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METHOD OF FILLING POROUS RECEPTACLES WITH POWDERED MATERIALS

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FIG. 1.

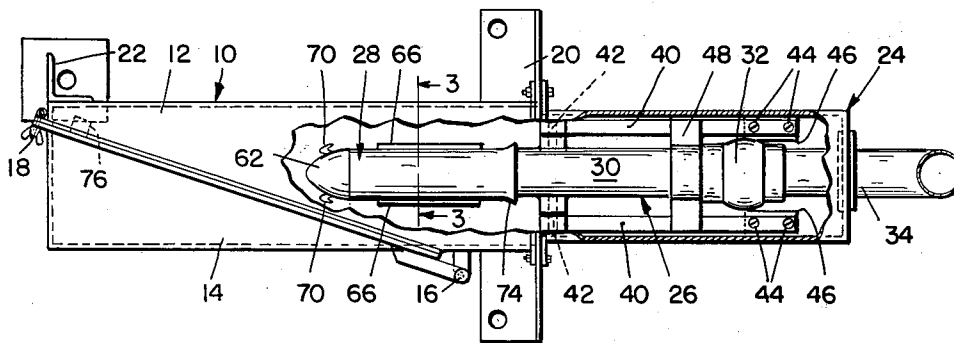


FIG. 2.

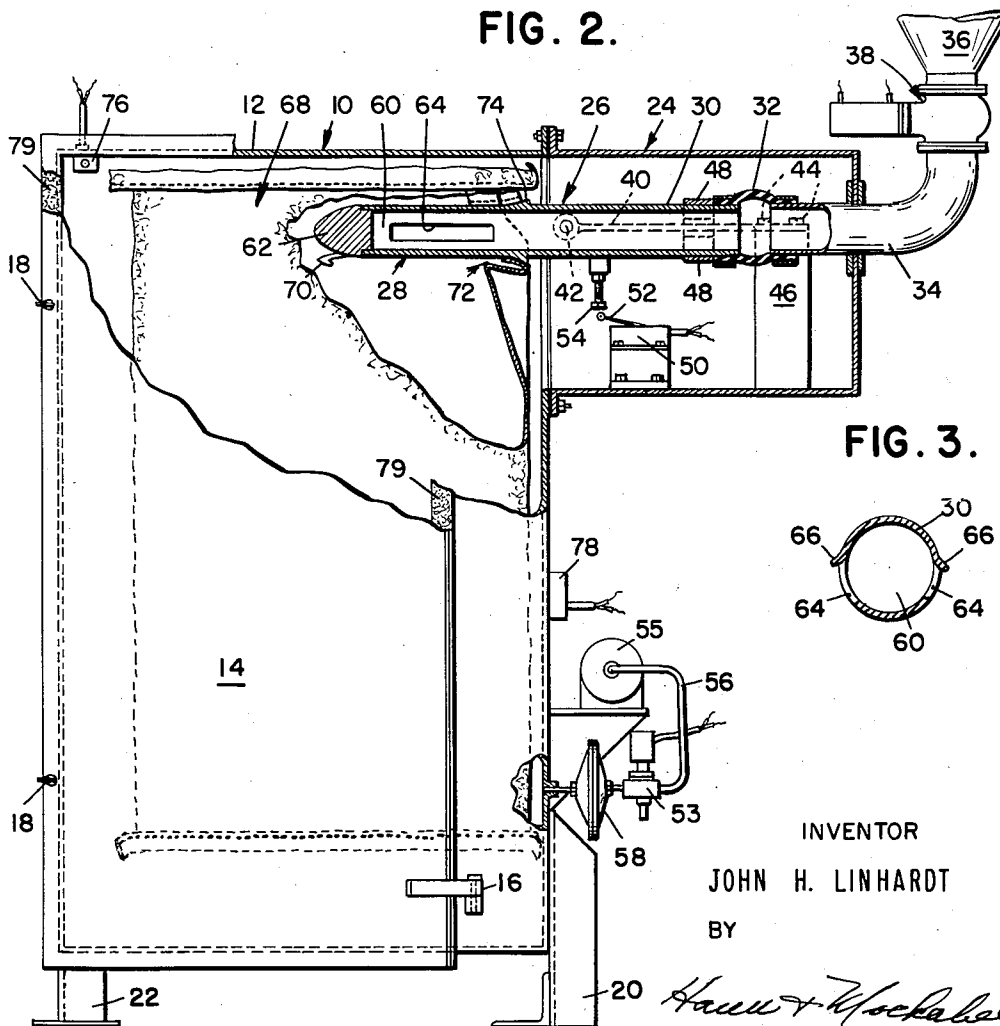
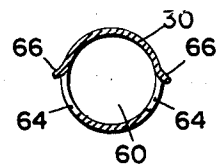


FIG. 3.



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METHOD OF FILLING POROUS RECEPTACLES WITH POWDERED MATERIALS

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5 Claims. (Cl. 141-7)

This invention relates to a method of an apparatus for filling containers with finely divided materials to reduce voids between the fine particles and thereby increase compaction of the particles with the result that a given quantity of materials can be packed in less space.

The invention relates more particularly to the handling and packing of micron type particles in porous containers as compared to placing larger granular materials such as coffee in non-porous containers.

When packages such as kraft paper bags are used for the packing of finely divided materials under conventional packing methods, there is considerable loss in shipment and handling of the bags. This is due primarily to compaction as a result of handling in shipment, leaving a considerable amount of space which permits the compact material to shift with sufficient force to rupture the bags. Various attempts have been made to overcome this difficulty without any appreciable success. Increasing the number of plies in an attempt to increase the strength of the bags or other containers is costly and does not solve the problem.

Investigation has shown that conventional packing of finely ground material in paper bags, 10 to 25% of the cubic volume in the bag is free air. For example, when packing 100 lbs. of a minus 325 mesh material in a 21" x 5" x 41" 5-ply open mouth paper bag, the highly aerated material has a volume of 4305 cubic inches, whereas the volume of 100 lbs. of the material itself is only 3360 cubic inches. Therefore the freshly packed bag contains 945 cubic inches of free air. When the filled bag is subjected to pressure such as in stacking of the bags, air is forced out of the bag through pores in the material of the bag with the result that there is a loosely packed product and not a solid package.

If the product could be packed in such a manner as to remove all free air the dimensions of the bag could be reduced to 21" x 5" x 32", resulting in a considerable saving in packing cost.

The porosity of container materials such as kraft paper is important in connection with the practice of my invention. A principal object of the invention is to support a porous container or bag provided with a conventional inlet valve and known as a valve bag, in a chamber which is subjected to a negative pressure. The free air inside of the bag is exhausted through the pores therein, thereby reducing the air and pressure within the bag. Then a supply of finely divided material is admitted to the interior of the bag and is sucked or drawn therein by the weight of the material fed from a hopper and the atmospheric pressure exerted on the material in the hopper. At the same time the entrained free air entering with the finely divided material will be exhausted from the bag through the pores in the walls thereof. The porosity of the bag is such that it will act as a filter permitting the escape of air but retaining the fine particles in the bag.

Not only does material packed according to my invention result in a saving in the quantity of bag material

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required for a given quantity of material packed, but the material is compacted to the extent that it fills substantially all of the volume of the bag and the material is held against shifting and resultant rupturing of the walls of the bag.

Other objects of the method and apparatus will more fully appear from the following description in connection with the accompanying drawing.

Fig. 1 is a top view of apparatus for practicing the invention, portions being broken away to show interior structure.

Fig. 2 is a side elevational view of the structure of Fig. 1 with portions broken away and in section.

Fig. 3 is an enlarged sectional detail taken approximately on the line 3-3 of Fig. 1.

Figs. 1 and 2 disclose an embodiment of the apparatus and include a bag filling chamber 10 including a stationary portion 12 and a door 14 hinged at 16 and secured to the body portion by a bolt and wing nut unit 18. The main chamber portion 12 is supported by suitable brackets 20 and 22.

Extending from the upper right hand portion of the chamber 10 is a housing 24. Located partially within said housing and partially in an upper corner portion of the chamber 10 is a filling spout 26 including a head 28 and a tubular extension 30. The right hand end of the extension 30 is connected by a flexible coupling 32 to a tube 34 leading from the bottom of a material hopper 36. A shut-off valve 38 is located in the tube 34.

The filling spout 26 is connected to a pair of leaf springs 40. As viewed in Figs. 1 and 2 the left ends of the springs 40 are connected to studs 42 extending from opposite sides of the spout assembly 26 and the right ends of the springs are secured by bolts 44 to posts 46 which extend upwardly from the bottom of the housing 24. Straps 48 lie about the right end portion of the tubular extension 30 of the spout 26 and engage the leaf springs 40. As a result of the spring mounting of the spout 26, when weight is applied to the bag filling head 28 to a sufficient degree the entire spout assembly will tilt counter-clockwise as viewed in Fig. 2.

Located in the housing 24 is a normally closed switch 50 having a switch arm 52 adapted to be engaged by an adjustable stud 54 mounted on the lower side of the tubular extension 30 of the filling spout 26. The switch 50 in turn will close a solenoid valve 38 at the bottom of the hopper 36 and simultaneously close a solenoid valve 53 which is located between a vacuum pump 55 and the lower portion of the chamber 10. There is a conduit 56 from the vacuum pump 55, through the solenoid valve 53 and a filter 58 to the interior of said chamber 10.

The left portion of the filler spout 26 comprises a filler head 28 mentioned above. This filler head has a hollow portion 60 and a closed end 62. The hollow portion is provided with elongated laterally disposed outlet openings 64 having deflectors 66 along their upper edges to direct finely divided material from the hopper 36 into a bag 68 which is supported on the filler head.

The filler head 28 is provided with a pair of resiliently mounted hooks 70 for a purpose to be described below.

When a bag is to be filled, the door 14 of the casing 10 is opened and a container such as the bag 68 is placed in the chamber 10, the filler head 28 being inserted through a valve 72 formed in an upper corner of the bag in a manner known in the art. It will be noted that the filler head 28 has a flared skirt 74 which assists in forming a seal between the bag valve 72 and said filler head.

When the bag is placed in position and prior to filling the filler spout 26 is held horizontally or with the filler spout 28 tilted slightly upwardly and supported by the leaf springs 40. When the door 14 is closed it will strike a normally open switch unit 76 and close the electrical

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control circuit to open the solenoid valve 38 and actuate the vacuum pump 55 which exhausts air from within the chamber 10. It is desirable that a seal or gasket 79 be provided between the door 14 and the main casing portion 12.

The solenoid valve 53 is connected to a timing switch 78, the switch causing the valve 53 to open to atmosphere and create a pulsating pumping action to exhaust air from the chamber 10.

As pressure within the chamber 10 is reduced, it will draw air through the walls of the bag 68 which is formed of a porous material. This material may, for example, be a suitable kraft paper which will pass air therethrough but will retain highly divided particles of the material with which the bag is to be filled.

Since the filler spout 26 is in its upper position supported by the springs 40, the switch 50 is closed since the stud 54 on the filler spout is not in engagement with the arm 52 which is adapted to open the switch 50 when the filler head 28 is tilted down under the weight of a filled bag. Since the switch 50 is closed at the beginning of the filling operation, the solenoid valve 38 is held open to permit the flow of finely divided material from the hopper 36 through the tube 34 and filler spout 26 into the bag 68.

During the initial operation of the vacuum pump 55, air is to a considerable extent exhausted from the bag 68. As this occurs, negative pressure builds up in the bag and this pressure is exerted through the filler spout to the hopper 36 to suck or draw finely divided material through the filler spout and into the bag. As the material flows into the bag it carries with it a certain amount of entrained air which is drawn from the bag 68 through the pores in its walls.

By reason of the removal of air from the interior of the bag through the pores of the bag material, air is removed from the voids in the material, causing the micron particles to settle into the bag with a considerable degree of compaction so that when the bag is filled there is a minimum of air in the bag and practically all of its interior volume is filled with the compacted micron particles.

When the bag is filled, the weight of the material in the bag will create a downward pull on the filler spout and flex the leaf springs 40 downwardly. Thereupon the stud 54 on the bottom of the filler spout 26 will actuate the switch arm 52, breaking the electrical circuit. This results in closing of the solenoid valve 38 and stopping of the vacuum pump 55.

When the bag 68 is filled and the filler head 28 drops down, opening the switch 50, the solenoid valve 53 will be actuated to vent to atmosphere, thereby breaking the vacuum in the chamber 10 and permitting door 14 to be opened. Otherwise the reduced pressure in the chamber 10 would hold the door 14 tightly closed and prevent it from being opened for the removal of the filled bag.

When the chamber 10 is opened, the switch element 76 will open the electrical circuit in another place so that when the filled bag is removed from the filler head 28 and the filler spout is permitted to return to its upper position, the vacuum pump will not be energized and the solenoid valve 38 will not be opened until the casing door 14 is again closed.

It will be noted that the bag valve 72 is folded so that it projects into the bag in the position shown in Fig. 2. When a filled bag is removed from the filler head 28, the hooks 70 will engage the inwardly directed edge of the bag valve and pull the valve out so it can be closed by stitching or other suitable means.

It should be remembered that the apparatus and method disclosed herein are intended to be utilized with the filling of containers such as bags having porous walls with extremely finely divided materials. The invention is not to be confused with vacuum packing of non-porous containers, with larger granular materials. As stated

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above the general objects of the invention are to provide a method and means whereby very finely divided materials can be compactly placed in porous containers so that the size of the container in relation to the amount of material packed can be considerably reduced and the damage usually resulting from the handling and shipment of bags conventionally filled with finely divided materials is reduced to a minimum. The filling of bags in accordance with the invention reduces shipping and storage space to a considerable degree. Also, when expendable pallets are used for shipping, the size of the pallets and the number required for a given quantity of material shipped can be greatly reduced.

With regard to savings in shipment, it has been found that it is necessary to use a fifty-foot box car to load 800 containers weighing 100 lbs. each. The same product, packed in containers in accordance with the invention, can be loaded in the same quantity and at the same depth in a forty-foot box car. Mention is made of the same depth of load because too great a weight imposed upon bags in lower layers is of course objectionable.

The purpose of the solenoid valve 52 is not only to vent the chamber 10, but also, with the aid of the timing switch 78, to vent the vacuum pump 55 to atmosphere while maintaining reduced pressure in the chamber 10, thereby creating a pulsation in the suction applied by the pump to the interior of the chamber 10. This results in what might be termed a tamping action on the material being introduced into the bag 68 and increasing the compaction of materials therein.

Another advantage of packing finely divided material according to the invention is that the bag can be filled and made to conform to a more or less rectangular shape, greatly improving storing and loading operations.

Efficiency of packing or time required to fill a bag can be controlled by varying the porosity of the material from which the package is formed.

Still another important advantage of the invention resides in the fact that tension or stress on the plies of multi-wall paper bags is distributed more evenly to all the plies to provide a stronger package, a condition which does not exist when multiple ply bags are filled in the conventional manner.

It will be understood that various changes can be made in the form and details of the apparatus and in the specific steps of the method disclosed herein without departing from the spirit of the invention.

I claim:

1. An apparatus for filling porous containers with finely divided materials which includes a substantially closed chamber having an inlet for the introduction of the finely divided material and an air exhausting outlet, a filler member comprising a material supply conduit extending into said chamber through said inlet, said chamber comprising a housing having a movable closure, an air suction device connected to the outlet of the chamber to exhaust air therefrom, and a control device interposed between the main body of the chamber and the movable closure and connected to the suction device and operative upon movement of the closure to its closed position to render the suction device operative.

2. Apparatus for filling porous bags having bag valves incorporated therein which includes a reduced pressure chamber for receiving a bag to be filled, a filler head in said chamber having means for connection with a supply of material to be packed, said head having a free end entrant into a bag through the bag valve, said filler head having a material discharge opening adjacent its free end, and a lateral projection adjacent the free end of the filler head to engage the bag valve and pull it outwardly relative to the bag proper when the head is removed from the bag.

3. Apparatus for filling porous containers with finely divided materials which includes a substantially closed chamber having an inlet for the introduction of the finely divided materials, said chamber having an air exhausting

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outlet, a filler member comprising a supply conduit extending into said chamber through said inlet and terminating in the chamber above the bottom thereof, said filler member lying generally horizontally in said chamber and providing a support for a container to be filled, an air suction device connected to the outlet of the chamber to exhaust air therefrom, a portion of the filler member in said chamber being downwardly yieldable under a predetermined weight, said supply conduit having a material flow control valve therein, a control device having a connection with the material flow control valve to open and close the valve, and said filler member being movable to actuate said control device.

4. A method of packaging finely divided materials in flexible containers of porous materials which includes supporting the containers by their tops in a vertical position, introducing the finely divided materials into the tops of the containers through an inlet of considerably less cross section than that of the containers while said containers are subjected to pulsating negative air pressures on the exteriors thereof during the filling operation, and producing with the pulsating negative pressures a maintained withdrawal of air from the containers through the pores of the bottom and sides thereof with a resultant compaction of the finely divided materials in the containers.

5. Apparatus for filling flexible porous containers with finely powdered materials which includes a substantially

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closed chamber, an inlet for the introduction of air and finely divided material including a spout extending into said chamber and located in the upper portion thereof, said spout having a portion upon which a container can be hung and supported in said chamber, said chamber having an air-exhausting outlet, an air suction device having a connection with said air-exhausting outlet to exhaust air from the chamber, and an air pulsator in the connection between the chamber outlet and said suction device.

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