fuel toward the outlet for said chamber. The supply-chamber has an outlet passage or communication a^4, shown in or near the bottom thereof, said communication opening into the delivery-chamber b, formed within a suitable casting constructed and adapted to be secured to the front of the furnace or combustion chamber to which fuel is to be supplied. This delivery-chamber b contains the delivery device C, here shown as rotary and comprising the barrel or cylinder c, mounted on suitable end journals and longitudinally grooved at its periphery to receive the wings or blades c'. (See Fig. 4.) In the construction here shown the grooves in the said barrel or cylinder are made dovetail in shape, with their inner ends wider than their outer or entrance ends, and the inner edges of said wings or blades are folded upon themselves and inserted in said dovetail grooves or recesses, in which they are secured in suitable manner, as by the insertion of wedges c^2. This forms a simple, convenient, and inexpensive means for attaching said wings or blades and also provides for ready removal thereof should occasion require. While these wings or blades are here shown as arranged parallel with the axis of the delivery device, obviously the general longitudinal arrangement thereof would be the same if the alinement of said wings or blades were varied somewhat.

Referring now to Fig. 3, the passage or communication a^4 between the supply-chamber A and the delivery-chamber b is provided with a measuring device, here shown in the form of a roller d, journaled in suitable bearings at its ends and provided at its periphery with pockets or grooves d', here shown as extended continuously from one to the other end of said roller. Opposed to this measuring device d in the construction shown is a feed-controlling device, shown in the form of a sliding guide e, mounted in suitable manner, as upon the rollers e', and adapted to be moved toward and from said measuring device. When moved with its edge close against said measuring device, the quantity of fuel permitted to pass through said communication a^4 from one to the other of said chambers is determined wholly by the capacity of the pockets in said measuring device and the rate of movement thereof. When moved more or less away from said measuring device, the quantity of fuel permitted to pass through said communicating passage is regulated only in part by said measuring device and in part by

the area of open communication between said chambers. Thus it is possible to provide for the most accurate regulation of the quantity of fuel permitted to pass into the delivery-chamber. For very fine regulation and light feeds the measuring device alone is ordinarily depended upon; but when greater capacity is required or when starting the apparatus said controlling device e is so moved as to permit a freer flow of fuel through said passage until such time as a less amount of fuel is required. In any case the fine regulation may be had by varying the rate of speed of rotation of the measuring device, while the more general regulation may be had by means of the feed-controlling device e.

The measuring device and feed-controlling device may be actuated in suitable and desired manner. Herein said measuring device is provided at one end at the outside of said apparatus (see Fig. 1) with a ratchet-wheel d^2, adapted for engagement by a pawl or hook d^3 on or carried by an eccentric-rod d^4 of an eccentric d^5, fast on one of the end journals of the rotating loosener a in the bottom of the supply-chamber.

The sliding feed-controller e is here shown as provided at its under side with a pair of ears e^2 e^2, between which works the end of a rocker-arm e^3 on a rocking shaft e^4, journaled in the side wall of the delivery-chamber. This rock-shaft may be operated in suitable manner either by hand or automatically. I have here provided automatic means for moving said controlling device as follows: Upon the extended end of said rock-shaft is a worm-wheel e^6, driven by a worm e^7 on a worm-shaft, journaled in suitable bearings e^8 on the chamber-wall, said worm-shaft at one end being fitted with a fine-toothed ratchet-wheel e^9. The end of said worm-shaft projects beyond the ratchet-wheel e^9 and carries a bell-crank lever e^{10}. (See Fig. 5.) One of the arms of this bell-crank lever has fulcrumed upon it the double-acting pawl e^{11}, the pivot e^{12} of which carries an arm e^{13}, shown as attached to a connection e^{14}, forming part of a suitable automatic regulating device typified at E, and which may be a pressure-responsive device of usual type and construction responsive to the changes in pressure of the boiler in connection with which the apparatus may be used. As the said connection e^{14} is raised by said device—indicating, for example, a rise in pressure—the pawl e^{11} will be turned into position to rotate the ratchet-wheel e^9 in the direction of the arm thereon and cause the rock-shaft e^4 to be moved to close the feed-passage between the supply and the delivery chambers of the apparatus. When said connection e^{14} is moved in an opposite direction, indicating a fall of pressure, said pawl e^{11} will be turned on its pivot into position to cause rotation of said ratchet-wheel and movement of its controlling device in an opposite direction to open said passage. The bell-crank lever e^{10}, that vibrates the pawl e^{11}, is itself actuated by an eccentric-rod $e^{14\times}$, jointed at e^{15} to the strap e^{16} of an eccentric e^{17}, also fast on the journal of said loosener device a. Thus rotation of said loosener by constantly vibrating said bell-crank causes its pawl e^{11} to reciprocate step by step the said ratchet-wheel in one or the opposite direction, according to the particular end of said pawl that is permitted by the automatic device to be in engagement with said ratchet-wheel. At normal pressure the connection e^{14} holds the said pawl in intermediate position, in which neither of its ends is permitted to engage with the teeth of the ratchet-wheel. The worm-shaft e^7 has a hand-wheel e^5, by which to rotate the measuring device d manually when desired.

In the operation of the apparatus the fuel deposited in the supply-chamber is fed through into the delivery-chamber at a rate determined by the said measuring device and said controlling device acting together or singly, such fuel upon entering said delivery-device chamber being caught by the rapidly-revolving delivery device and projected by the wings thereof into the combustion-chamber, there to promote combustion in well-known manner. Air admitted to the delivery-chamber, as through the opening h, is combined with the fuel entering said chamber and is projected with said fuel and thoroughly mixed therewith into the combustion-chamber.

In the construction here shown the feed device is operated automatically, and whatever movement is imparted to it is an automatic movement produced by the moving parts of the machine itself. Under ordinary conditions the movement of the measuring device, while intermittent would probably be continuous; but under certain conditions the movement may be made to cease at intervals to aid in regulating the feed of the fuel. To accomplish this, in the present instance of my invention I have connected the hooked actuator for the ratchet d^2 by a connection $d^\times$, also with said automatic regulator E, whereby movements of the latter in response to variations in pressure within the boiler will act to lift said hooked actuator from engagement with said ratchet and drop it into engagement therewith, as required to stop or start rotation of said measuring device, according to the requirements upon the apparatus. Obviously this automatic regulation of the automatically-operating measuring device and feed-controlling device may be used in connection with either of said devices, or both, at will.

The rotary loosening device a and delivery-clearing device c may be operated in well-known manner, as by the worm-wheel f, worm f', gears f^2 f^3, and pulley f^4, Fig. 2.

While I have here described one embodiment of my invention sufficiently to enable the latter to be understood, yet my invention is not limited to the embodiment shown nor in the matter of details, but may be varied within the spirit and scope of said invention.

What I claim, and desire to secure by Letters Patent, is—

1. A pulverulent-fuel-feeding apparatus having a supply-chamber, a delivery-chamber and a passage connecting the two and provided also with a traveling measuring device for said passage but leaving an opening to normally permit the passage therethrough of pulverulent fuel independently of the movement of said measuring device, agitating means to cause said fuel to be presented to said measuring device and passage in a separated or divided condition, and rotary delivery means to receive said fuel on its emergence from said passage and to deliver the same to the combustion-chamber.

2. A pulverulent-fuel-feeding apparatus having a supply-chamber, a delivery-chamber and a passage connecting the two and provided also with a traveling measuring device in said passage but leaving an opening to normally permit the passage therethrough of pulverulent fuel independently of the movement of said measuring device, means responsive to boiler conditions for controlling the area of said opening and the action of said measuring device, and delivery means to deliver the pulverulent fuel from said delivery-chamber to the combustion-chamber.

3. A pulverulent-fuel-feeding apparatus having a supply-chamber and a delivery-chamber and a passage connecting the two and provided also with a traveling measuring device for said passage but leaving an opening to normally permit the passage therethrough of pulverulent fuel independently of the movement of said measuring device, means responsive to boiler conditions for controlling the area of said opening and delivery means for delivering the fuel from said delivery-chamber to the combustion-chamber.

4. A pulverulent-fuel-feeding apparatus having a supply-chamber, a delivery-chamber, a traveling measuring device for measuring definite quantities of pulverulent fuel and permitting their passage to the delivery-chamber, means also to supply said delivery-chamber with pulverulent fuel independently of the action of said measuring device, means for varying the quantity of fuel fed to said delivery-chamber both by said measuring device and said independent means, and delivery means to deliver the fuel from said delivery-chamber to the combustion-chamber.

5. A pulverulent-fuel-feeding apparatus having a supply-chamber, a delivery-chamber, a traveling measuring device for measuring definite quantities of pulverulent fuel and permitting their passage to the delivery-chamber, means also to supply said delivery-chamber with pulverulent fuel independently of the action of said measuring device, means for varying the quantity of fuel fed to said delivery-chamber, and delivery means to deliver fuel from said delivery-chamber to the combustion-chamber.

6. A pulverulent-fuel-feeding apparatus having a supply-chamber, a delivery-chamber, a traveling measuring device for measuring definite quantities of pulverulent fuel and permitting its passage to the delivery-chamber, means also to supply said delivery-chamber with pulverulent fuel independently of the action of said measuring device, means responsive to boiler conditions for varying the quantity of fuel fed by said measuring device and delivery means to deliver the fuel from said delivery-chamber to the combustion-chamber.

7. A pulverulent-fuel-feeding apparatus having a supply-chamber, a delivery-chamber, a traveling measuring device for measuring definite quantities of pulverulent fuel and permitting its passage to the delivery-chamber, means also to supply said delivery-chamber with pulverulent fuel independently of the action of said measuring device, means for controlling the supply of fuel fed by said independent supply means and delivery means to deliver the fuel from the delivery-chamber to the combustion-chamber.

8. A pulverulent-fuel-feeding apparatus having a supply-chamber, a delivery-chamber, a traveling measuring device for measuring definite quantities of pulverulent fuel and permitting its passage to the delivery-chamber, means also to supply said delivery-chamber with pulverulent fuel independently of the action of said measuring device and delivery means to deliver the fuel from said delivery-chamber to the combustion-chamber.

9. A pulverulent-fuel-feeding apparatus having a supply-chamber, a traveling measuring and feeding device to measure and feed pulverulent fuel in a continuous stream, from said supply-chamber to said delivery-chamber, agitating means to cause said fuel to be presented to said measuring device in a separated condition, and rotary delivery means arranged in close proximity to said measuring and feeding device to receive the fuel directly therefrom and deliver the same to the combustion-chamber still in its separated condition.

10. A pulverulent-fuel-feeding apparatus having a supply-chamber, a delivery-chamber, a traveling measuring and feeding device to measure and feed the fuel in a continuous stream, from said supply-chamber to said delivery-chamber, a rotary delivery device arranged in close proximity to said measuring and feeding device to receive the fuel directly therefrom and deliver the same into the combustion-chamber and means for varying the amount of fuel measured and fed by said device.

11. A pulverulent-fuel-feeding apparatus having a supply-chamber, a delivery-chamber, a traveling measuring and feeding device to measure the fuel and permit the same to be fed to said delivery-chamber, a rotary delivery device arranged to receive the fuel from said measuring device and to deliver the same into the combustion-chamber.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANK N. SPEAR.

Witnesses:
FREDERICK L. EMERY,
A. E. CHESLEY.