United States Patent

Gramlich

[15] **3,679,082**

[45] **July 25, 1972**

[54] BULK TRANSPORTER

[72] Inventor: **Fritz Gramlich,** Mosbach/Baden, Germany

[73] Assignee: **Ludwig Spitzer sen. KG,** Mosbach/Baden, Germany

[22] Filed: **June 8, 1970**

[21] Appl. No.: **44,143**

[30] **Foreign Application Priority Data**

Aug. 14, 1969 Germany ..... P 19 41 351.5

[52] **U.S. Cl.** **214/518,** 214/83.28, 302/50

[51] **Int. Cl.** **B60p 1/42,** B65p 1/60

[58] **Field of Search** 214/83.28, 519, 64.2, 518; 302/50, 52, 56

[56] **References Cited**

UNITED STATES PATENTS

2,108,416	2/1938	Smith et al.	214/83.28 X
3,339,759	9/1967	Wellons	214/17 DA
3,508,670	4/1970	Schuld	214/17 DA
2,395,727	2/1946	Devol	302/29 X
2,532,351	12/1950	Wedebrock	302/50
2,170,258	8/1939	Borch	214/83.28 X

Primary Examiner—Albert J. Makay
Attorney—Karl F. Ross

[57] **ABSTRACT**

A bulk transporter comprises a pressure-retentive container adapted to be displaced along the ground and provided with a pair of downwardly converging discharge cones. Each cone in turn is provided with an internal arch-breaker and has a fluidized internal wall to prevent the bulk from becoming compacted. The arch-breaker element is rotated around the inside of the cone, adjacent the gas-fluidized wall. This element can be an auger which also serves to pull the bulk toward the outlet mouth of the cone whence it is pneumatically blown away through an unloading conduit.

10 Claims, 8 Drawing Figures

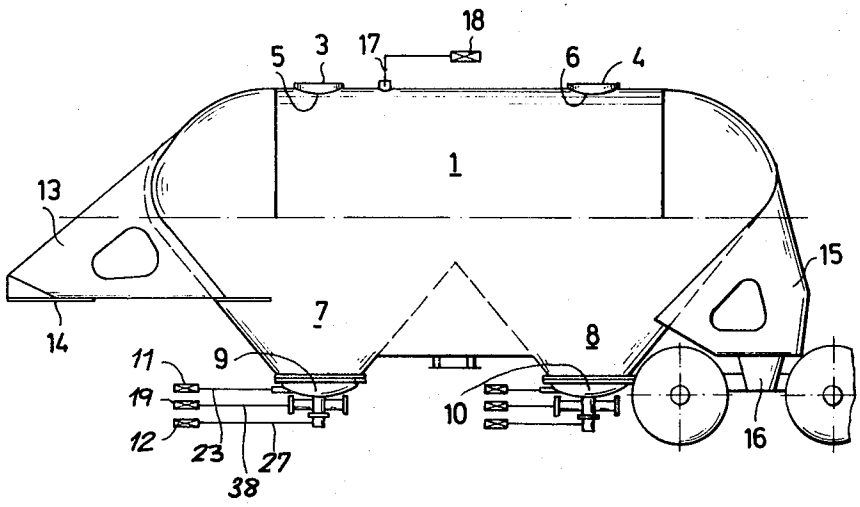
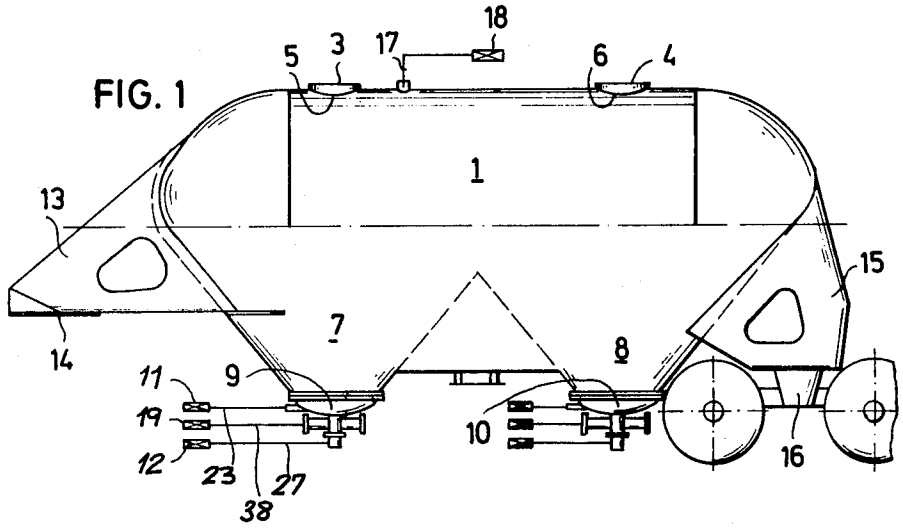


FIG. 1



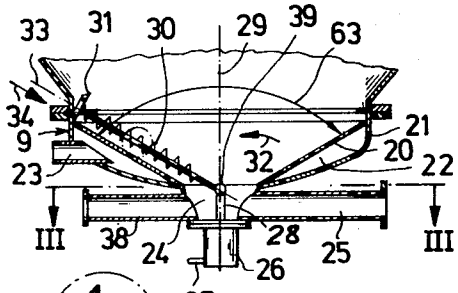


FIG. 2A

FIG. 2

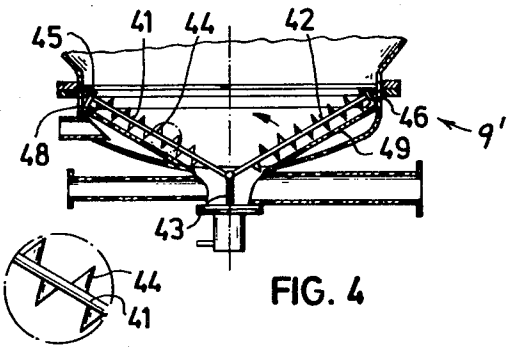
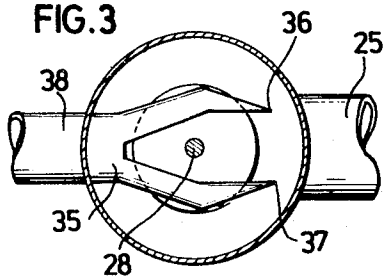


FIG. 4

FIG. 4A

FIG. 3



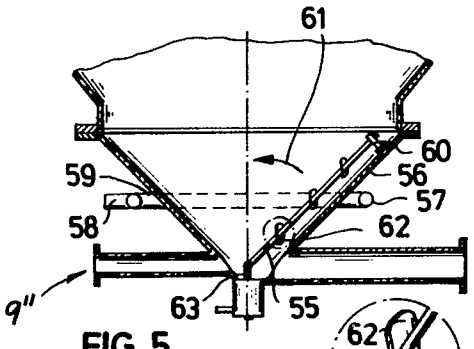


FIG. 5

FIG. 5A

INVENTOR:
Fritz Gramlich

BY

Karl F. Ross
Attorney

BULK TRANSPORTER

1. FIELD OF THE INVENTION

The present invention relates to a transport vehicle for flowable bulk goods.

2. BACKGROUND OF THE INVENTION

A bulk-goods transporter generally comprises a cylindrical container fitted with wheels to act as a trailer and having at least one downwardly directed discharge cone. The bulk is unloaded by simply opening the bottom outlet of the cone and allowing the material to flow out, often under the effects of air pressure applied above the goods.

A problem, especially with fibrous goods such as asbestos, is the formation of arches bridging the discharge cone and preventing emptying the container. Simple fluidizing of the discharge-cone wall does not suffice to overcome this disadvantage.

3. OBJECTS OF THE INVENTION

It is, therefore, an object of the present invention to provide an improved bulk-goods transporter.

Another object is to provide such a transporter which overcomes the above-mentioned disadvantages.

4. SUMMARY OF THE INVENTION

The above objects are obtained according to the present invention by a transporter comprising a pressure-retentive container substantially as described in my U.S. Pat. No. 3,419,310 provided with means, such as wheels, supporting it and having at least one downwardly converging discharge cone. This cone is provided with gas-fluidizing means for preventing the flowable material from packing near the wall, and an arch-breaker element which can sweep this wall.

According to the principle of the present invention, therefore, the arch-breaker element of the invention sweeps along a generally downwardly convergent frustoconical wall of the discharge cone, preferably over the entire axial length thereof (i.e. from the wide mount at the upper end of the cone to the narrow outlet at the bottom thereof), while a fluidizing or aerating (loosening) gas is introduced along this wall.

Consequently, the gas blanket or layer along the wall continuously intercepts the arch-breaker element.

In accordance with a feature of this invention, the arch-breaker element is generally elongated and lies along a generatrix of the cone and has formations closely spaced front this wall. On the cone end, the arch breaker element serves to interrupt the aerated layer and creates pulses therefrom which have a more significant loosening effect than a continuous air flow. Between pulses of air, moreover, there are intervening pauses as the arch-breaker element sweeps along the wall, therefore preventing the aerated or fluidizing air from packing any arch of the flowable material from below. Apparently the aerating gas also cooperates to keep the arch-breaker element from packing the bulk material along the wall of the discharge cone and serves to sweep any accumulation of the bulk material from the arch-breaker element as the latter breaks up such material.

The present invention is applicable, as previously noted, to bulk transporters and especially bulk transporters which discharge and load under pressure, i.e. wherein a gas pressure head is maintained above the load of bulk material in the vehicle. Here again a surprising phenomenon is observed. There appears to be a combined action of the downward pressure upon the bulk material, which otherwise tends to form arches or bridges in the region of the discharge cone and both the aerating gases along the wall of this cone, and the arch-breaker element. In the absence of the pressure head, for example, the arch breaker is found to be materially less effective and even the aerating system acts less effectively to loosen the mass.

According to a particular feature of this invention, the arch-breaker element includes a rod, shaft or bar lying along a generatrix of the discharge-cone wall and coupled at its lower end by an elbow or knuckle with a drive shaft lying along the axis of the discharge cone. In one particularly advantageous configuration, the shaft, rod or bar, is provided with spaced formations therealong of a configuration and orientation such as to direct the bulk material downwardly toward the outlet and the apex of the cone. The formations may be worm, ribs, vanes, or blades in accordance with the particular requirements. Furthermore, the rod or shaft may be rotated about the cone axis, i.e. an axis parallel to the wall of the discharge cone, in which case a universal joint is provided between the drive shaft and the arch-breaker shaft. The aerating means, according to the present invention can be provided in any of a number of configurations, e.g. as a sintered-metal discharge-cone wall through which the fluidizing gas is forced, a perforated wall, or a wall provided with spaced apart opening preferably located at least in the region of a horizontal plane through this cone approximately midway between the large-diameter mouth and the outlet.

5. DESCRIPTION OF THE DRAWING

The above and other objects, features, and advantages will become apparent from the following description, reference being made to the accompanying drawing, in which:

FIG. 1 is a side elevational view of a bulk-goods transporter according to the present invention;

FIG. 2 is a vertical section, in enlarged scale through a detail of FIG. 1;

FIG. 2A is a detail of FIG. 2, in enlarged scale;

FIG. 3 is a section according to line III — III OF FIG. 2; and

FIGS. 4 and 4A, and FIGS. 5 and 5A are views similar to FIGS. 2 and 2A showing two further embodiments of the present invention.

6. SPECIFIC DESCRIPTION

As shown in FIGS. 1 - 3, a bulk transporter consists of a pressurizable container 1 having a pair of filling ports 3 and 4 fitted with respective gastight caps 5 and 6 and a pair of discharge cones 7 and 8 fitted with respective unloading devices 9 and 10.

At one end of the container 1 is a support 13 for other end is a support 15 for a pair of wheels 16 adapted to ride along the roadway. A supply 18 of compressed air can be connected to the interior of the container 1 at 17 to pressurize it, and to drive the flowable bulk goods out through the conical outlets 7 and 8.

FIGS. 2 – 3 show the unloading device 9, which is identical to the device 10. It has a conical inner wall 20 made of porous sintered metal, although polyester fabric or the like is usable, and a gastight outer wall 21 together defining a conical annular chamber 22 which is connected through a conduit 23 to a source 11 of compressed air. These walls 21 and 22 end at their lower edges at an outlet 24 which is formed with a laterally extending outlet conduit 25 and fitted with a hydraulic motor 26 connected via a conduit 27 to a source of hydraulic fluid 12. This motor 26 has a drive shaft 28 which lies on a vertical axis 29 and is attached at its upper end by a universal joint 39 to an auger 30 which is rotated to pull bulk material toward the apex of the cone, toward the outlet 24 (see arrow 34). The free end of the auger 30 is provided with a roller 31 that runs around the upper inside edge of the wall 20 in the direction shown by arrow 32 as the rotary motion of the motor about axis 29 is translated into rotation of the auger 30 about its longitudinal axis 33 which pulls the bulk material toward the outlet 24 and sweeping of the auger along the wall 20. Since compressed air passes through the wall 20 at the same time, it is impossible for the material to get packed in this region, so that the auger remains effective immediately adjacent this wall, and will not ride up on piles of packed material. This sweeping or precession of the auger 30 fully prevents the formation of arches.

Opening laterally into the outlet **24** across from the conduit **25** is a conduit **38** attachable to a compressed-air source **19** and formed with a nozzle **35** having two tips **36** and **37**.

Thus, in normal operation air pressure is applied to the top of the flowable material in the container **1** through the opening **17** to force it out through the lower outlets **7** and **8**. At the same time compressed air is applied through conduit **23** to fluidize the material in these outlets. Hydraulic pressure is applied to the motor **26** to set the auger **30** rotating about its own axis and sweeping the inner wall **20**. Compressed air is further blown in through the nozzle **35** to fluidize and carry off the material in the outlet **24**. During transport the conduits **17**, **23**, **27**, and **38** are closed and the outlet **25** is blocked.

FIGS. **4** and **4A** show an unloading device **9'** wherein a motor shaft **43** is rigidly connected (without a universal joint) to a pair of sweeping elements **41** and **42** in the form of bars provided with upwardly and downwardly extending spikes **44** and fitted at their ends with sliders **45** and **46** adapted to slide around the upper periphery **48** of the device. In all other particulars this embodiment is identical to that of FIGS. **1 – 3**.

FIGS. **5** and **5A** show a device **9''** having a motor shaft **63** is rigidly connected to a shaft bar **55** which extends along the inside of a single-walled cone **56** and is fitted at its upper end with a slider **60**. This rod **55** is fitted with three small shovels which are inclined backwardly downwardly relative to their orbits as shown by the arrow **61** so that they urge the product flowable goods downwardly as they sweep the wall **56**. Instead of the pipe **23**, the source **11** feeds compressed air through a conduit **58** to a ring **59** surrounding the device **9''** whence it passes through a plurality of connections **59** into the cone **56**.

I claim:

1. A bulk-goods transporter comprising:

a pressure-retentive container for flowable material;

means supporting said container for displacement and transport thereof;

a downwardly converging discharge cone below said container and having a wide mouth connected to said container and a narrow downwardly open outlet for discharging said material;

a multiplicity of through-going passages distributed along the inside wall of said cone between said mouth and said outlet, and means for supplying air to said passages for aerating said flowable material;

at least one arch-breaker element including a shaft lying along and substantially parallel to said wall in said cone bet-ween said mouth and said outlet; and

means connected to said shaft for sweeping said element along said wall, whereby said element serves as an arch breaker and additionally pulls the bulk goods toward the outlet mouth of the cone where it is discharged.

2. The transporter defined in claim **1**, further comprising means for pressurizing said container above the goods held therein for forcing said goods out said outlet.

3. The transporter defined in claim **2** wherein said shaft has one end attached to said means for sweeping said wall and another end describing a substantially circular orbit during sweeping.

4. The transporter defined in claim **3** wherein said element is provided with a plurality of lateral projections.

5. The transporter defined in claim **3** wherein said element is provided with a plurality of blade members each extending transversely to said member and being inclined backwardly downwardly relative to the orbits they describe.

6. The transporter defined in claim **3** wherein said element is an auger.

7. The transporter defined in claim **6** wherein said element is provided with a universal joint connected to said means for sweeping said walls for rotation during sweeping.

8. The transporter defined in claim **2** wherein said gas-fluidizing means includes a porous inner wall of said discharge cone and a nonporous outer wall, defining an annular chamber around said cone, and means for pressurizing said chamber for forcing gas under pressure through said porous wall.

9. The transporter defined in claim **8** wherein said wall is made of sintered metal.

10. The transporter defined in claim **1** wherein said shaft is provided with a roller rollingly supported along said mouth.

* * * * *