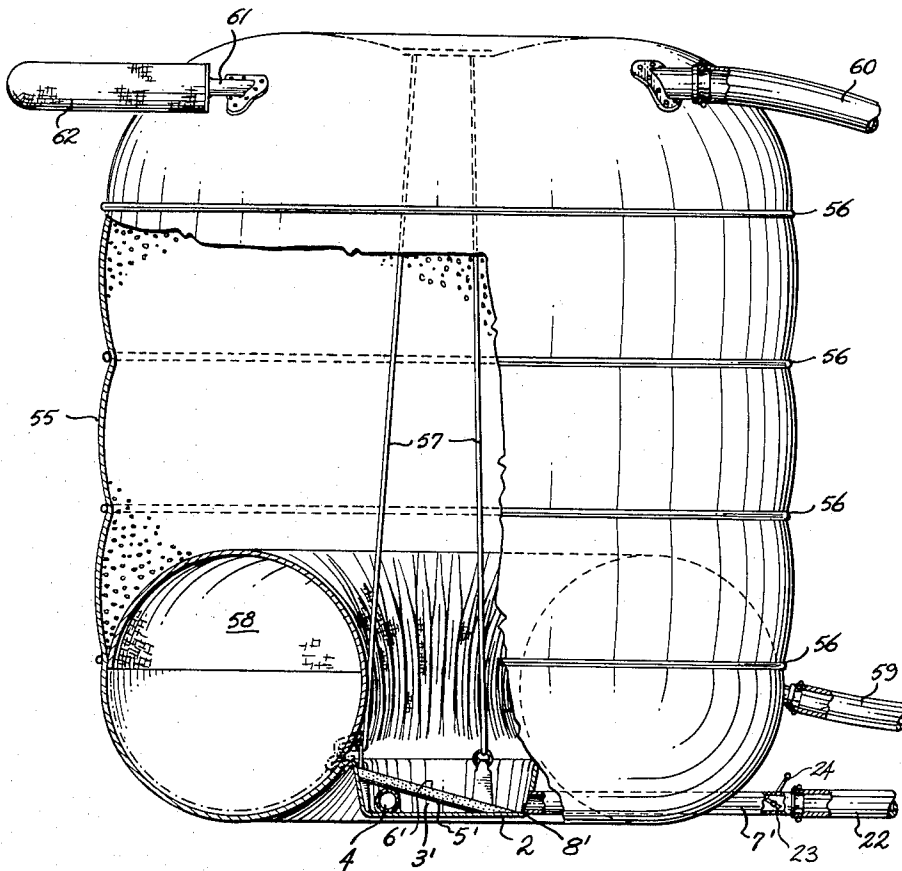


May 31, 1966

H. N. K. PATON
COLLAPSIBLE CONTAINER WITH GAS-FLUIDIZING
CONTAINER-EMPTYING CAP
Original Filed March 23, 1962

3,253,751



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COLLAPSIBLE CONTAINER WITH GAS-FLUIDIZING CONTAINER-EMPTYING CAP

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Original application Mar. 23, 1962, Ser. No. 181,981.

Divided and this application Oct. 8, 1964, Ser. No. 402,586

5 Claims. (Cl. 222—195)

The present invention relates to a collapsible container equipped with a special type of cap by which gas is supplied to fluidize granular material or powder in the container for the purpose of emptying it through a discharge aperture in the cap. Such container-emptying cap may be attached to the container at a destination in place of a conventional closure. This application is a division of my prior application Serial No. 181,981, filed March 23, 1962 for Gas-Fluidizing Container-Emptying Cap, now abandoned.

It is a principal object of this invention to provide an improved type of collapsible container of large capacity for storing or transporting granular material or powder, emptying of which can be expedited by the use of a special cap which will fluidize the material in the container.

In general, the collapsible container may be composed of a flexible wall preferably of substantially cylindrical shape which is reinforced by circumferentially extending tension members spaced lengthwise of the container, and internal tension members extending lengthwise of the container connect its opposite ends. Granular material can be supplied to the container by a connection to its upper portion and the material can be removed from the container by a gas-fluidizing cap connected to the lower portion of the container, which preferably is of a diameter much smaller than the diameter of the container. Such gas-fluidizing cap is composed of a pan having in it spaced from its bottom a porous partition and above it a discharge duct opens toward the top of the pan. Preferably such partition is inclined toward the discharge opening, the partition sloping sidewise and the discharge duct being connected to the lower portion of the pan. A plenum chamber is formed between the partition and the bottom of the pan and a fluidizing gas supply pipe is connected to the plenum chamber for supplying gas under pressure which will permeate the partition to fluidize the material in the container above it.

The figure of the drawing is an elevation of a flexible-wall container in accordance with the present invention having a container-emptying cap applied to it, parts being broken away.

The container of the present invention has a cylindrical wall 55 which can be made of heavy rubberized material. Because of the flexible nature of the container walls, the container is particularly useful for shipping material in one direction so that the container can be collapsed and returned in collapsed condition. Alternatively, such a container can be used for temporary storage purposes and can be collapsed and itself stored when it is not in use. In order to withstand the pressure of powder or granular material filling it the wall may be restrained by annular reinforcing bands 56, preferably made of cable so that they can be rolled up or folded up to occupy small space when not in use. Excessive bulging of the container ends can be prevented by interconnecting the container ends by ties 57, which again may be of flexible cable material, extending axially through the container.

The central portion of the container bottom wall can be recessed to receive a gas-fluidizing cap. The pan 2 of such cap can be secured around its edges to the wall

of the container so as to seal the opening in the container through which the cap communicates with its interior. The gas-fluidizing cap preferably has a gas-permeable partition including a perforated plate 5' sloping from one side of the pan 2 to its opposite side. A mat 6' of resilient permeable material is supported on the plate 5' and slopes correspondingly. Consequently, the plenum chamber 3' formed between the perforated plate 5' and the end wall of the pan tapers in depth from one side of the pan to the other. A supply pipe 4 for gas under pressure should be connected to a portion of the pan where the plenum chamber is comparatively deep, and such connection is shown as being to the side of the pan generally opposite the outlet conduit 7' which extends therefrom transversely of the axis of the cylindrical side wall 55. Thus the gas-permeable partition 5', 6' slopes sidewise to the opening of the outlet conduit 7' located just above the lower side of the partition. The portion of the container bottom wall encircling the central portion is shown in the drawing as being at least as low as the lower side of the container-emptying discharge conduit 7', for engaging a supporting surface below the discharge conduit to support the container. In order to shift powdered or granular material from the lower peripheral portion of the container a flexible dump wall 58 is provided in the container bottom and an auxiliary supply pipe 59 for gas under pressure is connected to the container at a location behind this dump wall.

The container can be filled with powdered or granular material through an inlet pipe 60 connected to the upper portion of the container. The material may be blown into the container by gas under pressure and the excess gas can escape through the pipe 61 to which is attached a filter sleeve 62 which will prevent powdered or granular material from escaping into the air. The valve in the outlet duct 7' can be closed, and the connections for pipes 59, 60 and 61 also can be closed for shipping of the container. At the destination the pipes 4, 22 and 59 will be connected to their appropriate connections.

It is desirable to provide a control valve in the discharge pipe 22 controlled by handle 24. If the valve 23 is now opened by swinging handle 24 the fluidized material will flow out of the drum through the discharge opening 8' and the conveying pipe 22. The rate of material discharge can be regulated both by controlling the amount of fluidizing gas supplied by the pipe 4 and by adjusting the position of the control valve in the outlet by swinging handle 24. Even the slight slope of the upper surface of the cap's partition will be sufficient to cause all of the material in the drum to be emptied from it through the discharge opening 8' because of the fluidizing action of the gas supplied to the material in the container through the partition 5', 6' of the cap.

During the discharge of material from the container, it is preferred that the inlet connection and the venting connection at the top of the container be closed so that the container will be maintained substantially in its inflated condition by air supplied through the partition 5', 6' of the cap. When most of the material has been emptied from the container, air can be supplied through pipe 59 to force the dump wall 58 away from the broken line position shown in the drawing into the full line position so as to move the material from the sides of the container into registry with the fluidizing cap. Such deflection of the dump wall will insure that the entire contents of the container will have been emptied.

When the container has thus been emptied, air will be discharged from the container through the conveyor pipe 22 and the supply of gas under pressure through the pipe 4 can be shut off. With the pressure within the collapsible container thus terminated, the container can be collapsed into a flat package. The conveyor pipe 22

can be disconnected from the outlet duct 7' and the pipe 4 can be disconnected from the gas-fluidizing cap. Also the pipe 59 can be disconnected from the container. The entire container can then be rolled up into a small package and shipped back to the origin of the material shipment for reuse.

It will be appreciated that during the container-emptying operation the pressure within the container will be at a value greater than atmospheric. Consequently, it is desirable not only to restrain the bulging of the cylindrical wall 55 by the annular reinforcing bands 56 and to restrain excessive bulging of the end walls by the tie means 57, but it is desirable for the corner portions of the container ends to be curved also. It will be seen that the cross-sectional curvature of the lower portion of the container between the lowermost reinforcing band 56 and the edge of the gas-fluidizing cap pan 2 is substantially semi-circular, that is, the annular bottom wall portion is substantially semitoroidal. Similarly, the cross section of the dump wall is semicircular, making it also substantially semitoroidal, and its edges are attached to the inner and outer peripheries of the semitoroidal bottom wall portion of the container, so that, when the dump wall is forced away from the container wall to the position shown in the drawing, the cross-sectional shape of the chamber between the dump wall and the lower corner of the container is substantially circular and the entire chamber is in the shape of a torus.

The edges of the dump wall are connected to the container wall at opposite ends of a diameter of the cross section of such torus which slopes from the upper edge of the gas-fluidizing cap pan upwardly and outwardly to the reinforcing band 56 nearest the bottom of the container. The proportioning of the upper corner of the container can be generally similar so that the side wall merges with the top of the container in a smoothly rounded curve.

I claim as my invention:

1. A collapsible container comprising a flexible side wall of generally cylindrical shape disposed with the axis of such generally cylindrical side wall upright, a flexible upper end wall joined to said flexible side wall, a bottom end wall including a central bottom wall portion having a container-emptying discharge conduit extending therefrom transversely of the axis of said generally cylindrical side wall to a location beyond said side wall and a flexible annular bottom wall portion encircling and joined to said central bottom wall portion and to said flexible side wall and being at least as low as the lower side of said container-emptying discharge conduit for engaging a supporting surface below said container-emptying discharge conduit to support the container, and tie means extending generally axially through said container and con-

necting said central bottom wall portion and said upper end wall.

2. A collapsible container comprising a flexible side wall of generally cylindrical shape disposed with the axis of such generally cylindrical side wall upright, an upper end wall joined to said flexible side wall, a bottom end wall including a central bottom wall portion having a gas-fluidizing container-emptying cap and a flexible annular bottom wall portion encircling and joined to said central bottom wall portion and to said flexible side wall and being at least as low as the bottom of said gas-fluidizing container-emptying cap for engaging a supporting surface to support the container, and tie means extending generally axially through said container and connecting said central bottom wall portion and said upper end wall.

3. The collapsible container defined in claim 2, in which the tie means are connected to the gas-fluidizing cap.

4. The collapsible container defined in claim 1, in which the flexible annular bottom wall portion is substantially semitoroidal, and a substantially semitoroidal dump wall within the annular bottom wall portion having its inner and outer edges attached, respectively, to the inner and outer peripheries of the substantially semitoroidal container bottom wall portion, said annular dump wall be movable by differential pressure away from the container wall into a position forming therewith a toroidal chamber, for dumping material from the marginal portion of the container onto the central bottom wall portion of the container.

5. A collapsible container comprising a flexible side wall of generally cylindrical shape disposed with the axis of such generally cylindrical side wall upright, an upper end wall joined to said flexible side wall, a bottom end wall including container-emptying means, tie means connecting said bottom end wall and said upper end wall, means connected to the upper portion of the container for supplying particulate material thereto, and filtering vent means establishing communication between the interior and exterior of the container.

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