Sept. 4, 1956 R. A. SHIELDS 2,761,741

CONTAINER

Filed March 3, 1951 2 Sheets-Sheet 1

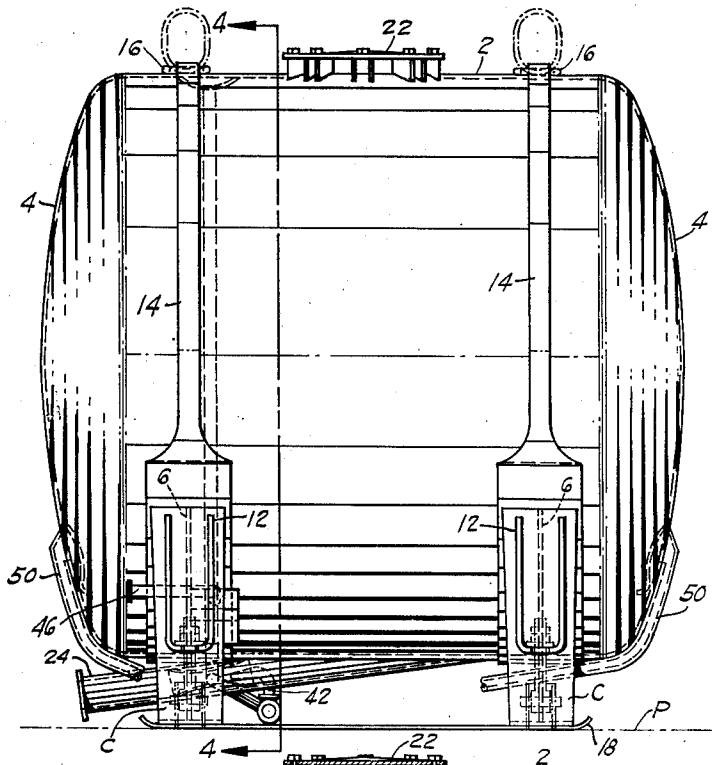


Fig-1

Fig-3

INVENTOR

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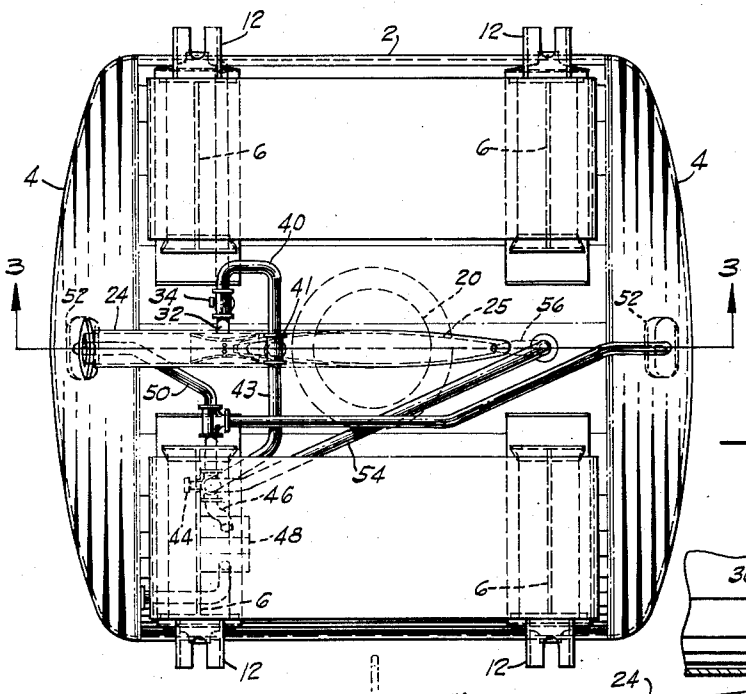


Fig. 2

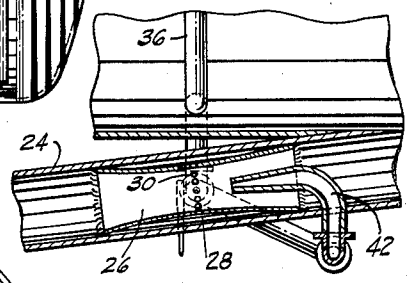


Fig. 5

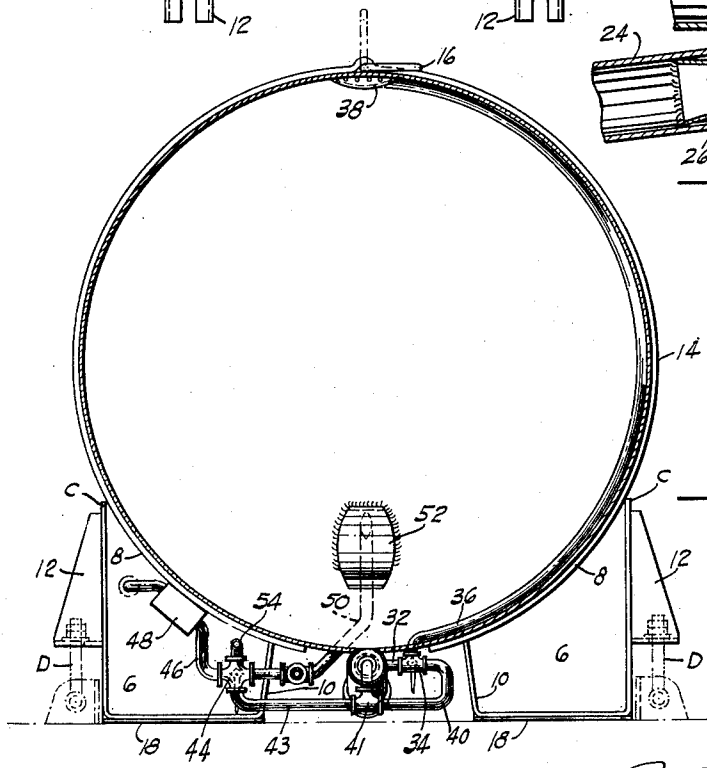


Fig. 4

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2,761,741

CONTAINER

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8 Claims. (Cl. 302—53)

This invention relates to containers in general and in particular to containers for the transport of flowable material.

In the transport of flowable material such as cement, flour, etc., the material tends to pack due to the vibration in transit. With the present type of containers, it has been extremely hard and in some cases impossible to break up this packed material and place it in an aerated or flowable condition. Once the material has been properly aerated or fluidized, than it may be readily flowed or forced out of the container by means of suitable air jets so located as to direct the material out of and through the container outlet.

It is an object, therefore, of the present invention to provide a closed container having the control apparatus so arranged as to permit the application of either super-atmospheric or subatmospheric pressures to the space above the material.

A further object of the invention is the provision of a closed container having an outlet passage containing a venturi tube, the throat area of which is connected to the space above the material.

A still further object of the invention is the invention of a closed container having a plurality of discharge nozzles and valves so aranged as to permit ready selection of the various nozzles to thereby discharge the material and subject the material to either sub-atmospheric or super-atmospheric pressures.

A yet further object of the invention is the provision of a closed container having a plurality of discharge nozzles supplied from a common source including a vibrator to assist in breaking up compacted material.

Another object of the invention is the provision of a closed container provided with cradles, skid plates, and lifting and holddown devices whereby the container may be readily transported.

These and other objects of the invention will be apparent to persons skilled in the art from a study of the following description and accompanying drawings in which:

Fig. 1 is a elevational view of the improved container;

Fig. 2 is a bottom plan view;

Fig. 3 is a sectional view taken substantially on line 3—3 of Fig. 2;

Fig. 4 is a sectional view taken substantially on line 4—4 of Fig. 1; and

Fig. 5 is an enlarged sectional view through the discharge pipe at the venturi tube.

Referring now to the drawings in detail it will be seen that the container is made from a substantially cylindrical shell 2 to which is welded substantially convex ends 4. In order to support the container in a substantially horizontal position, a plurality of cradles C are provided each formed by a web plate 6 welded at its upper edge to a curved plate 8 and having its side and bottom edges stiffened by a bent plate 10 securely welded to the web plate. On the outer side of stiffening plate 10 is welded a substantially U-shaped plate member 12 slotted to receive a holddown device D which will be bolted or otherwise secured to any suitable supporting structure or platform P. This platform may be the floor of a railway car, highway truck, or even a stationary platform. The upper ends of curved plate 8 are welded to bands 14 encircling the container and carry at their upper central

portion lifting loops 16. In order that the container may be slid lengthwise on its supporting platform, the cradles at each side are joined by skid plates 18 extending between and welded to the bottom portion of reinforcing plates 10. From the above, it will be seen that the cradle may be supported on any reasonably flat platform and may be lifted and transported through the air by lifting devices fastened to loops 16 and that it may also be skidded along the platform on the skid plates 18.

In order to charge the container wtih pulverulent, granular, or other flowable material, an inlet opening 20 is provided and this opening is adapted to be closed by a lid 22 tightly fitting within the opening so as to seal the same in order that the container may retain pressure. As clearly shown, a discharge pipe 24 extends downwardly and outwardly toward one end of the container and between the cradles C. This discharge pipe intersects the shell of the container to produce an elliptical opening 25 as clearly indicated in Figs. 2 and 3. A venturi tube 26 is welded or otherwise secured within the discharge pipe so as to produce a space 28 between the discharge pipe and the throat area of the venturi tube. Small openings 30 are formed in the throat of the venturi tube so as to connect the space 28 with the interior or high velocity area of the venturi tube. A short pipe 32 connects the space 28 to a three-way valve 34, and the valve has its central passage connected by a pipe 36 following the inside contour of the container and ending in an open fixture 38 located at the central top portion of the container. The third outlet a valve 34 is connected by a short pipe 40 to a T connection 41, the central branch of which is connected to the main eduction nozzle 42 located to discharge into the throat of the venturi tube. Air or other fluid under pressure is supplied to the T 41 by a short pipe 43 connected to a four-way valve 44. Air or other pressure fluid is supplied to the four-way valve by piping 46 connected through a vibrating device 48 securely fastened to the container shell as clearly shown in Figs. 2 and 4. The port of valve 44 opposite pipe 46 is connected by piping 50 to fan discharge nozzles 52 welded or otherwise secured within the tank ends as clearly shown in Figs. 3 and 4. These nozzles are preferably formed by merely welding a dish-shaped plate to the tank and leaving the bottom portion unwelded but in close contact with the interior surface of the end walls. Thus, when air or other fluid is supplied through piping 50, a fan-shaped discharge will occur tending to clean the lower corners of the container. The port of valve 44 opposite pipe 43 is connected by piping 54 to a nozzle 56 located on the floor or shell portion of the container and in position to direct its blast downwardly into the outlet 24 thus assisting the main eduction nozzle 42.

The discharge operation will be as follows assuming the container to be substantially filled with pulverulent, granular, or other flowable material:

A source of air or other fluid under pressure will be connected to pipe 46 while the outlet 24 will be connected to any suitable conveying system adapted to receive material from the container. Upon turning pressure fluid into pipe 46, the vibrator 48 will start operation and such operation will continue as long as pressure fluid flows to the container. As soon as pressure fluid flows through pipe 46 and vibrator 48, it immediately passes through pipe 43 to the main eduction nozzle 42. Regardless of the position of the four-way valve 44, fluid under pressure will always be supplied to this main eduction nozzle. Dependent on the position of four-way valve 44, fluid under pressure may flow either to the fan-shaped discharge nozzles 52 or to the nozzle 56. In other words, by manipulation of the four-way valve, the flow of fluid under pressure may be selectively controlled and the

activation of secondary nozzles **52** and **56** selected. By manipulation of the three-way valve **34**, fluid under pressure will either be blocked at the valve or can enter pipe **36** and discharge into the container through fixture **38**. Normally, however, when the container is being discharged, the valve **34** will be in position so as to connect pipes **32** and **36** with the throat space **28** of the venturi tube. In this way, the reduced pressure caused by the action of eduction nozzle **42** will be transmitted to the space above the material and fluid under pressure escaping either from **56** or **52** will be drawn upwardly through the material to aerate the same. The fluid flowing upwardly through the material will be drawn out of the container through pipes **36** and **32** and holes **30** in the venturi tube. Once the material in the container is thoroughly aerated or fluidized, a high pressure may be imposed above the material by turning the three-way valve **34** so as to connect pipes **40** and **36**. While it has been indicated that the space above the material will be subjected to a sub-atmospheric pressure, it will be seen that conditions may arise in which the space is at higher than atmospheric pressure but at a pressure below that existing in the discharge pipe. It is intended, therefore, that this term "sub-atmospheric" applies to conditions where fluid under pressure flows upwardly through the material to aerate the same.

While the invention has been described more or less in detail with specific reference to the accompanying drawings, it is obvious that various modifications and rearrangements may be made without departing from the scope of the invention as defined by the following claims.

What is claimed is:

1. Apparatus for discharging pulverulent or granular material from a sealed container comprising, an outlet for discharge of material from the container, nozzle means directed toward said outlet, means for admitting fluid under pressure to said container adjacent the bottom thereof, means to supply fluid under super-atmospheric pressure to said nozzle means, and means to selectively apply super-atmospheric or sub-atmospheric pressure to the space above the material in the container.

2. Apparatus for discharging pulverulent or granular material from a sealed container comprising, an outlet for discharge of material from the container, nozzle means directed toward said outlet, means for admitting fluid under pressure to said container adjacent the bottom thereof, means to supply fluid under super-atmospheric pressure to said nozzle means, means to apply sub-atmospheric pressure to the space above the material in the container to thereby assist aeration and discharge of the material.

3. Apparatus for discharging pulverulent or granular material from a sealed container comprising, an outlet for discharge of material from the container, nozzle means directed toward said outlet, means for admitting fluid under pressure to said container adjacent the bottom thereof, means to supply fluid under super-atmospheric pressure through said nozzle means, a venturi tube associated with said nozzle means, and means connecting the throat area of said venturi tube to the space above the material in the container to thereby assist in aeration of the material.

4. Apparatus for discharging pulverulent or granular material from a sealed container comprising, an outlet for discharge of material from the container, a venturi tube secured in said outlet, nozzle means directed into said venturi tube to move material therethrough, means connecting the throat area of said venturi tube to the interior of said container, means for admitting fluid under pressure to said container adjacent the bottom thereof, and means to supply fluid under pressure to said nozzle means.

5. Apparatus for discharging pulverulent or granular material from a sealed container comprising, an outlet for discharge of material from the container, a venturi tube in said outlet, means connecting the throat area of said venturi tube to the space above the material in the container, a first nozzle means directed into said venturi tube to move material through the outlet, secondary nozzle means positioned within the container and directed toward said outlet, and means to supply fluid under pressure to said nozzle means to cooperate with said first named means to aerate and discharge the material from the container.

6. The substance of claim 5 characterized in that valve means selectively controls the flow of fluid under pressure to said secondary nozzle means and said first named means.

7. Apparatus for discharging pulverulent or granular material from a sealed container comprising, an outlet extending downwardly and outwardly from the container, a venturi tube secured in the outlet, piping connecting the throat area of said venturi tube to the container interior above the material, a first nozzle in said outlet and directed into said venturi tube toward its outlet, secondary nozzles secured within the container adjacent the bottom thereof and adapted to move material toward said outlet, piping to supply fluid under pressure to said nozzles, and valves in said piping to selectively control supply of pressure fluid to said secondary nozzles and to said first named piping.

8. Apparatus for discharging pulverulent or granular material from a sealed container comprising, an outlet extending downwardly and outwardly from the container, a venturi tube secured in the outlet, piping connecting the throat area of said venturi tube to the container interior above the material, a first nozzle in said outlet and directed into said venturi tube and toward its outlet, secondary nozzles secured within the container adjacent the bottom thereof and directed toward said outlet, piping to supply fluid under pressure to said nozzles, and a vibrator secured to the container and connected in said last named piping whereby the pressure fluid flowing to said nozzles will cause vibration of the container and assist said nozzles in discharge of material from the container.

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