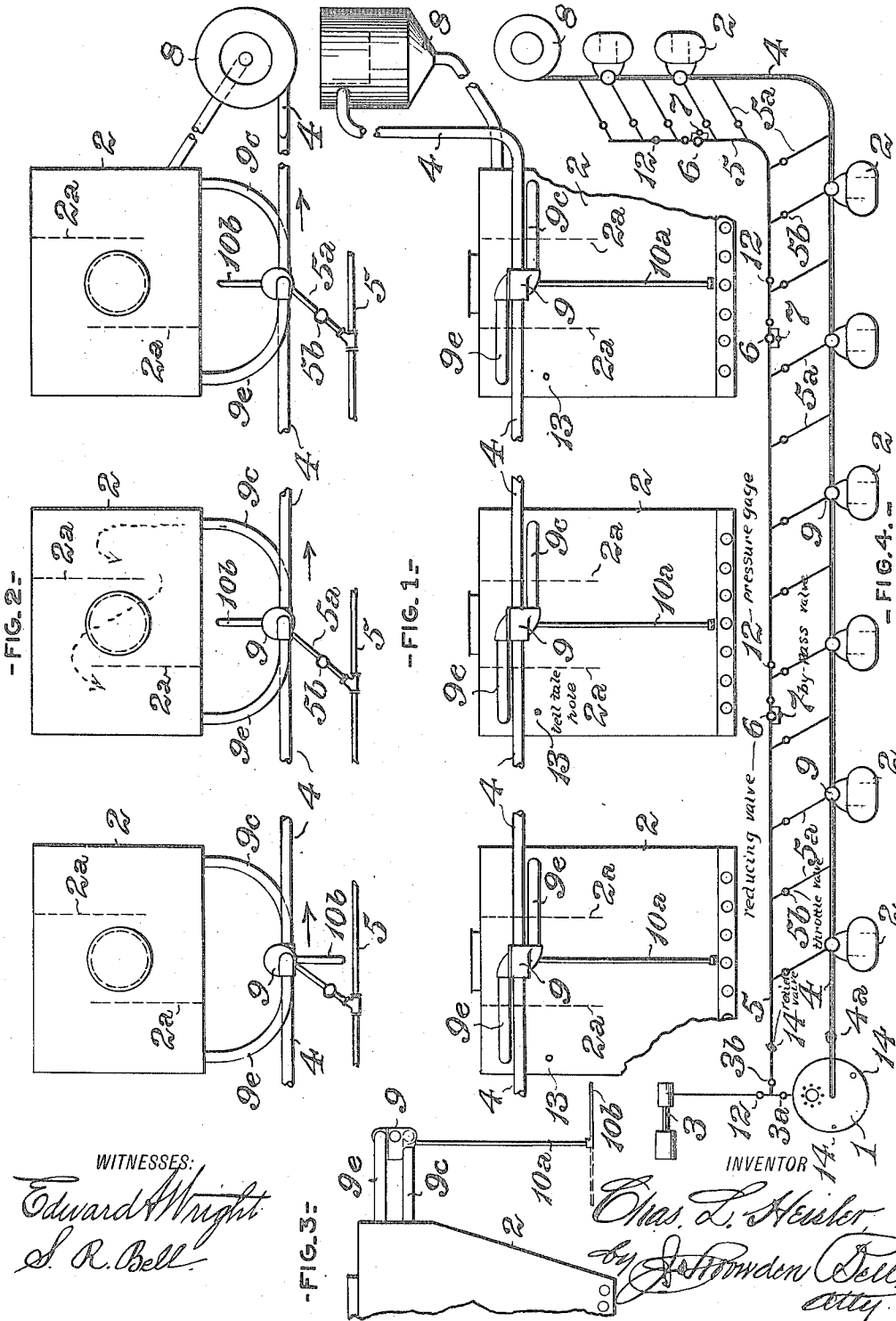


C. L. HEISLER.
DISTRIBUTING POWDERED MATERIAL.
APPLICATION FILED DEC. 27, 1916.

1,248,851.

Patented Dec. 4, 1917.

2 SHEETS—SHEET 1.



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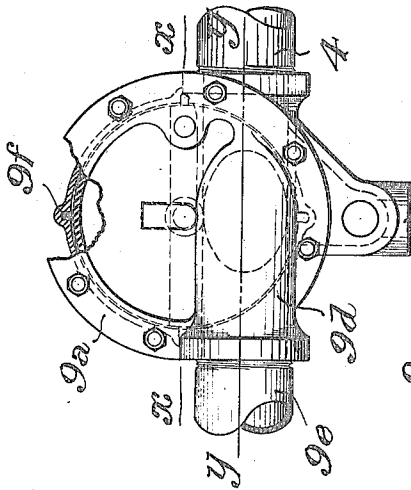
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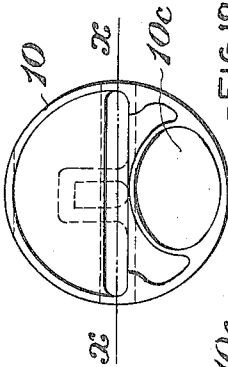
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2 SHEETS—SHEET 2.

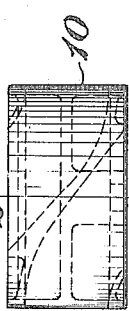
-FIG. 5-



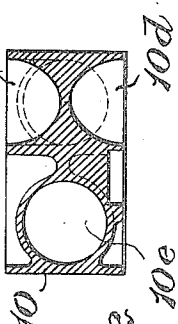
-FIG. 9-



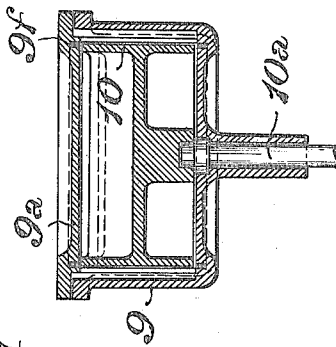
-FIG. 10-



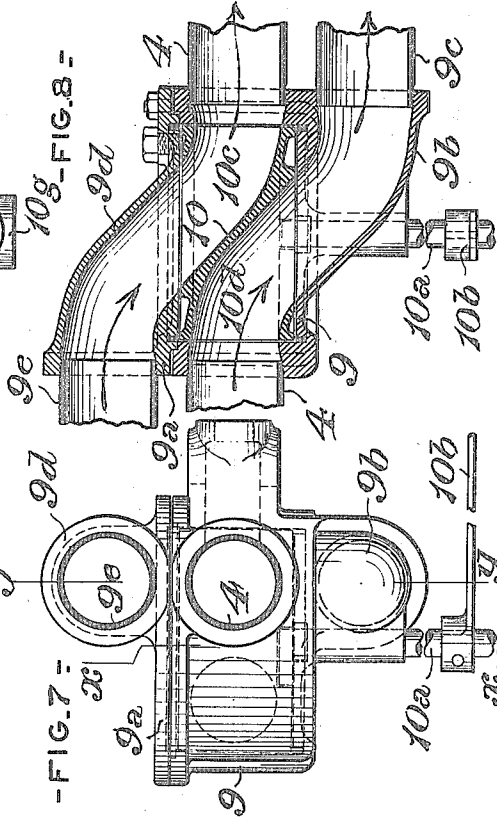
-FIG. 11- 10c



-FIG. 6-



-FIG. 8-



-FIG. 7-

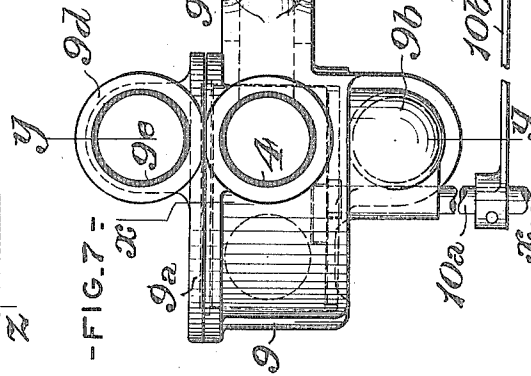
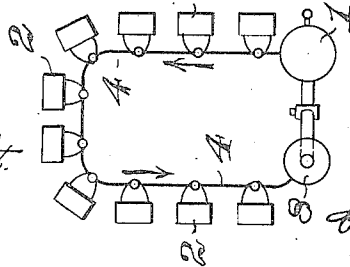


FIG. 12-



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UNITED STATES PATENT OFFICE.

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DISTRIBUTING POWDERED MATERIAL.

1,248,851.

Specification of Letters Patent.

Patented Dec. 4, 1917.

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To all whom it may concern:

Be it known that I, CHARLES L. HEISLER, of Schenectady, in the county of Schenectady and State of New York, have invented
5 a certain new and useful Improvement in Distributing Powdered Material, of which improvement the following is a specification.

My invention more particularly relates to
10 the application of pneumatic means for distributing powdered fuel from a source of supply to a plurality of fuel hoppers, located at any desired distance or distances therefrom, and its objects are to provide for the
15 successive pneumatic delivery of powdered fuel from a single distributing fuel blowing pipe into a plurality of closed hoppers, in such manner that the surplus of air and fuel, in each case, is caused to return to the blow-
20 ing pipe and to traverse therein to the next succeeding hopper, and the surplus from the last hopper to be discharged into a separator; to provide, in connection with a plurality of sections of a fuel blowing pipe,
25 means for successively reducing or stepping down the pressure of air discharged from an air supply line into the sections of the pipe, in order to attain greater economy in the use of air; and to provide for automatically
30 reinstating the flow of air after it has been clogged in any section of a long blowing pipe.

The improvement claimed is hereinafter fully set forth.

35 In the accompanying drawings: Figure 1 is a side view, in elevation, of a plurality of fuel hoppers, coupled to a fuel blowing pipe line by shunt valves, illustrating an application for the practice of my invention;
40 Fig. 2, a plan or top view of the same; Fig. 3, a partial end view of a hopper and its shunt valve casing; Fig. 4, a diagrammatic plan view of an installation, illustrating a comparatively long system of air and fuel
45 blowing lines and fuel hoppers; Fig. 5, a plan view of a shunt valve device; Fig. 6, a vertical section, on the lines *x x* of Figs. 5, 7 and 9; Fig. 7, an end view, as seen from the left; Fig. 8, a vertical section, on the
50 lines *y y* of Figs. 5 and 7; Fig. 9, a plan view of the valve proper, removed from the casing; Fig. 10, a side view of the same; Fig. 11, a transverse section, on the line *z z* of Fig. 10; and, Fig. 12, a diagrammatic
55 plan view, illustrating the dispositions of the blowing line to form a closed circuit, for

the purpose of returning the surplus of fuel from the last hopper to the blowing tank from which it was originally discharged.

In the practice of my invention, referring
60 descriptively to the specific embodiment thereof which is shown in the drawings, it is applied for the supply of pulverized fuel, from a fuel blowing tank, 1, successively to the members of a plurality of fuel hoppers,
65 2, which, for convenience of illustration, are shown in Figs. 1 and 2, as disposed in a straight row, but may obviously be located in any other desired relation, in accordance with the conditions of installation, as indicated in Figs. 4 and 12. Air, at suitable
70 pressure, is supplied to the fuel blowing tank, 1, by a compressor, 3, and is delivered from said tank to the fuel hoppers, through a fuel blowing pipe line, 4, leading from the
75 tank to each of the hoppers, said pipe line being controlled by a valve, 4^a, and being connected with said hoppers by shunt valve devices hereinafter described. The compressor, 3, also supplies air under pressure
80 to an air pipe line, 5, which extends parallel with the fuel blowing pipe line, 4, and is connected therewith, at a plurality of predetermined points, by air feeder pipes, 5^a. The supply of air to the fuel blowing tank,
85 1, and to the air pipe line, 5, is independently controlled by valves, 3^a and 3^b, respectively, and the air feeder pipes are controlled by throttle valves, 5^b. When the fuel and air pipe lines, 4 and 5, are of considerable
90 length, the air pipe line is divided into a predetermined number of sections, in which the air pressure is successively stepped down or reduced, from section to section, by reducing valves, 6, so as to reduce the air pressure proportionately to the increase of distance from the fuel blowing tank. A bypass valve, 7, is applied in connection with each of the reducing valves, for use in emergency, as hereinafter described.
100

The discharge end of the fuel pipe line leads into a separator, 8, which is provided for the reception of any residue of fuel that may not be precipitated from the fuel pipe line into the last of the fuel hoppers, 2, and
105 the air pipe line is connected with the fuel pipe line, in advance of its discharge end, so as to also discharge into the separator. A shunt valve device, the casing of which is indicated by the reference numeral, 9, is
110 interposed between each of the fuel hoppers and the fuel pipe line, and each of the hop-

pers is provided with baffle plates, 2^a, or other known means for trapping the powdered fuel and separating the air therefrom, so as to permit the air to flow from the hopper, through the shunt valve device, and continue down the line to the next succeeding shunt valve device and hopper, and so on until discharged from the separator, 8, to the atmosphere. Pressure gages, 12, and relief valves, 14, are connected to the system to prevent damage from an excess of air pressure.

Referring to Figs. 5 to 11 inclusive, the shunt valve device comprises a cylindrical casing, 9, which has an integral bottom, and is closed at top by a removable cover plate, 9^a. A downwardly curved nozzle, 9^b, is formed on the bottom of the casing, and an inlet pipe, 9^c, leads from said nozzle into the adjacent fuel hopper, 2. An upwardly curved nozzle, 9^d, is formed on the cover plate of the casing, and a return pipe, 9^e, leads from the adjacent fuel hopper to said nozzle. The casing, 9, is interposed between the two sections of the fuel pipe line, 4, which open into it on opposite sides. The shunt valve proper, 10, is of cylindrical form, and is fitted in the casing on a stem, 10^a, which projects through the bottom plate thereof, and carries an operating arm, 10^b, by manipulation of which it may be turned about its axial line. A port, 10^c, extends upwardly from one side of the valve to its top, and a port, 10^d, located immediately below the port, 10^c, extends downwardly from the other side of the valve to its bottom. The ports, 10^b and 10^c, are located on one side of a diametral plane of the valve, and a straight through port, 10^e, extends through the valve on the opposite side of said diametral plane.

In order to prevent fuel dust from clogging the valve, 10, it is fitted loosely under the cover plate, 9^a, so as to permit the use of felt packing strips, 9^f, to form a dust tight joint. An auxiliary air admission port, 10^f, see Fig. 5 is formed in the valve, to feed air into the fuel line from the air line, through the throttle valves, 5^b. The port is inclined in direction corresponding with the flow of fuel through the valve.

The operating arm is preferably so disposed, relatively to the valve, as to point toward the hopper with which the valve device is connected, when said hopper is being filled, and to be turned, through an angle of 180 degrees, so as to point away therefrom, when the fuel is passing by the hopper and down the fuel line. When the valve, 10, is turned into the position shown in Figs. 5 and 8, with the arm, 10^b, pointing toward the adjacent hopper, the fuel is blown from the pipe line, 4, downwardly through the inclined port, 10^d, as indicated by the arrow, into the inlet pipe, 9^c, and

through said pipe into the hopper, where it is separated from the air and deposited by the baffle plate, 2^a. The air and any undeposited fuel that may be carried off therewith, pass from the hopper, through the return pipe, 9^e, and thence, through the port, 10^c, into the fuel pipe line, 4. Inasmuch as the powdered fuel flows similarly to a liquid and completely fills the pipe line, the downward passage of the air and fuel through the inclined ports, reduces the tendency to clog the valve by lodgment of fuel therein. When the arm, 10^b, is turned 180 degrees, so as to point away from the hopper, the straight port, 10^e, registers with the opposite sections of the fuel pipe line, 4, and presents a straight and unobstructed avenue for the fuel to pass through the valve and line. Communication with the hopper is then cut off by the ports, 10^d and 10^c, being moved out of register with the inlet and return pipes 9^c and 9^e. The operation of the single valve operating arm is so simple as to be readily understood by an ordinary laborer, and capable of ready actuation by an operative of such class, without liability to clogging of the line, whereas, when using more than one valve, as in prior systems, a more intelligent operator often becomes confused and clogs the line by actuating the wrong valve.

Fig. 4 illustrates, diagrammatically, the installation of a 1600 feet fuel conveying blow line system, wherein air, at 100 pounds pressure, is supplied by the air compressor, 3. The flow of air into the fuel blowing tank, 1, is controlled by the valve, 3^a, and the air valve, 3^b, controls the flow into the air pipe line, 5, which is much smaller in diameter than the fuel blowing pipe line, 4. The shunt valves control, as before described, communication between the several fuel hoppers, 2, and the fuel line, 4. Diagonally disposed air feed pipes, 5^a, establish communication between the air pipe line and the fuel line, at a plurality of intervals, the flow of air to the fuel line through each of these pipes being governed by a throttle valve, 5^b.

In the example illustrated, pressure reducing valves, 6, set at 75, 50, and 25 pounds, respectively, step down the air pressure in the air line, at predetermined intervals, so as to divide the 1600 feet line into four sections, operating under 100, 75, 50 and 25 pounds pressure of air, respectively, as indicated by the corresponding gages, 12. It has been developed in practice that approximately 25 pounds difference of air pressure is required for each 400 feet in length of the fuel supply line, 4. The first section of 400 feet, which is nearest the compressor, operates under a pressure of 100 pounds to the square inch above the atmosphere, and the fourth or last section of 400 feet,

at the right or discharge end of the line, operates under 25 pounds pressure, and by successively reducing the pressures as stated, a material saving in air is effected in the utilization of the work of expansion. By pass valves, 7, are provided at the reducing valves, to permit a flow of air past them, when it is desired to materially increase the pressure at the discharge end of the fuel and air lines, for the purpose of clearing the fuel line if it should become clogged.

In the operation of the system, the shunt valves are first set to deliver fuel into the empty hoppers, by turning the operating arms of the valves to point toward the hoppers, the by-pass valves, the air supply valve, 3^b, and the blowing tank valve 4^a, having been previously closed. Air is then admitted, by the valve, 3^b, to the air supply pipe line, 5, in the several sections of which its pressure is successively reduced, as before explained, and the throttle valves, 5^b, are each slightly opened, those nearest the beginning of each section being opened the greater amount, so as to feed air into the fuel pipe line, throughout its entire length, with successive steps down or reductions in pressure, corresponding approximately to the distances of the throttle valves from the blowing tank, as predetermined by trial. The valve 4^a, is then opened, to permit fuel to be discharged from the blowing tank into the fuel supply pipe line, and the fuel is carried from one section to the other by the differences in pressure as determined by the corresponding reduction valves. The coal is delivered into the hoppers through the shunt valves, any portion which may escape from one hopper being carried into the next, as before described.

When each hopper becomes filled, which will be indicated by a small tell tale discharge hole, 13, near its top, the shunt valve operating arm is turned 180 degrees, so as to permit the fuel to pass through the straight port of the shunt valve, and down the line to the next hopper, the shunt valves being similarly moved until all the hoppers have been filled, any fuel escaping from the last one being trapped by the separator, 8, at the end of the line. The separator may discharge as usual into the last hopper, or into the fuel blowing tank when the line is in the form of a return loop, as indicated in Fig. 12.

In the event of the line becoming obstructed by a clog or accumulation of fuel in any of the sections, as, for example, in the second, the air from the air supply line will blow the third and fourth sections of the fuel supply line clear, by passing the throttle valves of the air feed pipes 5^a, of the latter sections. These throttle valves, which, in practice, are spaced about 50 to 75 feet apart, remain slightly open. After

the third and fourth sections of the fuel supply line have been cleared, the air pressure therein drops nearly to that of the atmosphere, and the pressure in the first section, and at all points between the clog and the blowing tank, increases to approximately 100 pounds, if so much pressure should be necessary to blow the section clear, after all the air feed pipes, 5^a, beyond the clog, have relieved the greater part of the resistance to the flow of the fuel. Under extremely adverse circumstances, the by pass valves may be opened temporarily to afford full air pressure along the entire line for the purpose of removing a clog.

It will be understood that by the use of the term "fuel" as hereinbefore, and in the claims, I mean any fluent solid material in powdered form, and that by the use of the term "hopper" in the claims, I mean any form of storage receptacle.

I claim as my invention and desire to secure by Letters Patent:

1. In an apparatus for distributing powdered fuel into a plurality of hoppers, the combination with the hoppers, of a fuel conduit passing adjacent thereto, an inlet connection from said conduit to each hopper and an outlet connection from each hopper to said conduit, a shunt valve at the points of junction of said connections and conduit, and means to pneumatically force fuel through said conduit, whereby any one of the hoppers may receive fuel from the conduit and the surplus dust-laden air be simultaneously returned from the hopper into said conduit.

2. In an apparatus for distributing powdered fuel into a plurality of hoppers, the combination with the hoppers, of a fuel conduit passing adjacent thereto, an inlet connection and an outlet connection between said conduit and each hopper, a shunt valve for each hopper and controlling both of said connections, a fuel supply tank connected to said conduit, means to force air into said tank, and means to supply additional air at said shunt valves, whereby fuel may be fed into any one or more of said hoppers and the surplus dust-laden air be simultaneously returned to said conduit.

3. In an apparatus for distributing powdered fuel into a plurality of hoppers, the combination with the hoppers, of a fuel conduit passing adjacent thereto, an inlet connection and an outlet connection from said conduit to each hopper, a shunt valve controlling said connections, a fuel supply tank connected to said conduit, means to force air into said tank, a separator at the other end of said conduit, an additional air supply pipe adjacent said conduit, valved connections between said pipe and each of said shunt valves, and pressure reducing valves arranged at intervals in said pipe.

4. In an apparatus for distributing powdered material, the combination of a fuel blowing supply tank; a fluid compressor; a fuel blowing conduit leading from the
5 supply tank; a fluid pressure pipe; valve controlled communications between the fluid compressor and the fuel supply pipe and between said compressor and the fluid pressure
10 pipe; a plurality of storage receptacles; shunt valve devices, each interposed between the fuel blowing conduit and one of said receptacles; means for diverting a charge
of powdered material, through a shunt valve device, successively into each of said receptacles; a plurality of valve controlled pipes 15 connecting the fluid pressure pipe and the fluid blowing conduit; and a plurality of pressure regulating valves, disposed at predetermined intervals in the line of the fluid pressure pipe.

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Witnesses:

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E. B. CLARK.