N. L. WARFORD.

PULVERIZED COAL BURNER.

APPLICATION FILED DEC. 5, 1914.

1,147,833. Patented July 27, 1915.

FIG. 1.

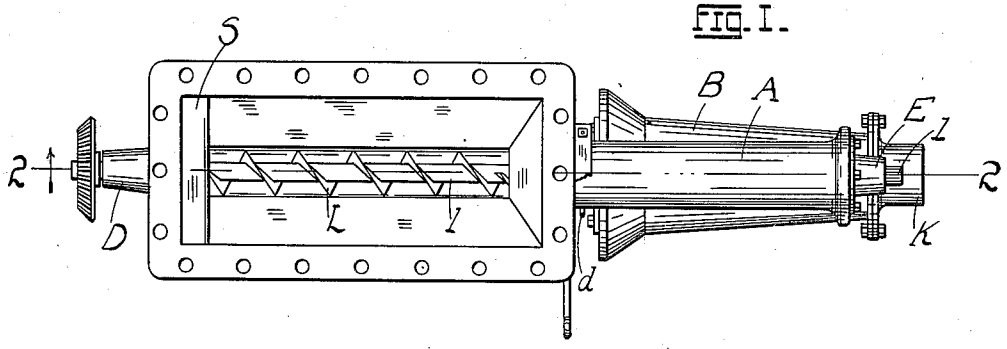


FIG. 2.

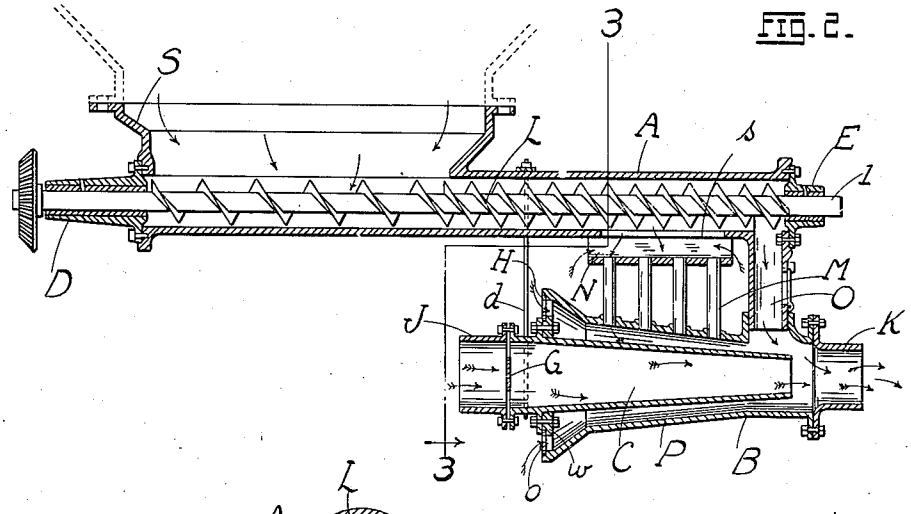
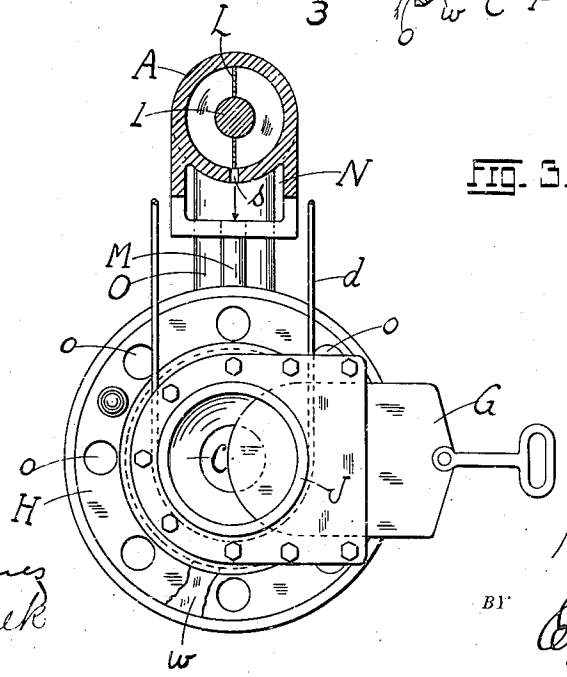


FIG. 3.



WITNESSES:

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PULVERIZED-COAL BURNER.

1,147,833. Specification of Letters Patent. Patented July 27, 1915.

Application filed December 5, 1914. Serial No. 875,665.

To all whom it may concern:

Be it known that I, NORMAN LEW WARFORD, a citizen of the United States, residing at Anaconda, in the county of Deerlodge and State of Montana, have invented certain new and useful Improvements in Pulverized-Coal Burners, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention has relation to improvements in pulverized coal burners; and it consists in the novel features of construction more fully set forth in the specification and pointed out in the claims.

In the drawings, Figure 1 is a top plan of my improved burner; Fig. 2 is a vertical longitudinal section on the line 2—2 of Fig. 1; Fig. 3 is an enlarged vertical cross-section on the zig-zag line 3—3 of Fig. 2.

The present invention is directed to a burner which shall operate on any suitable powdered or comminuted material such as coal dust, pulverized coal, coke, wood dust, and other equivalent material capable of responding to a blast of air or other gas under pressure for purpose of feeding the same to a furnace, fire-box, or other point of consumption.

Among the objects sought are (1) to provide a burner which will effect a thorough mixture between the fuel and air (or oxygen) before their conjoint discharge out of the burner nozzle or chamber to their ultimate point of consumption; one in which the operator can have perfect control over the character of the final mixture of fuel and air; one which shall insure perfect and complete combustion of the fuel; one which is simple in construction and susceptible of ready manipulation; and one possessing further and other advantages better apparent from a detailed description of the invention, which is as follows:

Referring to the drawings, S represents a fuel hopper into which the powdered coal (or its equivalent) is first charged from any suitable source (not shown) and from which the fuel is discharged into a dust-tight casing or housing A in which operates a feed-screw conveyer L, the shaft *l* of which is supported in a drive-end bearing D and a discharge-end bearing E as shown, rotation to the conveyer being imparted from any suitable power (not shown) applied to the drive-end of the shaft *l* as fully understood by the skilled mechanic. Formed in the bottom wall of the housing A at a point beyond the hopper S, but terminating short of the free end of the housing is a longitudinally disposed long narrow slot *s* discharging the fuel or powdered coal in a thin stream into an open ended depression or air pocket N freely traversable by air currents, said fuel stream being received by a series of tubes, pipes or conduits M leading from the bottom of the pocket, the lower ends of the pipes communicating with, and discharging into the mixing chamber P of the mixing chamber casing or housing B, said chamber being traversed by a longitudinally disposed blast air-nozzle C spaced from the walls of the chamber and terminating at its inner end beneath the bottom of the large pipe O leading from the extreme end of the housing A beyond the slot *s*. The nozzle C is bolted to the casing B and additionally braced by a strap or hanger *d*, the outer end of the nozzle having secured thereto a sleeve J for connecting the same to a blast air-pipe (not shown) leading from any suitable source of compressed air or gas supply, a suitable valve or blast air-control gate or valve G being interposed between the members C and J as shown. The peripheral walls of the housing B flare outwardly at the end opposite from the discharge end of the nozzle C, the wall *w* closing said flaring end being provided with a free air intake opening or openings *o* controlled by a suitable valve or damper H. The valves G and H may be any variety known to the trade and are shown herein more or less conventionally.

K represents a sleeve for connecting the mixing chamber with any suitable discharge pipe (not shown) adapted to deliver the powdered fuel into a furnace or fire box or other point of consumption, not shown. The member K or said member with any pipe extension thereof should one be necessary, may be termed as the burner pipe or nozzle, since it would be at the discharge end of such member where ignition of the sprayed fuel would first take place when the fuel was ignited.

The operation of the burner is substantially as follows: The powdered fuel gravitates along the inclined walls of the storage hopper S, toward the screw conveyer L, which, as it rotates, advances the charge through the housing A and over the slot *s*,

any material not escaping through the slot being carried forward to the intake end of the large pipe O through which it drops onto the walls of the inner end of the blast nozzle C. The large passage afforded by the pipe O prevents clogging of the fuel dust in the housing A should the fuel for any reason fail to escape freely through the narrow slot *s*. The material drops through the slot *s* in the form of a thin stream or sheet which flows through the open ended pocket N into and through the pipes M, and falls onto the peripheral walls of the nozzle C (located beneath the pipes M) said pipes M serving to spread the same and subdivide it, thereby affording free access of the air to each particle of fuel and insuring a thorough final mixture of fuel and air. As the powdered fuel drops from the walls of the blast nozzle, the material is picked up by the current of free air induced through the openings *o* controlled by the damper H, it being understood that the blast of air (or other gas) under pressure traversing the nozzle C operates on the principle of an injector, drawing after it not only a current of free air through the openings *o*, but also the powdered fuel picked up by said current as it is drawn rearwardly through the space between the walls of the members B and C. The current thus induced not only picks up the fuel distributed over and dropping from the walls of the blast nozzle C beneath the pipes M, but likewise the portion which drops onto the nozzle walls through the large pipe O. As the fuel or powder-laden current passes by the rear or discharge end of the nozzle C, it comes in contact with the blast traversing and escaping from the nozzle, and is forcibly projected through the member K and any extension thereof if there be any, into the fire box or furnace or other point of consumption. The ends of the pocket N being open to the atmosphere, it follows that a current of air will likewise be induced through the pocket and be drawn with the fuel as the latter flows through the tubes M. It follows therefore that the fuel receives its initial mixture of air at the intake ends of the tubes M or as it leaves the slot *s*. This initial accession or instalment of air is a very important feature of my invention, as it insures a final sufficiency of air (with the portion drafted into the mixing chamber P through the openings *o*) to effect complete combustion of the fuel as the latter is projected out of the mixing chamber P. The pipes or tubes M perform another function not heretofore mentioned, to wit, they serve to subdivide the sheet of fuel as it leaves the slot *s* so as to effect a better mingling between the air (drafted through the pocket N) and the fuel falling through the tubes.

Obviously the details of the burner might be changed in many particulars within the purview of the skilled mechanic, without departing from the nature or spirit of the invention.

Having described my invention, what I claim is:

1. In a fuel burner of the character described, a source of fuel supply, a casing for receiving the fuel, a screw-feed conveyer in said casing, means operating to discharge the fuel from said casing in the form of a sheet disposed substantially parallel to the axis of the conveyer, means for subdividing said sheet, a mixing chamber for receiving the fuel so subdivided, and a blast nozzle in said chamber disposed in the path of discharge of said fuel, whereby the fuel is distributed for substantially its full length along the walls of the nozzle to afford access of air to the particles of the fuel so distributed.

2. In a fuel burner of the character described, a source of supply for the fuel, means for conveying the fuel to a point of discharge in sheet form, an air pocket for initially receiving the fuel-sheet, a mixing chamber, means interposed between the pocket and mixing chamber for subdividing the fuel-sheet and delivering the same into the mixing chamber, a blast nozzle in the mixing chamber disposed in the path of discharge of the subdivided material, the blast operating to cause atmospheric air to mingle with the fuel delivered to the pocket and to the mixing chamber, and suitable outlet means from the mixing chamber coöperating with the blast nozzle.

3. In a fuel burner of the character described, a source of supply for the fuel, means for conveying the fuel to a point of discharge in sheet form, means for subdividing said sheet, a mixing chamber, and a blast nozzle in said chamber positioned to intercept the fuel so subdivided throughout substantially the full length thereof.

4. In a fuel burner of the character described, a source of fuel supply, a mixing chamber, an air pocket for receiving the fuel from said supply source, a series of conduits for conducting the fuel from said air pocket to the mixing chamber, and means positioned in the path of discharge of the fuel from said conduits for supplying air to the fuel while in the mixing chamber.

5. A burner of the character described comprising a casing provided with an intake and a terminal discharge opening, a screw conveyer for advancing the material from the intake toward the discharge opening, there being a longitudinal discharge slot of a relatively smaller area than the terminal discharge opening interposed between the latter and the intake end of the casing, an air pocket or depression communicating with the slot, a mixing chamber, a series of tubes connecting the air pocket with

the mixing chamber, a pipe connecting the terminal discharge opening of the conveyer casing with the mixing chamber, the said chamber being provided with a discharge opening, a blast nozzle traversing the mixing chamber beneath the discharge ends of the tubes and pipe aforesaid and spaced from the walls of the chamber, the fuel-intake ends of the tubes being in free communication with the atmosphere through the air pocket aforesaid, the mixing chamber being provided with a valve-controlled free air inlet opening whereby a final complement of air is drawn into the mixing chamber, the blast nozzle discharging toward the discharge opening of the mixing chamber.

6. In a fuel burner of the character described, a conveyer casing provided with a narrow slot for discharging the material in sheet form, a multiplicity of conduits for subdividing the sheet into independent streams, a mixing chamber for receiving the subdivided material, and means in the path of discharge of the material from said conduits for supplying air to the mixing chamber.

7. In a fuel burner of the character described, a conveyer casing provided with means for discharging the material in sheet form, means for subdividing the sheet into independent streams, a mixing chamber for receiving the subdivided material, and a blast nozzle in the mixing chamber positioned in the path of discharge of the subdivided material.

In testimony whereof I affix my signature, in presence of two witnesses.

NORMAN LEW WARFORD.

Witnesses:

W. C. CAPRON,

H. G. WRIGHT.