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[54] PACKING METHOD AND APPARATUS FOR
PERFORMING THE METHOD
19 Claims, 3 Drawing Figs.

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10—12, 67—69, 71, 73, 74, 77, 114, 313—317;
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ABSTRACT: A container to be filled having deformable walls is engaged prior to or in the early stages of filling by members deflecting at least one of the container walls inwardly reducing the container volume. As the container is filled, the weight of the material moves the container walls outwardly to assume their normal extended position, which action insures complete filling of the container and deters clumping of the material or creation of air pockets during the filling.

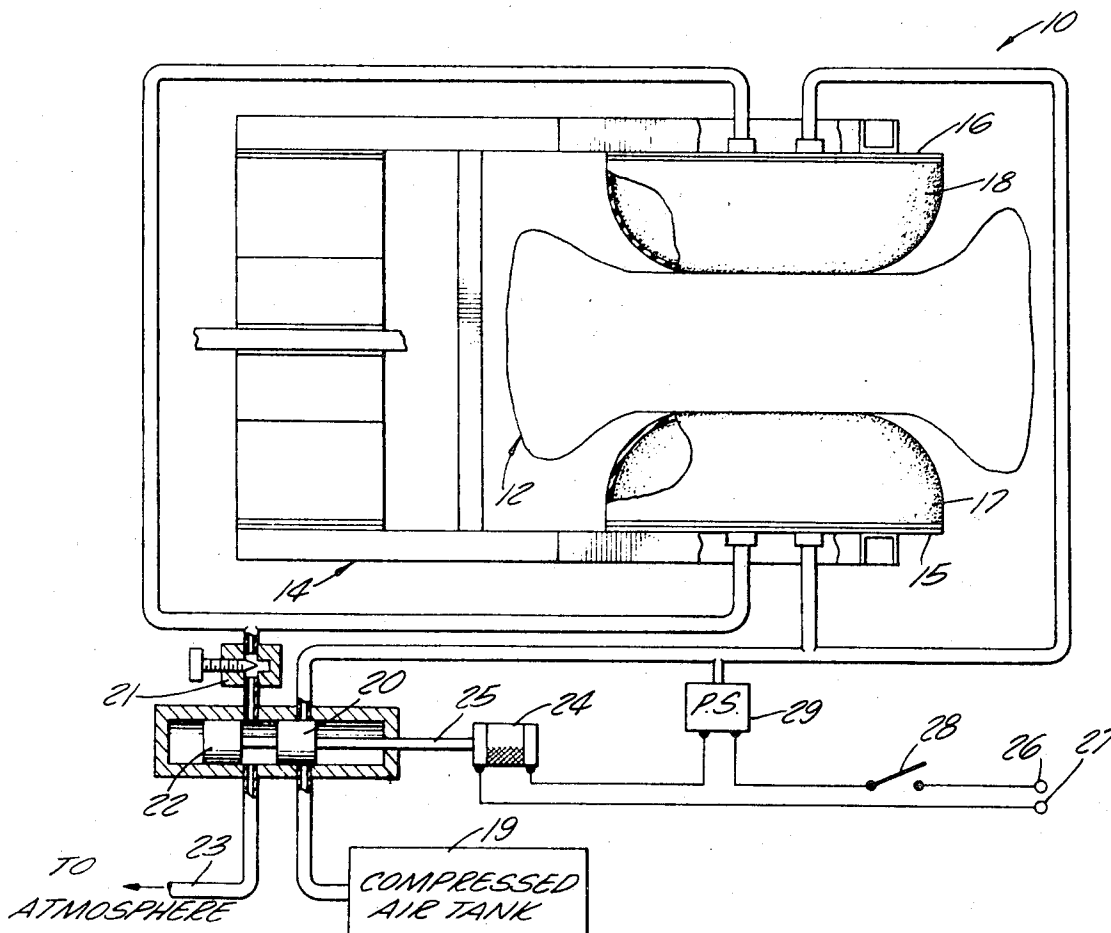


FIG. 1.

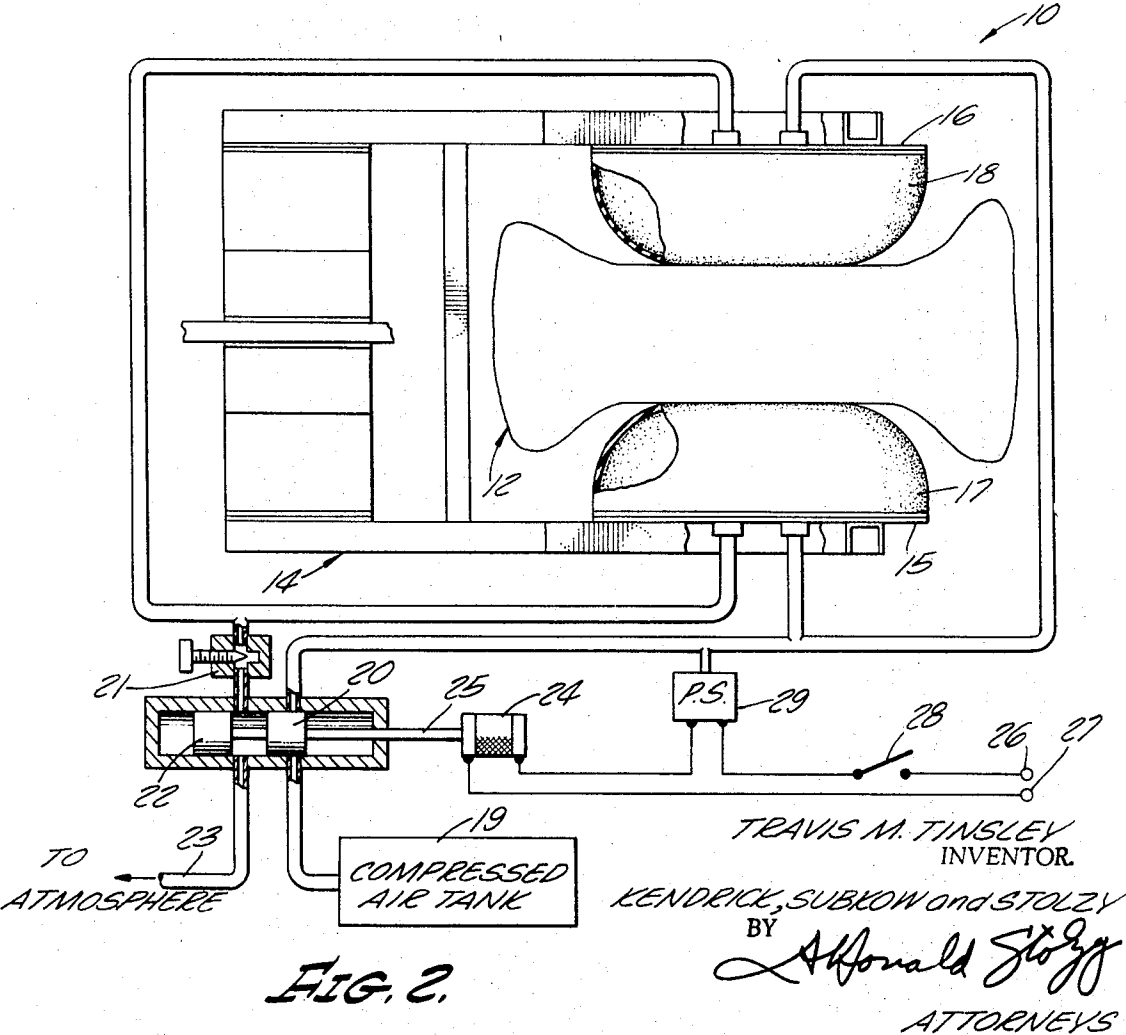
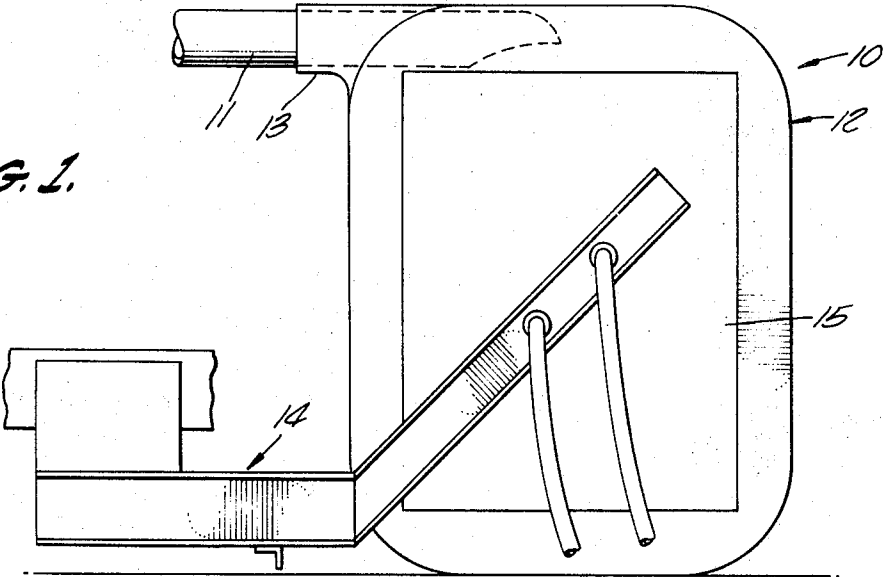


FIG. 2.

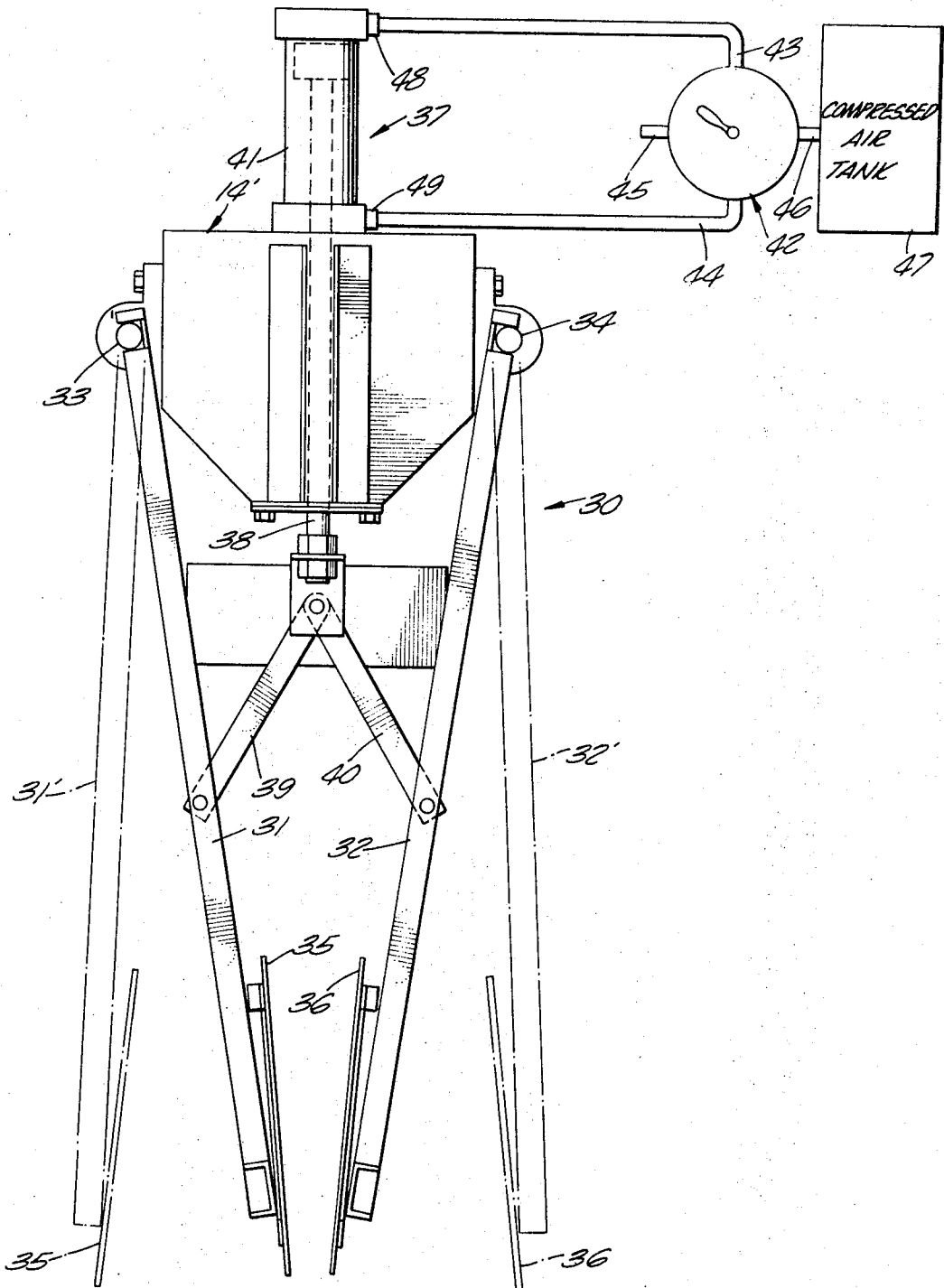


FIG. 3.

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PACKING METHOD AND APPARATUS FOR PERFORMING THE METHOD

This invention relates to the packaging art, and more particularly to an improved method and apparatus for fully packing a container in the shortest possible time.

In the past it has been the practice to blow material in the form of a dry powder into an air permeable paper bag by the use of compressed air.

Although the blower type bag packing method of the prior art is employed extensively, it has several serious disadvantages. In the first place, the bag has only one opening into its interior. The bag packer outlet is therefore tied to the bag opening. Air in the bag escapes through the air permeable top side and bottom walls of the bag. The bag thus effectively strains the powder out of the air in which it is suspended as it is blown into the bag. For this reason, the strained powder collects in a caked layer over the entire internal surface of the bag. This phenomenon causes several problems.

The layer of powder covers the pores in the bag walls and produces an air tight seal therewith. This prevents air in the bag from escaping from the interior to the exterior thereof through the bag walls. This, in turn, causes a back pressure to build up at the packer outlet. Thus, the velocity of both air and powder being blown into the bag is greatly reduced. Further, an excess of air is retained in the bag after it is packed.

The packer must be attended by an operator. Thus, the slowed rate of packing increases the labor and overhead cost of packing.

Another end result is that the powder finally settles and after several hours the air escapes from the bag. By examining the bag later on one will therefore find that the bag has not really been fully packed due to settling.

The settling problem increases bag size per unit product to be packed. This therefore increases bag cost. The large size bag and the large amount of air which is initially blown thereto also increases freight costs.

In the prior art some auxiliary devices have been used to overcome some of the above-described disadvantages using a blower type bag pack. Such auxiliary devices are used in addition to the bag packer itself.

One auxiliary device incorporates a support for the bottom of a bag while it is being filled. The support is vibrated to crumble the caked layer on the bag walls down into a heap at the bottom of the bag. However, this device actually slows the packing process for light and fluffy materials such as Kaolin clay which has a density of 30 pounds per cubic foot. Apparently a detrimental effect is produced because the vibrator continuously creates a powder cloud inside the bag. This makes it very difficult for the powder particles in the cloud to precipitate out of the air in which they are suspended.

Another of the above mentioned prior art auxiliary devices actually places a vacuum on the bag to draw the air out of it. This apparatus is quite helpful in providing at least a partial engineering solution to all of the above-described problems of the prior art. However, the vacuum device is very expensive to construct, to maintain and to operate.

In accordance with the method and apparatus of the present invention, the above-described and other disadvantages of the prior art are overcome by crushing in the sides of a flexible container and gradually allowing the sides to expand as the container is filled with the material to be packaged.

In accordance with the invention, a product may be tightly packaged in this manner in the shortest possible time. For example, the side of an air permeable paper bag may be crushed in and a dry powder blown into the bag while the sides are crushed in. The bag sides may be released gradually. The bag sides may be released continuously or during certain periods of time, if desired. Alternatively, the bag sides may be released in steps. At any rate, the bag sides are released in accordance with the present invention after a first portion of the powder has been blown into the interior of the bag. The powder may be blown into the bag during the entire packing operation, if desired. Further, after the bag sides are released, dry powder

is still blown into the interior of the bag. If desired, the releasing and blowing steps may be repeated alternately any number of times.

It is an outstanding feature of the present invention that by releasing the sides of the bag, the bag is allowed to expand away from the caked layer of the powder which forms in contact with the interior surface of the bag. The bag can therefore breathe again, so to speak. In other words, air can escape through the bag because an airtight seal is no longer produced over the pores in the bag walls by the layer of caked powder which would otherwise lie in contact with the interior surface of the bag. Further, the caked layer can be gently crumbled into the center and to the bottom of the bag in a position such that the escape of air from the interior to the exterior of the bag is no longer impeded.

In accordance with the foregoing, the packer employed to blow the powder into the bag, no longer develops back pressure. Thus, air and powder are continuously blown into the bag at a high velocity. No excessive air is therefore retained in the bag after it is packed.

Due to the high velocity air and powder, the time that it takes to pack a bag is decreased. The time of the packer operator is therefore reduced, and both labor and overhead costs are reduced.

Due to the fact that no air is retained in the packed bag, bags packed in accordance with the present invention are more fully packed than those packed in accordance with the prior art.

Due to the fact that the present invention overcomes the settling problem of the prior art, smaller bag sizes may be employed to carry larger amounts of a granular or powdered product. The cost of a paper bag is, in general, directly proportional to its size. The present invention therefore makes it possible to ship a greater quantity of a powdered material at a lower cost than bag packing methods permitted in the prior art. Further, the smaller bag and tight pack make it possible to reduce freight costs due to a decrease in shipping space.

Due to the fact that only gradual movement of the bag sides are permitted in accordance with the present invention, the method and apparatus of the present invention may be employed to pack either very dense powdered materials or to pack very light and fluffy powdered materials, such as Kaolin clay.

Due to the relatively simple method of the present invention in allowing the paper bag walls to expand, the method of the present invention may be performed very easily and the apparatus thereof may be constructed, maintained and operated at low cost.

The advantages of the invention may be summarized as follows. The invention may be employed to pack a powder rapidly and tightly inside a paper bag. Due to the tight pack, a small bag may be used. Due to the fact that the bag may be packed in a short time, labor and overhead cost is saved. Due to the fact that a smaller bag can be used, the bag cost is reduced. The compact tight bag takes less space and therefore makes it possible to achieve a saving on freight cost. However, the invention may be employed on a wide range of heavy and light materials including Kaolin clay. The apparatus of the invention may also be constructed, operated and maintained economically.

The above-described and other advantages of the present invention will be better understood from the following description when considered in connection with the accompanying drawings.

In the drawings which are to be regarded as merely illustrative:

FIG. 1 is a side elevational view of a portion of one embodiment of the present invention;

FIG. 2 is a top plan view partly in section of the embodiment shown in FIG. 1; and

FIG. 3 is a top plan view of still another embodiment of the present invention.

In FIGS. 1 and 2, one embodiment of the invention is indicated at 10. In FIG. 1 the outlet of a conventional bag packer is indicated at 11. Bag 12 has an inlet 13 which may be fixed to packer outlet 11 by any conventional means. A powdered material is blown through outlet 11 into bag 12 as the material is suspended in air.

Embodiment 10 includes a high beam frame 14 which rests on the floor. Frame 14 has a plate 15 fixed thereto. A similar plate 16 is also fixed to frame 14. Rubber bags or flexible diaphragms 17 and 18 are fixed to plates 15 and 16, respectively. Apparatus 10 includes a compressed air tank 19. Air is admitted to the interior of bags 17 and 18 through a valve 20. Air is allowed to escape from the interior of bags 17 and 18 through a needle valve 21, a valve 22 and an exhaust vent 23. Valves 20 and 22 are operated by a solenoid 24 that has a plunger rod 25 fixed to valves 20 and 22. Electrical input terminals are provided at 26 and 27. A manually operable switch 28, and a pressure switch 29 are connected in series with solenoid 24 between terminals 26 and 27. If desired, switch 28 may be a momentary contact switch which is spring biased open.

In the operation of the embodiment of the invention shown in FIG. 1, switch 28 is closed. Solenoid 24 is then energized and valve 20 is opened and valve 22 is closed. Air then fills bag 17 and bag 18 from tank 19. Bags 17 and 18 are flexible. However, bags 17 and 18 are also both elastic and expandable to crush in the side walls of bag 12 as shown in FIG. 2. Bags 17 and 18 are thus inflated by the air from tank 19. In general, the side walls of bag 12 will be crushed in before air is blown into bag 12 out of outlet 11. Solenoid 24 will be energized only for a short period of time. When the pressure in the line from valve 20 to bags or diaphragms 17 and 18 reaches a certain pressure, pressure switch 29 will open the line to solenoid 24 and it will be deenergized. At that point, switch 28 will be opened. The air inside bags 17 and 18 will then escape from vent 23 through valves 21 and 22. Needle valve 21 is adjustable. It therefore may be set to allow the escape of air at a rate corresponding to the rate at which it is desired to allow the side walls of bag 12 to expand.

In FIG. 3, an alternative embodiment of the present invention is shown at 30. The device 30 includes arms 31 and 32 which are pivoted at 34. Arms 31 and 32 have plates 35 and 36, respectively, fixed thereto. Plates 35 and 36 crush the side walls of bag 12 in the same manner as do bags 17 and 18.

Arms 31 and 32 are operated by a pneumatic ram 37 which has a piston rod 38 connected to arms 31 and 32 respectively by pivoted linkages 39 and 40, respectively. Air is alternately admitted to the forward and rearward ends of a cylinder 41 of ram 37 by a conventional valve 42. Valve 42 has outlet ports 43, 44 and 45, and an inlet port 46 connected from a compressed air tank 47.

In the operation of the embodiment 30 shown in FIG. 3, bag 12 is initially crushed and a powdered material suspended in air is blown into bag 12 as before. Cylinder 41 has ports at 48 and 49. Valve 42 may have an operative position at which all of its ports are closed to the atmosphere. Arms 31 and 32 are pulled together by admitting air to cylinder port 49 by the operation of valve 42. Arms 31 and 32 are spread apart by admitting air into cylinder 41 through port 48 by the operation of valve 42. Arms 31 and 32 may thus be spread apart continuously by cracking valve 42. Alternatively, valve 42 may be operated intermittently to spread arms 31 and 32 away from each other in one or more steps. If desired, arms 31 and 32 may be spread apart all the way to the dotted line position shown at 31' and 32' in FIG. 3.

For some smaller paper bags, it may be desirable to squeeze the bag sidewalls as close together as 2 inches. The bag might then be allowed to expand so that the side walls are spaced a distance of 5 inches apart. For larger bags, a minimum spacing might again be 2 inches and a maximum spacing about 14 inches. Notwithstanding the foregoing, none of the bag spacing dimensions given herein are in any way critical.

Although the embodiment of the invention of FIG. 1 is operated manually to the extent that switch 28 is closed until switch 29 opens, it will be appreciated that a self-locking relay could be employed with normally open contacts for switch 28 and that such a relay could be deenergized by pressure switch 29, if desired. Note will be taken that, although the method and apparatus of the present invention is especially useful in connection with powdered material blown into a paper bag, the invention still may have substantial utility when used with bag packers having an auger type or screw type conveyor, a rotary impeller or a gravity feed.

Note will be taken that the method of the present invention may actually be performed manually.

In accordance with the present invention, it will be appreciated that the embodiment 10 may utilize simply bag 12 and bag 18, the use of bag 17 being absolutely unnecessary to the practice of the invention. It is, of course, desirable to have one member or one side of the bag 12 movable relative to the other side to crush the bag 12.

A further alternative might be the use of bags 17 and 18 of a flexible, but not elastic, membrane or diaphragm. Bags 17 and 18 are expandable, but according to the broad concept of the invention, neither bags 17 and 18 need be elastic. Although both arms 31 and 32 are movable relative to a frame 14' shown in FIG. 2, note will be taken that the invention could be practiced by making only one of the arms 31 and 32 movable relative to the other.

For purposes of definition herein including the terminology used in the claims to follow, the word "member" in any of its forms is hereby defined to include both plates 35 and 36 and bags 17 and 18.

Note will be taken that in the method of the present invention, the side walls of bag 12 may expand due to the internal preponderance of pressure inside bag 12, but that in general, the expansion of the side walls of bag 12 will be restrained either by plates 35 and 36 or bags 17 and 18.

According to the method of the present invention, a first portion of powder is blown into bag 12 before the side walls of bag 12 are allowed to expand; a second portion is blown into bag 12 after the side walls have been allowed to expand. However, for purposes of definition in this description and in the claims to follow, the reference to "first portion" is hereby defined to include any portion preceding the retraction of bags 17 and 18 or plates 35 and 36, it being understood that bag 12 can be partially filled before the method of the present invention is practiced, if desired. In other words, the method of the present invention may be practiced even though bag 12 is initially not completely empty.

The word "sides" as describing the side walls of bag 12 is not limited to the side walls thereof but include both the top, bottom and end walls thereof since the word "side" can have and does herein have the meaning of upper side, lower side, etc.

Although powder can be blown into bag 12 before or after the side walls thereof are released and the bag 12 is allowed to expand in general, powder will be blown into bag 12 continuously as bags 17 and 18 are retracted and as plates 35 and 36 are retracted. Thus, the steps of blowing in powder and releasing the pressure on the side walls of bag 12 may be performed simultaneously, if desired.

In accordance with the present invention, as air is exhausted from the interior of bags 17 and 18, bag 12 is allowed to expand. This then allows the side walls of bag 12 to expand away from the caked layer of powder therein. Air can then flow rapidly out of the bag 12. At the same time, a high velocity input of air and powder may be maintained to pack bag 12 very rapidly. Bag 12 is also packed tightly because air is allowed to escape through the side walls thereof. Although it is understood that a portion of the surface of bags 17 and 18 and plates 35 and 36 may lie very close to the external surface of bag 12, air is nevertheless allowed to escape. Further, in practice, it has been possible in some cases to pack 60 pounds of a powder in a bag designed to carry 40 pounds thereof.

In accordance with the foregoing, the settling problem of the prior art is solved. The fact that bags may be packed at a high rate of speed also reduces labor and overhead costs. Bag size also can be reduced. The method and apparatus of the present invention is also unlimited as to the type of powder that can be packed. Some of the powdered materials which the invention may be used to pack are: asbestos, diatomaceous earth, Kaolin, clay, talc, carbon black, titanium dioxide, paint pigments of all kinds, polyvinyl chloride, other pulverized plastics of all kinds, including polyethylene and polypropylene, insecticides, wheat flour, cement, limestone dust and bentonite clay. The apparatus of the present invention also can be constructed, operated and maintained at a low cost.

Although only a few embodiments of the present invention have been described and illustrated herein, many changes and modifications thereof will of course suggest themselves to those skilled in the art. The present invention should therefore not be limited to the embodiments selected for this disclosure, the true scope of the invention being defined only in the appended claims.

I claim:

1. Apparatus for rapidly filling and fully packing conventional air pervious flexible paper bags with a dry powdered solid material, said apparatus comprising: means to blow said material into a bag while said material is suspended in air; a rigid frame on each side of said bag, said frames being fixed in position relative to each other; two air inflatable expandable rubber bags, each rubber bag being fixed to a different corresponding frame, said rubber bags being positioned on opposite sides of said paper bag; a tank of compressed air; an intake valve actuable to admit air from said tank into the interior of said rubber bags; an adjustable needle valve connected from said rubber bags; an exhaust valve connected from said needle valve to the atmosphere; a solenoid to open said intake valve and to close said exhaust valve when energized, said intake valve being closed and said exhaust valve being open when said solenoid is deenergized; and supply means to provide electric power for said solenoid, said supply means including an initiating switch and a pressure switch connected in series with said solenoid.

2. Apparatus for rapidly filling and fully packing an air pervious flexible container with a dry powdered solid material, said apparatus comprising: feed means to blow said material into the container while said material is suspended in air; a rigid frame on each side of said container, said frames being fixed in position relative to each other; two air inflatable expandable elastic bags, each bag being fixed to a different corresponding frame, said bags being positioned on opposite sides of said container; pneumatic means for initially inflating said bags to contact and crush in the sides of said container substantially reducing the container volume from the filled container volume; and means for cutting off fluid supply to said bags after the container sides are crushed and maintaining said bags in a substantially deflated condition during container filling to permit the walls of said container to expand against said bags away from material therein.

3. Apparatus for rapidly filling and fully packing an air pervious flexible container with a dry powdered solid material, said apparatus comprising: feed means to blow said material into the container while said material is suspended in air; a rigid frame on each side of said container, said frames being fixed in position relative to each other; at least one air inflatable flexible bag fixed to one of said frames in a position between said frames; and pneumatic means for inflating said bag to contact and crush in the side of said container when empty substantially reducing the normal container volume; and means for cutting off fluid supply to said bag after the container sides are crushed and for maintaining said bag in a substantially deflated condition during container filling to permit the wall of said container to expand against said bag away from material therein.

4. Apparatus for manipulating a flexible container to permit it to be rapidly filled and fully packed with a dry granular solid material, said apparatus comprising: a rigid frame on each side of said container, said frames being fixed in position relative to each other; expansion control means including at least one air inflatable flexible bag fixed to one of said frames in a position between said frames; and pneumatic means for inflating said bag to move in the side of said container before filling and reduce the container volume; means for deflating said bag upon initiation of container filling and maintaining said bag in a substantially deflated condition throughout filling to permit the moved wall of said container to expand against said bag away from material therein causing the container to assume normal volume.

5. The invention as defined in claim 4, wherein said expansion control means also includes a second flexible bag fixed to the other of said frames between said frames, said deflating means being actuable to control the pressure in both of said bags.

6. The invention as defined in claim 5, wherein both of said bags are flexible, expandable and elastic.

7. The invention as defined in claim 4, wherein said bag is expandable and elastic.

8. Apparatus for manipulating a flexible container to permit it to be rapidly filled and fully packed with a dry granular solid material, said apparatus comprising: expansion control means on opposite sides of said container; a source of a fluid under pressure operatively connected to the expansion control means, said expansion control means including a flexible and expandable diaphragm responsive to the pressure of said fluid for crushing in one wall of said container prior to filling for reducing container volume, and means for reducing the fluid pressure on said diaphragm and maintaining said lowered pressure throughout filling to permit the wall of said container to expand against said diaphragm away from material therein.

9. The invention as defined in claim 8, wherein said expansion control means also includes a second flexible and expandable diaphragm responsive to the pressure of said fluid for crushing in the wall of said container opposite said one wall thereof, said pressure reducing means lowering the pressure of that portion of said fluid which lies in pressure contact with said second diaphragm.

10. The invention as defined in claim 9, wherein said diaphragms are elastic.

11. The invention as defined in claim 8, wherein said diaphragm is flexible elastic.

12. Apparatus for manipulating a flexible container to permit it to be rapidly filled and fully packed with a dry granular solid material, said apparatus comprising: expansion control means including members on opposite sides of said container; and a source of fluid under pressure operatively connected to said control means during initial stages of filling, at least one of said members being responsive to the pressure of said fluid for inwardly deforming the walls of said container between said members an amount sufficient to substantially reduce container volume; and means for reducing the fluid pressure and maintaining the lowered fluid pressure in said expansion control means during substantially the entire filling cycle to permit the walls of said container to move said members outwardly and to expand away from material in said container.

13. Apparatus for manipulating a flexible container to permit it to be rapidly filled and fully packed with a dry granular solid material, said apparatus comprising: a frame; a member on each side of said container, both of said members being mounted on said frame in positions movable relative to said frame in directions toward and away from each other; expansion control means to urge said members toward each other initially; and means for terminating the urging of said expansion control means to allow said members to be spread apart by said container as said container is filled with said material.

14. Apparatus for manipulating a flexible container to permit it to be rapidly filled and fully packed with a dry granular solid material, said apparatus comprising: a frame; a member

on each side of said container, both of said members being mounted on said frame in positions movable relative to said frame in directions toward and away from each other; expansion control means to initially urge said members toward each other; and means for terminating the urging of said members by said expansion control means to spread said members apart and thereby to allow the side walls of said container to expand outwardly away from each other as said container is filled with said material.

15. The invention as defined in claim 14, wherein said members are elastic diaphragms.

16. The invention as defined in claim 14, wherein said members are flat rigid plates, said expansion control means including an arm pivoted on said frame to support each plate in a position movable relative to said frame, and power means actuatable either to pull said arms together or to spread said arms apart.

17. The invention as defined in claim 16, wherein said power means includes a pneumatic ram having a cylinder with first and second ports at opposite ends thereof, a compressed air tank, and a valve to admit air under pressure from said tank alternately into opposite ends of said cylinder through said ports, said first port being connected to said tank through said

valve while said second port is vented to the atmosphere and vice versa, said valve being actuatable to a position closing both of said ports to maintain said arms in a stationary position, said arms being spread apart when compressed air is admitted to said cylinder through the other of said ports.

18. The method of tightly packaging a product in the shortest possible time, said method comprising the steps of: crushing in the sides of an air permeable paper bag; blowing a dry powder into said bag while the sides thereof are crushed in as aforesaid; releasing said bag sides after a first portion of said powder has been blown into the interior of said bag; and blowing a second portion of said powder into said bag after the sides thereof have been released as aforesaid.

19. The method of tightly packaging a product in the shortest possible time, said method comprising the steps of: crushing in the sides of an air permeable paper bag; blowing a dry powder into said bag while the sides thereof are crushed in as aforesaid; releasing said bag sides after a first portion of said powder has been blown into the interior of said bag; blowing a second portion of said powder into said bag after the sides thereof have been released as aforesaid; and alternately repeating said last mentioned releasing and blowing steps.

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