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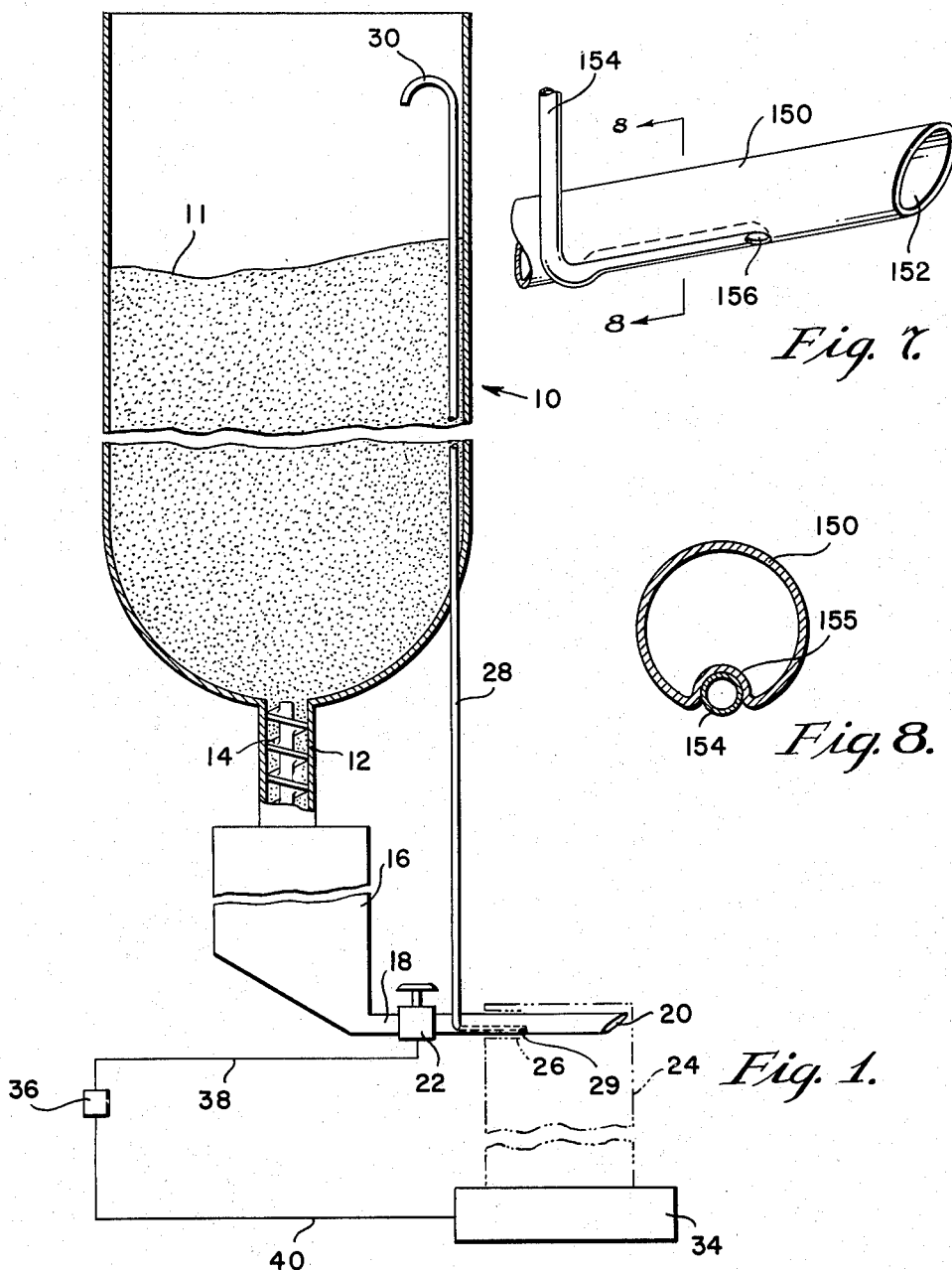
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2,733,848

BAG-FILLING APPARATUS

Filed Feb. 20, 1953

3 Sheets-Sheet 1



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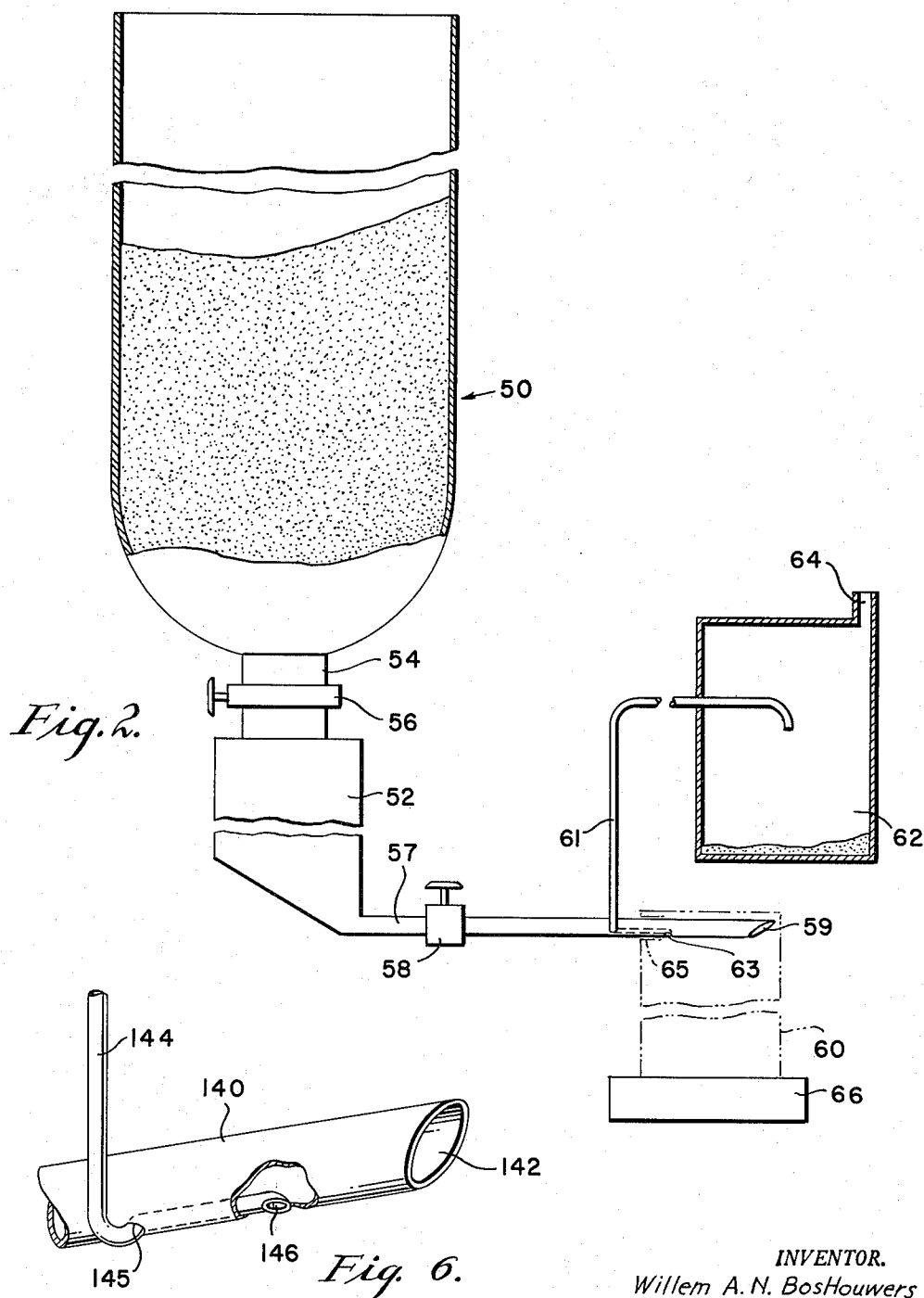
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3 Sheets-Sheet 2



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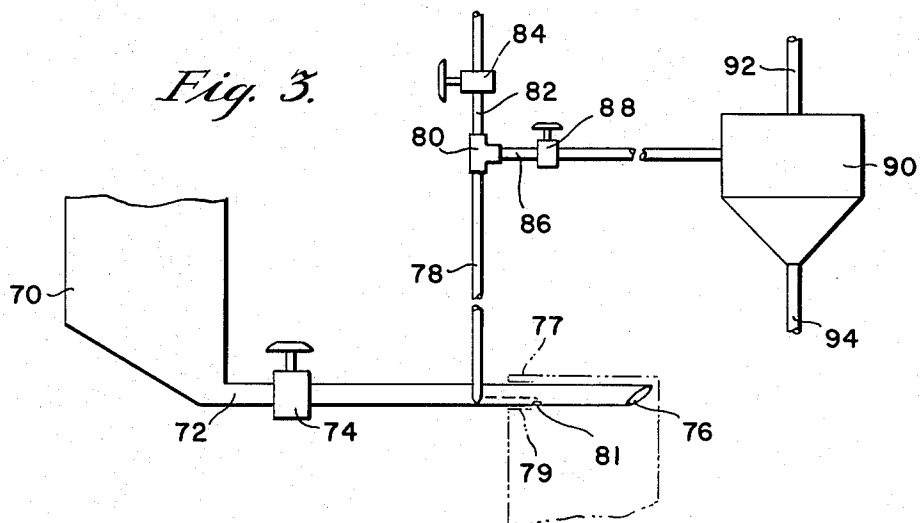
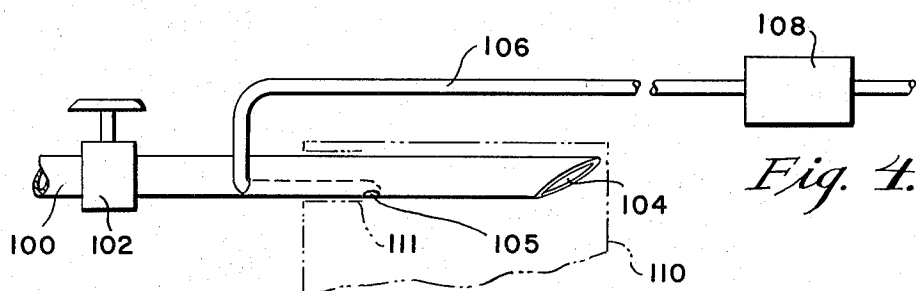
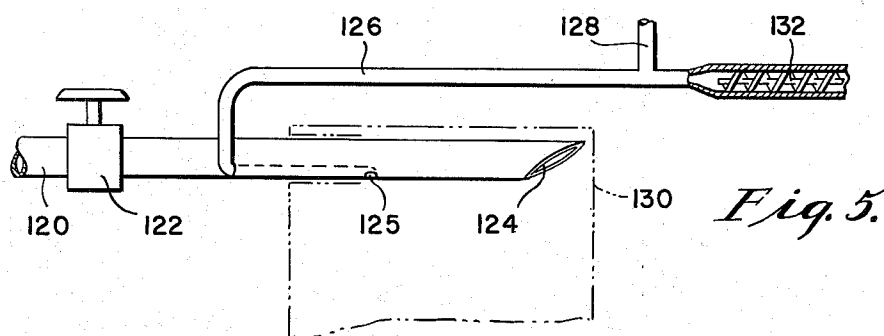
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3 Sheets-Sheet 3



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2,733,848

BAG-FILLING APPARATUS

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Application February 20, 1953, Serial No. 338,117

5 Claims. (Cl. 226—48)

This invention relates to a bag-filling apparatus, and more particularly, to a horizontal discharge bag-filling apparatus for filling valve-type bags with pulverulent material.

The packaging of pulverulent solids such as cereals, grains, pulverized lime, cement, powdered or particulated chemicals, etc., in bags, such as paper bags, is subject to a number of serious problems. Thus, in packaging pulverulent materials care must be taken to prevent the material from being blown into the atmosphere. Otherwise, the atmosphere will become fouled with the pulverulent solid or dust or fines therefrom, and nearby objects will become coated with such dust. Inasmuch as many forms of dust are detrimental to human and animal health, and injurious to bearings and other moving contacting surfaces, it is most desirable to prevent the escape of such dusts in packaging pulverulent material.

Moreover, in the past, it has proven very difficult to rapidly and accurately package pulverulent solids. For example, with conventional open-mouth bags, which are normally filled by means of a vertical discharge hopper, it is necessary to position the open-mouth bag below the discharge exit of the discharge hopper and either tightly engage the lips of the bag with the discharge hopper or employ an enveloping tent or shield around the discharge hopper to prevent the pulverulent material being passed to the bag from fouling the atmosphere. Both of these expedients are unwieldy. Thus, if the lips of the bag are wrapped tightly around the discharge exit of the discharge hopper, entrapped air from the bag will prevent the bag from being completely filled without manual adjustment of the bag during the filling operation or without resorting to other expensive expedients. Moreover, the wrapping of the wide lips of the bag around the discharge exit of the discharge hopper is a relatively expensive and time-consuming operation. The use of tents or shields is likewise expensive inasmuch as it requires the spilled pulverulent material to be collected and repackaged. The use of such tents or shields and the like is not only wasteful, but in the case of dangerous and corrosive solids, such as pulverized alkali, the use of such means may prove hazardous.

While a number of expedients have been proposed to circumvent the aforementioned difficulties, there has not been any completely satisfactory inexpensive method for rapidly filling bags with pulverulent solids heretofore developed.

This invention has as an object the provision of an apparatus for filling bags of pulverulent material which permits the rapid filling of such materials.

This invention has as a further object the provision of an apparatus for filling bags with pulverulent material in which the escape of pulverulent material during the filling operation is prevented.

This invention has as a still further object the provision of an apparatus for filling bags with a pulverulent material in which close regulation of the quantity of pulverulent material discharged into the bags can be achieved.

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These and other objects are achieved by the apparatus of my invention which comprises a horizontal discharge bag-filling apparatus for filling a bag with pulverulent material. The apparatus of my invention is particularly suited for the so-called valve-type bag. The valve-type bag is a preclosed bag, either pasted or sewn, having at its upper periphery, usually at or near the upper edges of the bag, a small opening having a paper valve. The apparatus of my invention includes a hopper adapted to contain the pulverulent material and a horizontal spout leading from the hopper. The horizontal spout is provided with a discharge opening for discharging the pulverulent material from the hopper into a bag having an opening operatively engaged with the horizontal spout. It is essential for the purposes of the apparatus of my invention that the horizontal spout be provided with a vent tube disposed adjacent the terminal discharge portion thereof, such as within the terminal discharge portion thereof, which vent tube terminates closely adjacent the discharge opening of the horizontal spout, permitting the escape of trapped air from the bag.

For the purpose of illustrating the invention, there are shown in the accompanying drawings, which comprise diagrammatic representations, forms thereof which are at present preferred, although it is to be understood that the various instrumentalities of which the invention consists can be variously arranged and organized and that the invention is not limited to the precise arrangements and organizations of the instrumentalities as herein shown and described.

Referring to the drawings in which like reference characters refer to like parts, and which are diagrammatic,

Figure 1 is a vertical view partly in elevation and partly in section of an apparatus for filling bags in accordance with my invention.

Figure 2 is a vertical view partly in elevation and partly in section of a modification of the apparatus for filling bags in accordance with my invention.

Figure 3 is a partial sectional view of another modification.

Figure 4 is a partial sectional view of still another modification.

Figure 5 is a partial sectional view of still another modification.

Figure 6 is a partial view of a spout of my invention.

Figure 7 is a partial view of another modification of the spout of my invention.

Figure 8 is a cross-sectional view taken on line 8—8 of Figure 7.

The aforementioned drawings, which are hereby incorporated into my specification and made a part thereof, are diagrammatic, as indicated above, and are not to be regarded as working drawings of the embodiments shown therein.

Referring to Figure 1, 10 is a storage bin for storing pulverulent material, the upper level of the pulverulent material being indicated by the numeral 11. A transfer conduit 12 provided with a conveying screw 14 extends from the bottom of storage bin 10 for transferring pulverulent material from storage bin 10 to hopper 16. It is to be understood that hopper 16 need not necessarily be located directly below storage bin 10 but that screw conveyors or other solid-conveying means can be utilized to convey pulverulent material from storage bin 10 to hopper 16. Alternatively, screw conveyor 14 can be eliminated and the pulverulent material discharged through a valve by gravity-feed from bin 10 to hopper 16.

Hopper 16 discharges the pulverulent material from bin 10 through a cylindrically-shaped horizontal spout 18 terminating in a discharge opening 20. Valve 22, which is located on horizontal spout 18 intermediate the main body of hopper 16 and discharge opening 20,

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regulates the rate of flow of pulverulent solid material from hopper 16 through discharge opening 20.

A valve-type impervious paper bag 24 (shown in broken section line) having an internal valve-opening 26 in the form of a cylindrically-shaped prehensile nipple adapted to operatively engage with horizontal spout 18 is shown positioned in place in operative engagement with horizontal spout 18.

Horizontal spout 18 is provided with a vent tube 28 the bottom portion of which is disposed within the portion of horizontal spout 18 intermediate valve 22 and discharge opening 20. Vent tube 28 terminates with vent tube opening 29 adjacent to discharge opening 20. It is particularly advantageous to have vent tube opening 29 terminate and be positioned on the bottom of horizontal spout 18, since as more fully discussed below this facilitates a continuous venting of air from bag 24. The vent tube 28 extends from horizontal spout 18 into storage bin 10 and has a reverse elbow or bend 30 located in storage bin 10 at a point above the level 11 of the pulverulent material stored in storage bin 10.

The valve-opening 26 of valve-type bag 24 is retained in place on horizontal spout 18 by frictionally gripping onto horizontal spout 18. If desired, a clamp (not shown) can be used to hold bag 24 in position over horizontal spout 18. Normally, this is not necessary as cylindrically-shaped horizontal spout 18 can be adapted to operatively engage with valve-opening 26 of valve-type bag 24. Valve-type bag 24 is supported on scale 34. A standard or conventional electric regulator or valve-controller designated 36, which is attached to valve 22 by wire 38 and to scale 34 by wire 40, is arranged to close valve 22 when the weight of material in valve-type bag 24 has reached a predetermined weight level. The attainment of this predetermined weight level actuates scale 34 to operate valve-controller 36 and thus close valve 22.

The operation of the apparatus shown in Figure 1 is effected as follows: The pulverulent material in storage bin 10 is passed through material-conveying screw 14 in transfer conduit 12 to hopper 16. Valve 22 in hopper 16 is closed. A portion of horizontal spout 18 including vent tube opening 29 and discharge opening 20 is inserted through valve-opening 26 of a valve-type bag 24 beyond the lips or edges thereof. Valve 22 is then opened. Pulverulent material from hopper 16 flows through horizontal spout 18 under the head of the weight of material in hopper 16, and also, if necessary, the head provided by material moving screw 14. The pulverulent material from horizontal spout 18 passes through discharge opening 20 into valve-type bag 24 and displaces trapped air contained in valve-type bag 24. The trapped air is removed from valve-type bag 24 through vent tube 28 along with some entrained pulverulent material. The removal of trapped air is continuous; the material falling from discharge opening 20, displacing air which is vented through vent tube opening 29 subsequently adjacent to discharge opening 20. The positioning of vent tube opening 29 at the bottom of spout 18 facilitates the removal. The mixture of air and entrained pulverulent material passes upwardly through vent tube 28 and is discharged therefrom through reverse elbow 30 into the storage bin 10 above the level 11 of stored pulverulent material contained in storage bin 10. The trapped air is discharged through the top of storage bin 10 and the entrained pulverulent material added to the solids stored in bin 10. When a predetermined weight of pulverulent material has been deposited in valve-type bag 24, scale 34 actuates valve-controller 36, and as heretofore indicated, effects the closing of valve 22. Valve-type bag 24 is then removed from horizontal spout 18, the valve in valve-opening 26 thereof is closed, due to the pressure of air within bag 24, and is sewn, and another valve-type bag affixed on horizontal spout 18. In this manner, accurate and rapid filling of

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valve-type bags can be achieved without either the trapped air from the bag interfering with the flow of material through the discharge opening or the loss of pulverulent material to the outside atmosphere.

Another modification of my invention is shown in Figure 2, in which a storage bin 50 surmounts a hopper 52. Storage bin 50 is in direct communication with hopper 52 through transfer conduit 54, so that pulverulent material from storage bin 50 can be transferred by gravity-feed to hopper 52. A gate-valve 56 is provided in transfer conduit 54 to regulate the rate of flow of pulverulent material from bin 50 to hopper 52. Hopper 52 is provided with a basal horizontal spout 57 which terminates in discharge opening 59. A manually-regulated flow control valve 58 is positioned on horizontal spout 57 intermediate the main body of hopper 52 and discharge opening 59, to regulate the flow of material through horizontal spout 57. A vent tube 61 is disposed within the portion of horizontal spout 57 intermediate valve 58 and discharge opening 59 and terminates with vent tube opening 63 adjacent the discharge opening 59 of horizontal spout 57. The valve-opening 65 of valve-type bag 60 is positioned over horizontal spout 57, its edges terminating somewhat in back of vent tube opening 63 as shown in Figure 2. Vent tube 61 removes trapped air and entrained solids from valve-type bag 60 to solids-collector 62. Solids-collector 62 which collects the entrained solids from the filling operation is provided with a vent 64 for discharging trapped air from valve-type bag 60. Valve-type bag 60 is supported upon a platform or scale 66. The filling of valve-type bag 60 can be regulated by visual observation of its weight recorded upon a dial (not shown) of scale 66 and corresponding manual regulation of valve 58; or if desired, valve-type bag 60 can be filled to a certain specified volume which can be determined either visually through observation of the configuration of valve-type bag 60 or by other means.

Except for the alternative modifications indicated above, the operation of the modification of my invention shown in Figure 2 follows that heretofore set forth for the embodiment shown in Figure 1.

In Figure 3, an alternative modification of my invention is shown having a hopper 70, provided with a horizontal spout 72, a flow-regulating valve 74, a discharge opening 76 and a vent tube 78, provided with vent tube opening 81 terminating adjacent discharge opening 76. The valve-opening 79 of a valve-type bag 77 is positioned over horizontal spout 72 subsequent to vent tube opening 81. Vent tube 78 is provided with a bifurcating T 80 at a point remote from vent tube opening 81. Conduit 82, provided with valve 84, is inserted into one extension of T 80 and vents at the top of a storage bin (not shown) in a like manner to the modification shown in Figure 1. The other extension of T 80, is provided with conduit 86 and valve 88. Conduit 86 discharges to a centrifugal separator 90 which effects a separation between the trapped air and the entrained solids from valve-type bag 77. The trapped air is vented from the top of centrifugal separator 90 through line 92, and the solids are discharged from the base of centrifugal separator 90 into a storage vessel or other desired tank (not shown) by means of line 94.

Another modification of my invention is shown in Figure 4 in which a horizontal spout 100 is provided with a valve 102, a discharge opening 104 and a vent tube 106 terminating adjacent discharge opening 104 at vent tube opening 105. Vent tube 106 discharges into a filter designated 108 such as a tray filter, or if desired, an electrical filter, such as a Cottrell precipitator. Vent tube 106 is affixed to a vacuum-producing exhaust such as a steam jet or vacuum-pump (not shown) at a point subsequent to filter 108. In this modification, the trapped air withdrawn from valve-type bag 110, which is affixed by means of valve-opening 111 over horizontal spout

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100 subsequent to vent tube opening 105, is freed of entrained solids by means of filter 108 and then withdrawn from the apparatus by means of the vacuum-producing exhaust. This modification permits a very rapid filling of valve-type bag 110 since the vacuum-producing exhaust accelerates the removal of trapped air from valve-type bag 110. The section of vent tube 106 immediately in front of filter 108 can be fitted or manifolded so as to permit connection with vent tubes from a number of other bag filling machines, each of which can be serviced by a single vacuum-producing exhaust.

In the modification of my invention shown in Figure 5 horizontal spout 120 is provided with valve 122, discharge opening 124 and vent tube 126 terminating at vent tube opening 125. Vent tube 126 is provided with a vent 128 at a point remote from its termination adjacent to discharge opening 124. The trapped air and entrained solids from valve-type bag 130, which is positioned over the end of horizontal spout 120 and discharge opening 124, is withdrawn through vent 128 (the pressure on the trapped air having been reduced by its expansion through vent tube 126). The settled entrained pulverulent solids in vent tube 126 are withdrawn therefrom by means of material-conveying screw 132 and discharged to a storage receptacle (not shown).

Figure 6 reveals a modification of the spout of my invention (similar to that shown in operative engagement with a valve-type bag in Figures 1-5). The spout comprises a cylindrical tube 140 having a discharge opening 142. The discharge opening 142 is of elliptical cross-section, with the basal edge of the opening being shorter than the apical edge thereof. Vent tube 144 comprises an external cylindrical pipe of relatively small cross-sectional area when compared to that of cylindrical tube 140 and enters through the wall of cylindrical tube 140 at the point designated 145 and is disposed therewithin. Vent tube 144 terminates at vent tube opening 146 which is operatively aligned with a similar opening in the wall of cylindrical tube 140 and is the same plane as the external surface of the cylindrical tube wall. Preferably, cylindrical tube 140 is constructed of stainless steel. It is also desirable to construct vent tube 144 of stainless steel. Another modification of the horizontal spout of my invention is shown in Figures 7 and 8. As shown therein horizontal spout 150 comprises a cylindrical tube having a groove, pit or recess 155 in its base, comprising a depression extending into the central portion of horizontal spout 150. Vent tube 154 extends from an external position into groove 155 and when positioned in place, such as by welding, substantially occupies groove 155. The spout of the type shown in Figures 7 and 8, when in use, is inserted into the valve-opening of a valve-type bag up to approximately the point shown at line 8-8.

It is, of course, to be understood that other modifications of the spout of my invention can be used.

In the preferred form of my invention, the vent tube is positioned or disposed adjacent or within the base of the horizontal spout subsequent to its discharge opening, so as to facilitate the continuous removal of entrapped air from within the bag, as has already heretofore been discussed.

The apparatus of my invention permits the rapid and accurate filling of bags with pulverulent solids without the loss of appreciable quantities of such solids to the atmosphere. While the apparatus of my invention is preferably employed with a valve-type bag and indeed is most advantageously utilized with such bag, it can also be utilized with open-mouth bags, if provision is made for securing the open-mouth of the bag over the discharge opening of the horizontal spout. However, the use of such bags is not recommended inasmuch as their closure and sealing is time-consuming and interferes with the rapid filling operation which is feasible with the apparatus of my invention. The use of a valve-type bag having

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but a single small opening which can readily fit over the horizontal spout and is closed immediately after the bag has been filled materially aids in the rapidity of the overall bag-filling operation, and substantially increases the man-hour output.

Moreover, valve-type bags can be manufactured in leakproof form and thereby can be rendered structurally sturdy. Furthermore, since there is no over-pressure or building-up of pressure within the bag during the filling operation, the stresses and strains resulting from such pressure build-up are avoided and the possibility of encountering bag-tearing or bag-bursting due to such over-pressure of entrapped air is eliminated.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiments be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

Having described my invention what I claim as new and desire to protect by Letters Patent is the following:

1. An apparatus for filling a bag with pulverulent material including a storage bin for said pulverulent material, a hopper disposed beneath said storage bin and in solids communication therewith adapted to contain said pulverulent material, a transfer conduit intermediate said storage bin and said hopper for transferring said pulverulent materials from said storage bin to said hopper, a horizontal spout leading from said hopper, said horizontal spout having a discharge opening for discharging said pulverulent material from said hopper into a bag having an opening operatively engaged with said spout, a vent tube disposed adjacent the portion of said horizontal spout most remote from said hopper and terminating in an escape opening positioned at a spaced distance subsequent the discharge opening for permitting the escape of trapped air from said bag, said vent tube extending upwardly from said horizontal spout to said storage bin.

2. An apparatus for filling a bag with pulverulent material including a storage bin for said pulverulent material, a hopper disposed beneath said storage bin and in solids communication therewith adapted to contain said pulverulent material, a transfer conduit intermediate said storage bin and said hopper for transferring said pulverulent material from said storage bin to said hopper, a horizontal spout leading from said hopper, said horizontal spout having a discharge opening for discharging said pulverulent material from said hopper into a bag having an opening operatively engaged with said spout, a vent tube disposed adjacent the base of the portion of said horizontal spout most remote from said hopper and terminating in the base of said horizontal spout in an escape opening positioned at a spaced distance subsequent the discharge opening for permitting the escape of trapped air from said bag, said vent tube extending upwardly from said horizontal spout to said storage bin.

3. An apparatus for filling a bag with pulverulent material including a storage bin for said pulverulent material, a hopper disposed beneath said storage bin and in solids communication therewith adapted to contain said pulverulent material, a transfer conduit intermediate said storage bin and said hopper for transferring said pulverulent material from said storage bin to said hopper, a horizontal spout leading from said hopper, said horizontal spout having a discharge opening for discharging said pulverulent material from said hopper into a bag having an opening operatively engaged with said spout, a valve positioned on said horizontal spout intermediate the main body of said hopper and the discharge opening of said horizontal spout for regulating the rate of flow of said pulverulent material, a vent tube disposed within the portion of said horizontal spout intermediate said valve and said discharge opening and terminating in an

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escape opening positioned at a spaced distance subsequent the discharge opening for permitting the escape of trapped air from said bag, said vent tube extending upwardly from said horizontal spout to said storage bin.

4. An apparatus for filling a bag with pulverulent material including a storage bin for said pulverulent material, a hopper disposed beneath said storage bin and in solids communication therewith adapted to contain said pulverulent material, a transfer conduit intermediate said storage bin and said hopper for transferring said pulverulent material from said storage bin to said hopper, a horizontal spout leading from said hopper, said horizontal spout having a discharge opening for discharging said pulverulent material from said hopper into a bag having an opening operatively engaged with said spout, a valve positioned on said horizontal spout intermediate the main body of said hopper and the discharge opening of said horizontal spout for regulating the rate of flow of said pulverulent material, a vent tube disposed within the base of the portion of said horizontal spout intermediate said valve and said discharge opening and terminating in the base of said horizontal spout in an escape opening positioned at a spaced distance subsequent the discharge opening for permitting the escape of trapped air from said bag, said vent tube extending upwardly from said horizontal spout to said storage bin.

5. An apparatus for filling a bag with pulverulent material including a storage bin for said pulverulent material, a hopper adapted to contain said pulverulent material, a horizontal spout leading from said hopper disposed beneath said storage bin and in solids communication therewith, said horizontal spout having a discharge opening

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for discharging said pulverulent material from said hopper into a bag having an opening operatively engaged with said spout, a vent tube disposed adjacent the portion of said horizontal spout most remote from said hopper and terminating in an escape opening positioned at a spaced distance subsequent the discharge opening for permitting the escape of trapped air from said bag, said vent tube extending upwardly from said horizontal spout to said storage bin, an opening to the atmosphere from said vent tube at a portion thereof remote from said horizontal spout and a screw conveyor in said vent tube subsequent to said opening for conveying entrained solids from said trapped air through said vent tube to said storage bin.

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