

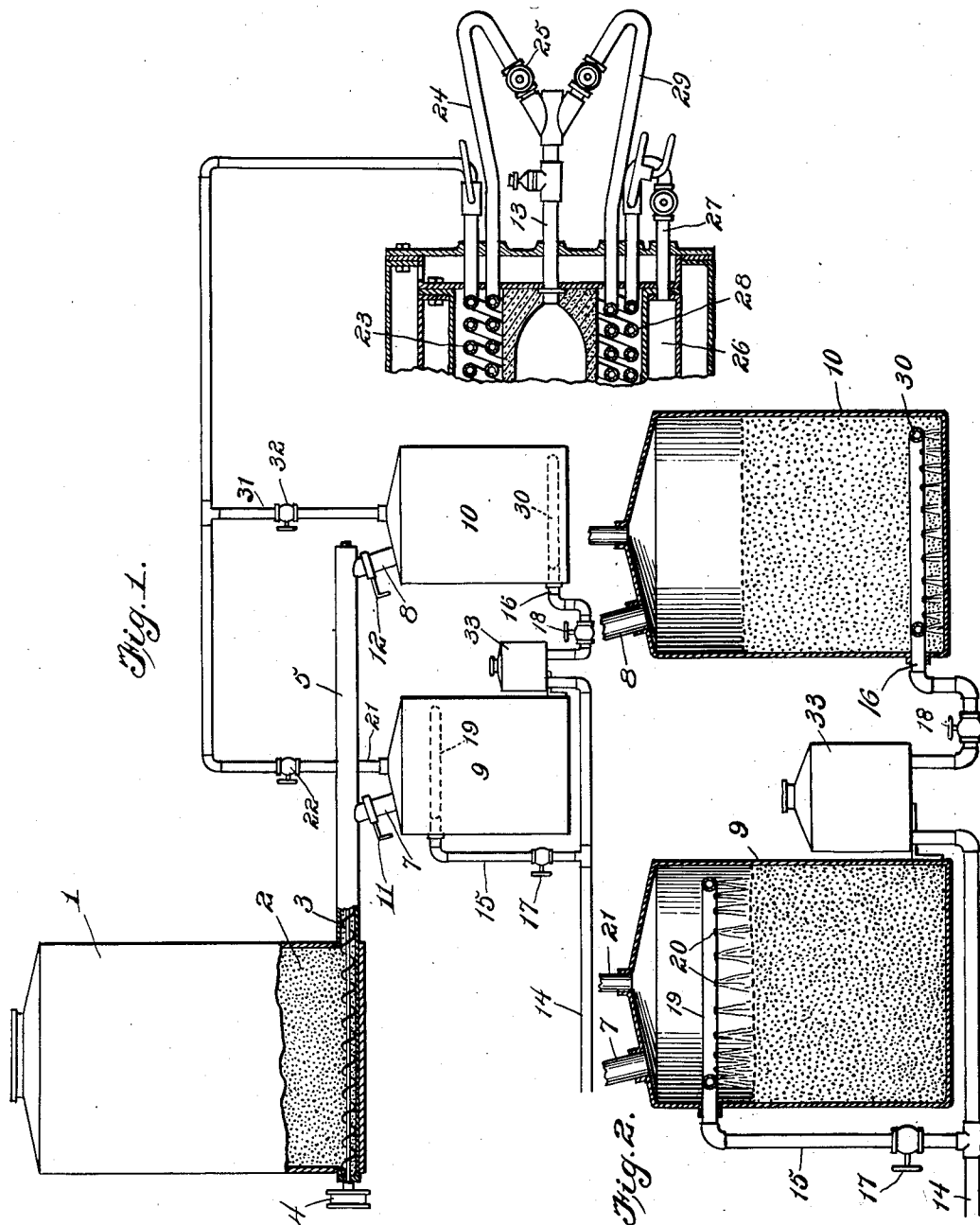
Nov. 3, 1925.

1,559,810

W. E. TRENT

METHOD OF FEEDING DRY PULVERIZED COAL

Filed Oct. 22, 1919



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Patented Nov. 3, 1925.

1,559,810

UNITED STATES PATENT OFFICE.

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METHOD OF FEEDING DRY-PULVERIZED COAL.

Application filed October 22, 1919. Serial No. 332,548.

To all whom it may concern:

Be it known that WALTER E. TRENT, a citizen of the United States of America, residing at Washington, in the District of Columbia, has invented certain new and useful Improvements in Methods of Feeding Dry-Pulverized Coal, of which the following is a specification.

The present invention relates to a method of feeding materials in a fine state of division, and although particularly adapted for the feeding of dry pulverized coal, it is capable of use in many other fields where it is desirable to feed a finely pulverized substance.

In the prior art methods it has heretofore been the custom to feed dry pulverized coal by mechanical means directly into a moving air current to be carried therein to a point of consumption. Methods of this character are not adaptable for feeding coal into generators operating under high internal pressures and are limited in use to boilers and furnaces operating under atmospheric pressure conditions.

The present invention comprises a method of feeding dry powdered coal dust continuously and uniformly under pressures of several hundred pounds to the square inch to pressure generators, or to boilers and furnaces under any desired pressures, eliminating the necessity of mechanical apparatus for metering the feeding of the fuel.

It is a further object of the invention to provide a method of feeding dry pulverized coal which consists in introducing a quantity of coal dust to a closed receiver, and in then blowing or carrying the coal in suspension in a fluid air current under pressure from the receiver to a point of consumption. The air, in addition to acting as a vehicle for feeding the coal, also forms a part of the air necessary to support the combustion thereof, additional air as may be required being supplied at or near the point of combustion.

In following the present method, where coal is to be fed, a closed receptacle is supplied with a given quantity of finely powdered coal dust and then the source of supply closed. Air is introduced to the closed receptacle at a higher velocity, preferably discharging downwardly upon the surface of a batch of coal creating air currents with-

in the receptacle to agitate or throw the dust into the currents which carry the same entrained therein from the receptacle to a point where the coal is to be consumed. It has been found that by introducing the air current to the receptacle at its upper portion so that the same discharges downwardly upon the surface of the coal, it causes a uniform feeding of the dust without allowing the coal left in the tank to absorb the moisture of the air. This manifestly prevents the dust from becoming damp or soggy, which condition may happen if the air is blown upwardly through the charge of coal dust, thus stopping the feeding of the same from the tank before its entire contents have been discharged.

It has been found that the air stream entering the closed receptacle can be made to carry more coal dust than its supply of oxygen will cause to burn, so that the mixture may be kept overrich and non-explosive during a superheating until additional air is introduced thereto at the point of burning. The additional air necessary to form the combustible charge is preferably also superheated and mixes with the overrich mixture at or near the combustion chamber. It will, therefore, be seen that by having part of the necessary air of combustion carrying all of the coal dust, it is possible to handle the dust in a perfectly safe manner while being superheated, which overrich mixture, after its heat treatment, is joined with a supply of heated air so that the ultimate mixture at the point of combustion will consist of the proper ratio of air and coal dust.

In following the present method, while it has been found preferable to introduce the air to a closed receptacle containing the batch of coal so as to discharge downwardly upon the surface of the mass, it will, of course, be understood that the air can be introduced to the bottom of the receptacle and allowed to pass up through the charge of coal dust carrying with it a determined quantity of coal, depending upon the pressure and velocity of the air. If the air is introduced to the receptacle in this manner, it is preferable to first pass the same through an apparatus to extract the moisture from the air so that when the same enters the closed receptacle it will have no

tendency to cause the mass of coal to become damp or soggy, which condition interrupts, or stops, the coal feeding entirely.

After the coal dust has left the receptacle and is travelling in suspension in the air currents, the mixture is preferably given a heat treatment prior to its discharge at a point of combustion by conveying the mixture through a conducting pipe disposed adjacent the combustion chamber of a generator so as to absorb some of the intense heat of the products of combustion and render the mixture in a condition to facilitate the burning of the coal. The additional air to be used with the coal to support the combustion thereof is preferably, as before stated, given a preliminary heat treatment, and I have disclosed in my copending application, Serial Number 326,899, a highly efficient apparatus for preheating both the air and fuel so as to render the fuel highly combustible, and this form of apparatus is preferably employed in following the herein described method.

In the accompanying drawings I have shown and described suitable apparatus capable of supporting the method, but it will be understood that many other forms of apparatus varying materially in structure may be used without departing from the spirit of this invention.

In the drawings Figure 1 represents a view of the apparatus with parts in section.

Figure 2 is a sectional view of the receiving tanks.

Referring now more particularly to the drawings wherein like reference characters indicate corresponding parts, the numeral 1 designates a main source of supply which is adapted to receive pulverized or finely divided material 2 that may be coal, reduced ore, or a mixture of ore and coal. If the material is coal, the same may have undergone a preliminary treatment so as to free it of its ash-forming substances as specified in my application, Serial Number 309,642, Patent No. 1,420,163, June 20, 1922, but it will, of course, be understood that it is not entirely essential that the coal be cleaned in this manner before introduction to the supply bin 1, as finely pulverized coal, such as is now usually burned, may be used for some purposes. Disposed within the body of the receptacle 1 is a screw feed conveyor 3, driven by the pulley 4 for discharging the coal through the feed pipe 5 having communications 7 and 8 with the coal receiving receptacles 9 and 10, two of these receptacle being shown for the purpose of illustration, but manifestly any desired number of receptacles may be employed. The communications 7 and 8 are controlled by the independently operable valves 11 and 12 so that by proper manipulation of either of these valves, a supply of coal dust may be intro-

duced to a single receptacle at the time, or to both simultaneously.

When pulverized coal is to be fed in its dry state to a combustion conduit designated by the reference character 13, a portion of a generator and this conduit being disclosed in Figure 1 of the drawings, one or both receptacles 9 and 10 are preferably filled to the level indicated in the sectional showing in Figure 2, whereupon the supply valves 11 and 12 are closed.

Communicating with each of the receptacles 9 and 10 is an air feed pipe 14 leading from any suitable source of supply and adapted to convey air under pressure to both of the receptacles. The pipe 14 has a branch pipe 15 communicating therewith and leading to the receptacle 9, while a similar branch pipe 16 leads to the receptacle 10. Each branch pipe is controlled by one of the independently operable valves 17 and 18 so that the source of supply of air is under instant control, permitting the air to be admitted to one of the tanks or receptacles without being admitted to the other.

In the tank 9 I have shown the air or gas supplying pipe 15 communicating with a circular discharge nozzle 19 disposed within the interior of this tank or receptacle, and provided with a plurality of jet openings 20 through which the fluid discharges. Assuming that this tank has been filled to the level indicated in Figure 2 with a supply of coal dust, the valves 18 and 32 of the tank 10 are closed, and the valves 17 and 22 opened, causing a supply of air to pass through the feed pipe 15, the jets in the nozzle 19, and directly upon the surface of the coal in the tank 9 creating a disturbance therein due to the air currents within the closed receptacle. The coal is gradually carried away in these air currents, passing outwardly through the feed pipe 21 controlled by the opened valve 22 into the coil 23 extending around the combustion chamber and then through the feed pipe 24 controlled by the valve 25 to the firing conduit 13, the mixture passing around the combustion chamber being superheated by the heat absorbed from the products of combustion. By having the feed nozzle 19 of a circular formation with a number of spray openings in its under side, the entire contents of the receptacle will be gradually discharged with the air without forming irregular pockets or openings in the surface of the coal supply.

The quantity of air necessary to feed a given amount of dry pulverized coal from the tank 9 is much less than the required volume of air necessary to support combustion of this fuel. The mixture of air and coal passing through the discharge pipe 21 is therefore overrich and will not burn when given a superheating, but to cause combus-

tion at or near the combustion chamber, an additional supply of air passing from the air reservoir 26 surrounding the combustion chamber is conveyed through the valve 5 controlled pipe 27, coil 28, and feed pipe 29 to the common firing chamber 13. As this current of highly heated pure air and the overrich mixture of powdered coal dust and air form a union at the firing chamber 13, 10 combustion results at once inasmuch as the mixture then has a proper ratio of air and fuel. The apparatus by which the mixture of air and coal dust and pure air alone are heated is merely disclosed in section, but it 15 will be understood that this apparatus forms the subject matter of another application, Serial Number 326,899, and is merely herein disclosed for the purpose of showing a highly efficient means for placing the coal 20 dust in condition for burning.

After the entire contents of the receptacle 9 have been discharged by reason of the air currents, the valves 17 and 22 are closed and the valve 11 opened to admit an additional supply of finely divided coal there- 25 to from the main supply bin 1. The valves 18 and 32 are then opened and air passes through the feed pipe 16 into the circular nozzle 30 shown in the lower portion of the tank 10 to discharge or feed a batch of 30 coal dust that has been deposited within this receptacle or tank. It will be observed that the air nozzle 30 is positioned in the lower portion of the tank which is distinguished from the position of the air nozzle 19 in the tank 9, but this is merely an alternative form of introducing air to a 35 receptacle when the same is sufficiently dry to permit feeding in this manner. It will be observed that the air entering the tank 40 10 is disclosed as passing through a filter or air dryer 33 so as to extract or remove any moisture that the air may contain before it is introduced to the receptacle. The discharged air passing through the jet open- 45 ings in the nozzle 30 rises through the mass of pulverized coal carrying a portion thereof in suspension through the discharge pipe 31 controlled by the valve 32 to the firing 50 conduit 13 for burning, the proportion of

air and coal being the same as described in connection with the feeding of the coal from the tank 9. The introduction of the air to the tank 10 is continued until the entire contents of this tank or receptacle have been 55 discharged, whereupon the air fed is shut off and by a proper manipulation of the valves, air is again admitted to the tank 9 which has meanwhile received a supply of coal, it being observed that the coal is fed intermit- 60 tently from one receptacle and then another.

As has been heretofore stated, it has been found that by introducing the air downwardly upon the surface of the supply of coal dust as disclosed in the tank 9, the dust 65 has no tendency to absorb the moisture of the air and thereby become damp or soggy. By feeding the air through the mass of coal from the bottom thereof, if the air is moist, it has a tendency to impart its moisture to 70 the coal dust in the tank. However, when feeding in this manner, if the air is moist, the same is preferably passed through the air dryer or filter 33 as disclosed in Figure 2 which may be of any of the well known 75 types to remove all the moisture from the air so that only dry air is admitted to the tank 10 by the nozzle 30.

Having thus described the invention, what I claim is: 80

A process for feeding pulverized coal in air suspension, consisting in providing a bulk supply of such coal in independent receivers, in introducing an air current to one of said receivers to impinge upon the 85 upper surface of the coal therein, to progressively carry said coal from said surface through such receivers until the contents thereof have been removed, in then discontinuing the introduction of air to such receiver and introducing a stream of air to 90 the second receiver under pressure discharging into the lower portion of the material therein to pass through said material toward its surfaces, and to carry particles 95 thereof in suspension, and in removing the moisture from said air before it is introduced to said last-mentioned receiver.

In testimony whereof I affix my signature.

WALTER E. TRENT.