

Aug. 18, 1925.

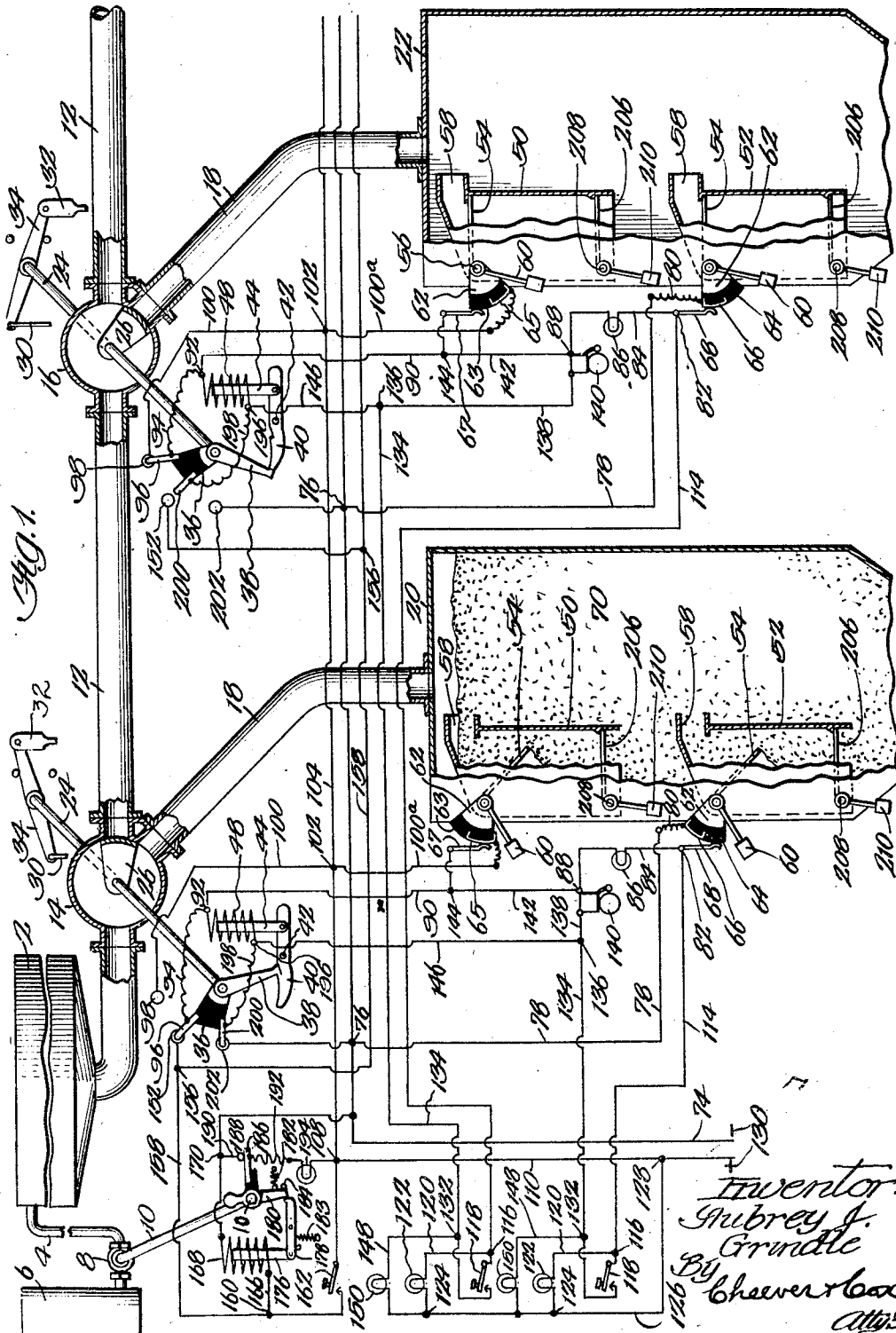
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A. J. GRINDLE

POWDERED MATERIAL DISTRIBUTING SYSTEM

Filed April 5, 1923

2 Sheets-Sheet 1



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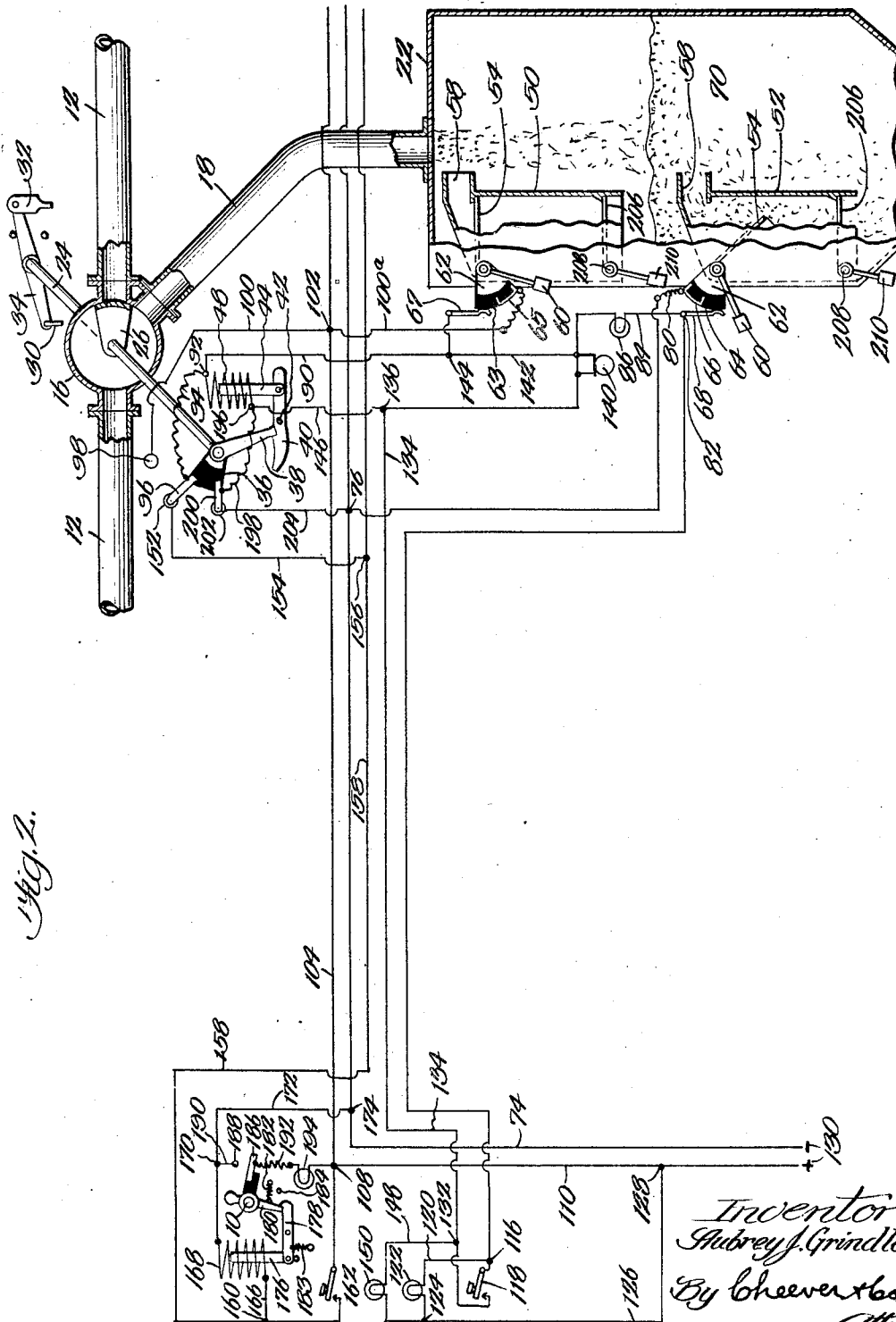
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POWDERED MATERIAL DISTRIBUTING SYSTEM

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

AUBREY J. GRINDLE, OF CHICAGO, ILLINOIS, ASSIGNOR TO GRINDLE FUEL EQUIPMENT COMPANY, OF HARVEY, ILLINOIS, A CORPORATION OF ILLINOIS.

POWDERED-MATERIAL-DISTRIBUTING SYSTEM.

Application filed April 5, 1923. Serial No. 630,053.

To all whom it may concern:

Be it known that I, AUBREY J. GRINDLE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Powdered-Material-Distributing Systems, of which the following is a specification.

This invention relates to powdered material distributing system in which powdered material, such as coal, is distributed from a central station to a plurality of outlying or sub-stations. It is in general an improvement or modification of the device shown in earlier United States application No. 440,007 filed January 26, 1921.

The object of this invention is to provide a central station and a plurality of stations to which the central station is to deliver powdered material with an electrically controlled automatic valve system in which each sub-station coal receptacle, as it empties, automatically signals the operator at the central station that coal is needed; in which on receipt of that information, the central station operator signals the sub-station operator that he may turn the material switch so that powdered material may be delivered to that sub-station; in which the condition of the sub-station, as it is being filled, is indicated more or less automatically to the central station; in which the complete filling of the sub-station automatically closes a valve to prevent the further delivery of material to that particular substation, automatically cuts off the further delivery of fuel at the central station; signals the operator at that station. A further object is to provide electrical means at the central station by which the operator at that station can at will limit the amount of material in progress of delivery to a given sub-station, this without interfering with other stations not then receiving material.

The invention consists in means for attaining the foregoing and other objects, and in many features and details of construction which will be hereafter more fully set forth in the specification and claims.

In the drawings, in which like numerals indicate the same parts through the several views:

Figure 1 is an electric circuit diagram showing how the various mechanisms, shown more or less diagrammatically and some-

what in perspective, entering into the invention, are connected up.

Figure 2 is a changed position view of the right hand sub-station powdered material tank 22 and associated parts in the positions which they occupy while said tank is being filled with powdered material but before it is full.

The drawing shows fragmentarily the main powdered material tank 2, supplied with air through a pipe 4 from a source of compressed air or other blowing material 6, this pipe 4 being controllable by a valve 8, rotatable by a shaft 10.

From the lower end of material tank 2 is a main line delivery pipe 12, having inserted in its length switching valve casings 14 and 16 exemplifying valves which may be used in multiplicity in a real system. Each of these casings 14 and 16 includes a branch or switch pipe 18 leading, in the particular case here illustrated, downward to a sub-station material tank 20 or 22, as the case may be. For convenience, tank 20 is shown filled with powdered material and in the early stages of the act of cutting itself off from further receipt of fuel material and of stopping the delivery of material from tank 2 while tank 22 is shown empty and just in the act of signalling the operator at the central station for fuel material.

Running through each valve 14 or 16 is a shaft 24 carrying inside the valve casing a valve segment 26, adapted to be moved from the position shown in connection with valve case 14 and also in Figure 2, in which the main line pipe 12 is closed off beyond the valve to the angular position of casing 16. Fig. 1 in which the main line pipe beyond the valve is open and admission of material to the side track pipe 18 is closed.

On each shaft 24 is a manually operable pull rod 30 and a weight carrying rod 32 on opposite ends of an intermediate lever 34, all as clearly set forth in prior United States patent application 619,313, filed February 15, 1923. On the opposite ends of each of these shafts 24 is mounted a bell crank 36—38 switch-locking lever mechanism co-operating with the latch dog 40, pivoted at 42, carrying a solenoid core 44 entering a solenoid 48, all as more fully appears in detail in said prior application.

At the top of each sub-station tank 20

and 22, is a level indicating or controlling box 50, and at the bottom of each such first mentioned tank is another level indicating box 52, equipped with switching mechanism 5 which is fully described and claimed in prior United States patent application 617,786, filed February 8, 1923. Each box 50 and 52 has a door 54 pivoted at 56 and held in place to close off its intake opening 58 by a counter 10 weight arm 60, all as more fully set forth in said prior application. Each shaft 56 carries a switch segment 62 having a contact surface made up of two parts: one 63 (or 64) of insulating material; the other 65 (or 66) of conducting material, each such 15 contact surface being engaged by a spring contact member 67 (or 68), all as more fully set forth in said prior application No. 617,786. These two switches at the top and 20 bottom of each sub-station tank are alike except that with box 50 insulating contact 63 is on top while with box 52 corresponding contact 64 is below—this to cause shut-off when the switch at the top of a given 25 tank 20 or 22 is operated and to cause admission of fuel material when the switch at the bottom of the same tank is operated; in other respects, these switches are identical and operate as fully set forth in said applica- 30 tion 617,786. In the drawing, the boxes 50 and 52 and their associated switch parts are shown in connection with tank 20 in the position which they assume when the tank is full of powdered material 70 and the device 35 is in the early stages of operation to close the valve 8 to shut off the supply of air from the tank 6 to the tank 2 and consequently stop the further delivery of powdered material, and the like boxes 50 and 52 and their 40 associated parts shown in connection with tank 22 are in the position which they assume when the tank is empty and an automatic signal is being given by the lower mechanism 52 to an operator at the central 45 station to send coal to tank 22.

At the left of Figure 1 are shown above lamps 150—122 and switch 118 belonging to tank 22, while below them is shown a group of identical parts belonging to tank 20.

50 Starting now with everything as in Figure 1, and considering first the situation existing in tank 22 and the parts of the system belonging to it: Electric current comes in from a main source of current 136 via 55 wire 74 to junction point 76; thence down wire 78 and wire 80, through contact member 66 and spring member 68 to junction point 82. Here the current divides. Part of it passes via wire 84 through the energizing mechanism of upper red lamp 86 to 60 junction point 88 from which it passes through wire 90 to junction point 92 from which it passes through wire 94 through movable contact member 96 to stationary 65 contact member 98; thence back through

wire 100 to junction point 102 from which point it passes back through wire 104 to junction point 108 and thence through wire 110 back to the source of power 130. From this, it appears that the 70 automatic movement of the parts associated with switch box 52 illuminates the red light 86 adjacent to tank 22, thus showing to the local operator that fuel is needed in this tank. The completion of the circuit just 75 described has put electric current at point 92 where it is ready to be sent through solenoid 48 whenever a path is provided for it as hereafter described.

Part of the current supplied in the operation of the circuit just described to division 80 point 82 travels via wire 114 to junction point 116 where it provides power ready to be sent through manually operated switch 118 when occasion requires. In the mean- 85 time, the current passes from this junction point 116 through wire 120 to upper red light 122, thereby energizing it and showing the central station operator that the sub-station tank 22 to which that red light be- 90 longs needs coal. After passing this red light, the current goes through junction point 124 to wire 126 and thence via junction point 128 to wire 110 and back to the original source 130. When the operator at 95 the central station gets the signal from lamp 122, he closes switch 118, thereby sending current from junction point 116 through the switch, junction point 132 and wire 134 to junction point 136. Here part of the cur- 100 rent traverses wire 138 through right hand bell 140 to wire 142 thence through junction point 144 to wire 90 heretofore described, and thence to junction point 92 from 105 which point it traverses, as in the case of the other current, wire 100, junction point 102, wire 104, junction point 108 and wire 110, back to the original source 130. The other part of the current which came by 110 wire 134 to junction point 136 passes up wire 146 to and through right hand solenoid 48 to junction point 92 and follows the same course back to the original starting point 130. This passage of current through 115 solenoid 48 draws up right hand core 44, thereby swinging lever 40 downward, releasing arm 38, all as fully set forth in said prior application 619,313, so that the sub-station operator can by pulling on rod 30 120 move valve 26 in case 16 from the position shown in case 16 to the position shown in case 14 and also in Figure 2, whereby powdered material from tank 2 may pass through pipe 12 through case 16 down pipe 18 to the tank 22. This releasing of latch 125 40 takes place instantly as soon as the operator closes switch 118 and begins to ring bell 140. The central station operator now, by conventional means not shown, puts shaft 10 and valve 8 in the position of Figure 1 (if 130

not already in that position) so that air can pass from tank 6 to tank 2 to force material out through pipe 12 to branch pipe 18 leading to tank 22 (the valve 26 of case 14 being by the time under description clear of pipe 12).

When the operator closes upper switch 118, as heretofore described, and so long as he holds it closed, current from junction point 132 passes via wire 148 through upper white light 150 and thence through junction point 124 and wire 126 back to the starting point 130. Until the operator pulls on right hand rod 30 to manipulate valve 26 in case 16 this upper white light 150 will only stay lighted while switch 118 is closed. The operator can, therefore, by momentarily releasing switch 118, determine by the lighting or non-lighting of lamp 150 whether the operator has as yet pulled rod 30 to manipulate valve 26 in case 16.

As soon as the operator does pull rod 30 and move valve 26, as described, to the position of Figure 2, coal 70 begins to come in through pipe 18. When it reaches the entrance 58 of box 52, it slides first onto and then past door 54 of box 52, thus rocking said door to the position of Fig. 2 and moving lower contact 66 out of engagement with lower switch 68, thus breaking the current between wires 78 and 114.

This breaking the circuit described between contacts 66 and 68 cuts off the current through right hand red lamp 86 and upper red lamp 122, thus extinguishing them, and showing to both the central operator and sub-station 22 operator that tank 22 is receiving coal.

When the operator pulled downward on rod 30, as heretofore described, and moved valve member 26 in case 16 to the position shown in Figure 2, he broke the contact between members 96 and 98, heretofore referred to, thereby cutting off the current from the right hand solenoid 48 and from the bell 140 by tank 22. The latter, however, of course, stops the ringing of the bell. The former action permits the locking lever 40, to, when lever arm 38 reaches the position of Figure 2, swing upward and lock lever 38 in the position shown in Figure 2, thus locking valve member 26 in case 16 in the position of Figure 2 until such time as solenoid 48 is again energized as hereafter described. With valve 26 in the position just described, powdered material flows down pipe 18 to tank 22 and gradually fills it up, in so doing first passing through the position of Figure 2 in which the circuit between members 68 and 66 is broken, as heretofore described.

When right hand bell crank member 36—38 reaches the position of Figure 2, arm 96 contacts at 152 with wire 154 connecting at junction point 156 with wire 158 leading

through a junction point 160 to a manually operable switch 162 in a wire 104 connected at junction point 108 with wire 110 leading to source of energy 130. From junction point 160 is a wire 166 energizing solenoid 168 from which current passes via junction point 170 and wire 172 to junction point 174 on wire 74, heretofore described.

Arm 96, heretofore described, is, as heretofore set forth connected by wire 94 to junction point 92 and thence by wire 90 to junction point 144 to which switch contact 67, heretofore described, is electrically connected. The situation just described results in the energization of right hand switch member 67 so that it can, when contact 65 is brought into engagement with it, as shown in connection with tank 20, pass current through said contact member 65 and wire 100^a to junction point 102 and thus send an electric current to solenoid 168. In other words, switch contacts 65 and 67 are prepared to energize solenoid 168 whenever the coal 70 in tank 22 reaches the height shown in tank 20 and some of it flows through the upper entrance 58 of box 50 in tank 22 to engage door 54 of said receptacle 50 and move it downward to the position in which the corresponding door appears in tank 20, thereby bringing contacts 65 and 67 into engagement with each other, i. e., as shown in connection with tank 20. Reciprocable in solenoid 168 is a core 176 pivotally connected to a lever 178 locking on the lower end of a lever 180 carried by shaft 10 and preferably, but not necessarily, held in the absence of energization of solenoid 168 in said position by spring 182. When solenoid 168 is energized by the closing of switch 65—67, the right hand end of lever 178 moves downward off from the end of lever 180 thereby allowing any suitable operating means as, for instance, spring 182 to rock shaft 10 in a counter-clockwise direction until such time as lever 180 strikes stop 184 thus operating valve 8 to shut off the supply of air from tank 6 to tank 4 and thus stop the delivery of powdered material from tank 2 to pipe 12 and thence to the particular sub-station tank which is in communication with it. Moving in unison with shaft 10 is a switch lever 186 adapted, when the valve 8 closes as just described, to engage a contact 188 and thus complete a circuit through wires 190—192 from junction point 170 to lamp 194 and thence to junction point 108 thereby lighting said lamp 194 and showing the operator at the main supply station that the air has been shut off and that he is therefore at liberty to respond to the lamp signal of some other station operator calling for material for his sub-station.

The closing of switch 65—67 in connection with tank 22 under discussion sends current through the circuit hereafter de-

scribed to solenoid 48, thus depressing latch lever 40 and releasing lever 38 so that weight 32 can in the manner set forth in said prior application No. 619,313, swing valve member 26 in case 16 from the position of Figure 2 back to the position of Figure 1, thus shutting off the delivery of powdered material to the particular substation tank 22. The circuit which now effects this energization of right hand solenoid 48 is as follows, starting with junction point 102: the wire 100^a contacts 65, contacts 67, junction point 144, wire 90, junction point 92, solenoid 48, junction point 196, wire 198, arm 200, contact 202, wire 204 to junction point 76. As junction points 76 and 102 are both energized from source 130, as heretofore described, the current flows when members 65 and 67 are in contact.

Switch 162, heretofore referred to, sending current through wire 158 to all junction points 156, may be used in the emergency that the closing of any switch 65—67 should fail to cause its solenoid 48 to release its lever 38 and thereby permit weight 32 to move valve member 26 from the position of Figure 2 to that of Figure 1, such condition of affairs being indicated by the continued illumination of that station's lamp 150 after lamp 194 is lighted as heretofore described. It is also of use in the event the operator should in any way discover that solenoid 168 has failed to operate in time to release lever 180 and thus permit spring 182 to rock shaft 10 and close valve 8 as heretofore described. When under either one of these conditions, the operator closes this lever 162, he sends current received from wire 110 and 108 in parallel through solenoid 168 and via wire 158 through the solenoid 48 which is in trouble thus insuring the proper operation of both devices as heretofore described.

Whenever the device is operated as heretofore described to allow weight 32 to return valve 26 in case 16 to the position of Figure 1, the switch-wiring system relating to tank 22 is all restored to the normal position of Figure 1 where it is ready to take care of the situation when tank 22 is again emptied.

For purposes of ready comprehension by the reader of the operation of the device, tank 20 is shown full of powdered material 70 which has acted to close the switch members 65—67 belonging to this tank ready to send current to energize the solenoid 48 belonging to this tank, to release lever 40 from arm 38 and it is assumed in this part of the figure that the current has not yet so acted on these parts 40—38.

When the upper switch mechanism 65—67 of a particular filled tank operates in the manner described to shut off the supply of air from tank 6 to tank 2 and to move its particular valve 26 so that no more powdered material can be delivered to it, and

the operator by mechanism not entering into this invention and not here shown gradually withdraws powdered material from said tank, said powdered material 70 moves down from the height shown in tank 20 of Figure 1 until it passes below lower door 206 pivoted at 208, normally held closed by counter-weight 210, whereupon the portion of powdered material 70 which was within the particular adjacent upper box 50 flows out of that box to, under the action of its counter-weight, swing up to the closed position shown in tank 22 of Figure 1, whereupon the contact 65—67 adjacent to that particular tank is broken, thus preventing any interference in the subsequent operation of the device when the tank is completely empty and the lower switch 64—66 of that particular tank again goes into operation to signal for more powdered material.

Summarizing the complete, normal operation of the device and in reference to tank 22 as shown in Figure 1: Its switch 66—68 lights its lamps 86 and 122; the central station operator presses its switch 118 ringing bell 140 and lighting its lamp 86. The substation operator pulls rod 30, moving valve 26 to the position of Figure 2, thus preparing switch contacts 65—67 for action and lighting lamp 150. Central station operator now starts sending fuel 70. When it reaches in tank 22 the position of Figure 2, contacts 66—68 are separated. When the fuel reaches the height of the fuel in tank 20, it operates door 54 of tank 22 to move contact 65 into engagement with contact 67 thus operating solenoid 48 to allow weight 32 to act and at the same time operating solenoid 168 to close valve 8. The same action extinguishes lamp 150, telling central operator delivery to tank 22 has ceased and he may recognize any other call for fuel and supply it.

Whenever one or more valves 26 at a series of substations installed in accordance with this invention are in the position shown in the right hand half of Figure 1 to close off the adjacent switch pipe 18, the operation of switch 162 will have no effect on the adjacent solenoids 48 belonging to said valves; but, if any one of the various substations has its mechanism in the position shown in Figure 2 or in the left hand half of Figure 1 where material can pass down the adjacent pipe 18 into that particular substation tank, the operator then can by operating said switch 162, to stop further flow of material, control the exact amount of powdered material which shall be delivered to that tank and that tank only.

As the delivery of material to a substation can only be started when the central station operator presses switch 118 belonging to that particular station and as switch 162 enables said operator to instantly stop

the delivery to such station, the device of this invention puts it in the power of said operator to by properly manipulating these switches in succession supply several sub-stations simultaneously calling for fuel with successive limited quantities of fuel to keep them going until there is time to put in larger quantities.

If the furnace man or oven tender to whom a given tank as 22 belongs, requires only a small amount of coal to finish a heat or something of that sort, he can let the central station operator begin delivering fuel to him, as heretofore described, and, when he has enough for this purpose, manually manipulate the upper lever arm 60 on his tank to close the switch 65-67 of his tank and thereby automatically shut off the supply of material just as though his tank were full of fuel.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a device of the class described, in combination, a central supply station, a plurality of remote consumption stations, a conveyer pipe leading from the central station adjacent to all the consumption stations, a branch pipe from the conveyer pipe to each consumption station, a valve at the junction of each branch pipe with the main conveyer pipe, selectively closing off either that consumption station or the passage of material from the main station to sub-stations beyond that particular one, locking means selectively holding each valve in each of its said positions, means by which said valve may be opened to the adjacent consumption station, automatic means tending to move said valve to its opposite position, automatic means operated by material approaching the top of each consumption station automatically releasing the lock on the adjacent valve so it can make the last mentioned movement, automatic means operated by the departure of material from the consumption station signalling the central station operator that material is required in said consumption station, and means operable by the central station operator releasing said lock so that the consumption station operator can move the adjacent valve in the main line pipe to permit delivery of material to his consumption station, and independent means by which the central station operator can then at will cause the closing of the valve between the main pipe and said consumption station.

2. In a device of the class described, in combination, a central supply station, a plu-

ality of remote consumption stations, a conveyer pipe leading from the central station adjacent to all the consumption stations, a branch pipe from the conveyer pipe to each consumption station, a valve at the junction of each branch pipe with the main conveyer pipe, selectively closing off either that consumption station or the passage of material from the main station to sub-stations beyond that particular one, locking means selectively holding each valve in each of its said positions, means by which said valve may be opened to the adjacent consumption station, automatic means tending to move said valve to its opposite position, automatic means operated by material approaching the top of each consumption station automatically releasing the lock on the adjacent valve so it can make the last mentioned movement, and simultaneously stopping at the central station the flow of material from that station, automatic means operated by the departure of material from the consumption station signalling the central station operator that material is required in said consumption station and means operable by the central station operator releasing said lock so that the consumption station operator can move the adjacent valve in the main line pipe to permit delivery of material to his consumption station, and independent means by which the central station operator can then at will cause the closing of the valve between the main pipe and said consumption station and the simultaneous stoppage at the central station of the delivery of material therefrom.

3. In a powdered material distributing system, a supply station, a consumption station, a valve associated with said consumption station for controlling the delivery of material thereto, means operating automatically to positively lock said valve in a position to prevent delivery of material to said consumption station, means at the supply station operable to release said locking means to allow said valve to be moved to a position to permit delivery of material to said consumption station, means operating automatically when said valve is so moved to positively lock the same in its last mentioned position, means at the supply station operable to release said last mentioned locking means, and means then operating automatically to return said valve to a position preventing delivery of material to said consumption station.

In witness whereof, I have hereunto subscribed my name.

AUBREY J. GRINDLE.