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APPARATUS FOR DELIVERING POWDERED COAL TO FURNACES.


To all whom it may concern:

Be it known that WILLIAM HOGG BAKER, a citizen of the United States of America, residing at 43 Prospect Avenue, in the city of Montclair, county of Essex, and State of New Jersey, has invented certain new and useful Improvements in Apparatus for Delivering Powdered Coal to Furnaces, of which the following is a specification.

My invention relates to systems for burning pulverized coal or other fuel and is designed to simplify the same in certain ways. Heretofore it has been customary to transport the fuel from a central source of supply by means of compressed air to a series of local tanks or bins, located one at each furnace to be supplied, and then to run fuel from the local tank into a controller by which it was discharged at graduated rates into the furnace according to the varying demand therefor resulting from varying rates of combustion. In such prior installations the fuel was blown from the central blowing tank through a main supply line of piping which had valve controlled branches to the various local tanks to be served by it. I have discovered that if the distances from the central blowing tank to the various furnaces to be served by it are not too great, coal can be blown directly from said central tank into the furnace through a small pipe line, thus dispensing with the local supply bins and controllers heretofore required. The best form of apparatus at present known to me embodying my invention, and one modification thereof, are illustrated in the accompanying four sheets of drawings in which:

Fig. 1 is a central vertical section of the preferred form of blowing tank and connections, parts being broken away.

Fig. 2 is a vertical central section of a modified form of blowing tank; and,

Fig. 3 is an enlarged detail of one of the cut-off valves for the curtain pipes, parts being broken away.

Throughout the drawings, like reference characters indicate like parts.

1 represents a vertically mounted cylindrical tank, supported on any suitable base 20, and provided at its upper end with a fuel inlet 2, which would be closed after the tank has been nearly filled with pulverized fuel.

8 is an inlet for compressed air to the upper portions of the interior of the blowing tank 1, and 9 is the pressure regulating valve therefor of standard construction. 10, 10, represents a series of outlet pipes extending to and opening into the lower portion of the tank 1, and passing out through the walls thereof, one to each furnace, where fuel is to be supplied. 11, 11, represents curtain pipes surrounding and movable on the discharge pipes 10, said curtain pipes being open at each end, and adjustably supported in any convenient manner as by means of bell cranks 12, pivoted to the tank wall at 13, one arm of the bell crank being pivoted to the curtain pipe and the other to a screw threaded eye-bar 14, which extends through a stuffing box 15 in the wall of the tank and is exteriorly supported by housing 18. On this threaded eye-bar is mounted nut 17, which may be rotated by any convenient means such as the chain wheel 16. 15, 15, represent check-nuts on the eye-bar, by which its endwise movement under operation of the nut 17 may be limited.

21, 21, represent a plurality of compressed air pipes entering the bottom of the tank 1, and discharging in line with the respective discharge pipes 10, 10. 22, 22, represent valves for regulating the flow of compressed air through these pipes 21. Preferably each compressed air pipe 21 terminates in or through a cone-shaped nozzle or collar 23, which is adapted to fit in the lower end of corresponding curtain pipe 11 when the same is lowered upon it. 24 is an upwardly extending conical projection placed at the center of the bottom of the interior of tank 1, the various sets of discharge pipes being arranged in a circle or concentric circles around this conical projection 24.

In operating the apparatus so far described the tank inlet 2 is connected to a storage bin, dryer, or other source of supply, and each discharge pipe 10 is led directly to the combustion chamber of the furnace which it is to supply; it being understood that suitable means are provided for also supplying a proper amount of low pressure air to produce a combustible mixture in said combustion chamber.

While the furnaces are in operation an air pressure of about 90 pounds to the square inch is maintained in tank 1 by means of pipe 8 and controlling valve 9. This tends to press the coal in the tank down around the inlet ends of discharge pipes 10, 10.
up over cone nozzles 23, 23, and into said pipes, if the curtain pipes are raised, as shown in Fig. 1. Compressed air is also supplied to pipes 21, 21, at a pressure of 30 pounds, and each jet of air so produced and discharged into the opposite and slightly larger pipe 10, produces a powerful injector action which picks up and draws in with it a uniform quantity of coal which mingles with the air to form a uniform mixture which is forced along to the furnace to which that particular pipe 10 is connected. By raising or lowering the corresponding curtain pipe 11, the quantity of coal so admitted is increased or decreased to suit conditions in the furnace. If any particular furnace is to be cut out, the corresponding curtain pipe 11 is forced down on the cone shaped nozzle 23. This shuts off access of coal to corresponding discharge pipe 10 but allows air to sweep through it, thus cleaning it of coal. Thereafter the discharge pipe is closed off completely by any suitable valve not shown, but which would be located at about the point 25.

While it is possible to discharge the coal by action of jet pipes 21, alone, without maintaining a high pressure in the tank by means of the compressed air supply 8, this requires such a large supply of compressed air as to be uncommercial. By using an internal pressure nearly equal to that of the jet the coal crowded into the line of discharge of the jet so that it operates most efficiently and there is only a small fraction of the quantity of compressed air which would be needed if the jets alone were operating. As the pressure in tank 1 exerted on the surface of the coal is mainly static, but little air need be supplied from pipe 8 to maintain this pressure.

On the other hand, it is also possible to expel the coal from the tank by using only the internal pressure supplied through pipe 8, without employing the jet pipes 21, but when this is done the coal passes out in slugs or masses separated one from another by long stretches of compressed air carrying no coal, and consequently the coal so transported cannot be delivered directly to the furnaces and evenly distributed on the beds of the fires therein. Consequently, if no jets 21 are employed local bins and special controllers are required at each furnace, as in the prior installations previously mentioned.

In the modified embodiment of the invention illustrated in Figs. 2 and 3 the two separate points of application of separate volumes of compressed air are preserved but the motive pressure applied directly to the inlet end of the discharge pipes 10, 10, is delivered through the curtain pipes 33 from a space 30 in the extreme upper portion of tank 30, instead of through separate jet pipes 21 as in Fig. 1. The compressed air space 30, is separated from the main lower portion of tank 30 by a perforated diaphragm 31 in the perforation in which are set the upper ends of curtain pipes 33, and also vertical central inlet pipe 32. To the upper end of pipe 32 any suitable air-lock and connections (not shown) would be attached. 34 is a pipe for supplying compressed air to the upper tank space 30 and 35 one for supplying compressed air to the lower, coal containing space of the tank. 36, 36, are the usual pressure regulator valves for these connections. In this modification the lower inlet ends of the discharge pipes 10 are permanently located within the curtain pipes, instead of normally protruding therefrom, as shown in the other form Fig. 1. Also, the curtain pipes 33 being fixed, it is necessary to have a movable component cooperating with their lower ends to control the flow of material to the outlet pipes nested in these fixed curtain pipes. Such control and ultimate closure is effected by movable cones 37, 37, one cooperating with the lower mouth of each curtain pipe 33. These cones are supported by ears 38, and links 39 hanging from bell-cranks 39, which are operated in the same way as bell-cranks 12 in the first described form of the invention. Passage through discharge pipes 10, 10, can be shut off by valves 40, 40.

In describing the operation of this form of the invention the lower portion of the tank 30 is assumed to be nearly filled with pulverized coal, which has been introduced through pipe 32 valves 40 closed and cones 37 raised as shown in Fig. 3 and at the right hand side of Fig. 2. To begin operation an air pressure of about 30 pounds should be created in the tank 30 to act on the surface of the body of coal therein, and the same or slightly higher pressure created in the space 30 above diaphragm 31 and in the curtain pipe 33. If then, for example, it is desired to start up the furnace connected to the second discharge pipe 10 from the right hand, its valve 40 is opened and the cooperating cone 37 lowered as shown. The air pressure on the surface of the coal in tank 30 will then force coal into the lower end of that curtain pipe, up over the cone toward the inlet end of the discharge pipe 10. The compressed air in the curtain pipe (supplied from the upper space 30) will be rushing out through the discharge pipe 10 in a rapid current and will pick up the coal fed to it over cone 37 as above described and carry it on to the furnace in a uniform mixture which will be readily combustible when discharged directly into the combustion cham.
Fig. 2, and any rate of fuel delivery to any of the connected furnaces can be attained by adjusting the position of the corresponding cone 37, through its supporting bell-crank. When any furnace is to be shut down, its corresponding cone 37 is raised to closure position as shown in Fig. 3 and then after the air-current has driven all coal out of the corresponding pipe 10 its valve 40 is closed.

The air pressures required vary with the distances to which the fuel must be transported but I have found that the system works well within a radius of 1,000 feet with pressures of approximately 30 pounds. In starting, a slight increase of pressure may be needed in jet pipes 21, (Fig. 1) or tank space 30a (Fig. 2) to overcome the inertia of the coal and air, but when the out flowing currents are established they can be maintained with reduced pressures.

Other modifications in details of construction and arrangement might be substituted for those described without departing from the substance of the invention so long as the general principles of operation herein described are retained. Also some of the cooperating elements might be dispensed with so long as the basic principle of the invention is retained.

Having described my invention I claim:

1. In an apparatus for storing and transporting finely divided material such as pulverized coal comprising an airtight tank, outlet pipes extending nearly to the bottom of the tank, adjustable curtain pipes located in the tank surrounding the outlet pipes and open at each end, and means for supplying compressed air to the upper interior portion of the tank, the combination, with such above described apparatus, of compressed air inlet pipes arranged to discharge jets of compressed air into the lower open ends of the outlet pipes in line with the axes thereof.

2. An apparatus such as set forth in claim 1 in which the discharge nozzles of the compressed air inlet pipes are cone shaped and adapted to fit into the lower ends of the curtain pipes when the latter are lowered thereon.

3. An apparatus such as set forth in claim 1 in which the tank is in the form of a vertical cylinder, the inlet ends of the outlet pipes are arranged in a circle near the bottom of the tank and said bottom is provided with a conical upwardly extending projection located centrally of the circle of outlet pipes.

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