

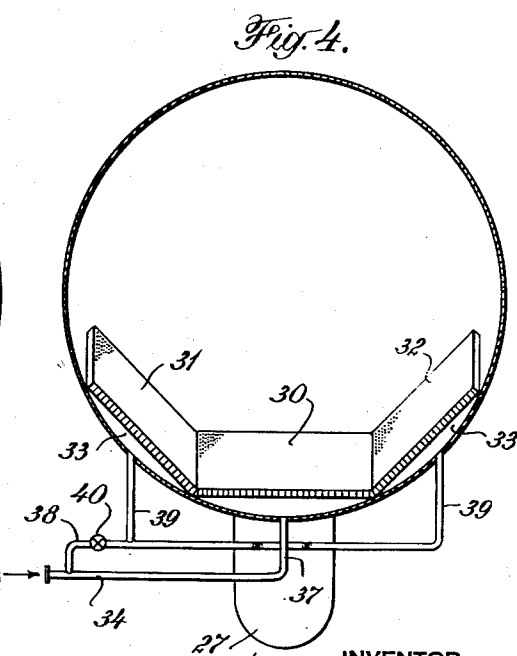
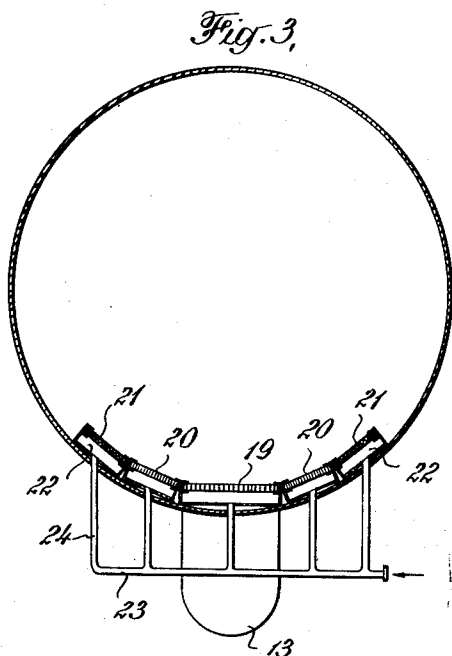
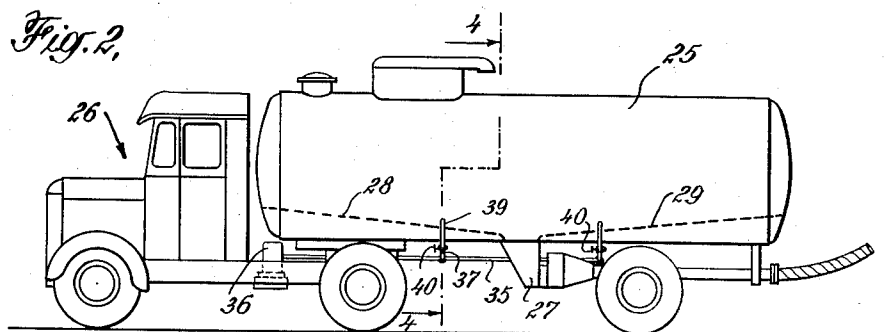
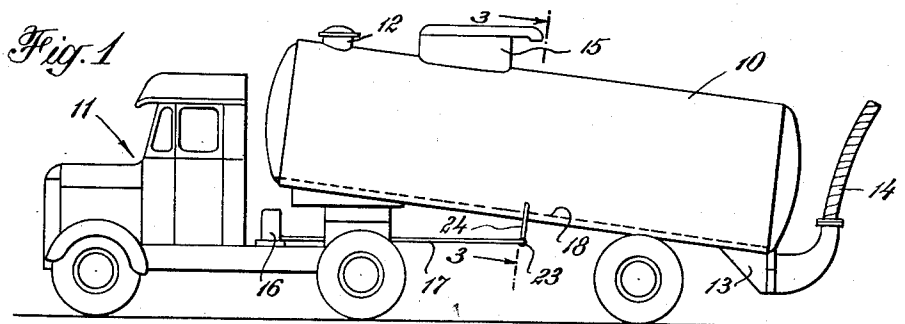
May 17, 1955

H. E. GALLE

2,708,602

DISCHARGE APPARATUS FOR PULVERULENT OR GRANULAR MATERIAL

Filed Dec. 18, 1951



INVENTOR
Hus Evid Talle
 BY
Rene Edwards, Morton Barrows Taylor
 ATTORNEYS

1

2,708,602

DISCHARGE APPARATUS FOR PULVERULENT OR GRANULAR MATERIAL

Hans Emil Galle, Copenhagen, Denmark, assignor, by mesne assignments, to F. L. Smidth & Co., New York, N. Y., a corporation of New Jersey

Application December 18, 1951, Serial No. 262,254

4 Claims. (Cl. 302—29)

This invention relates to the discharge of pulverulent or granular material from a container, such as a tank, and is concerned more particularly with a novel apparatus for holding such finely divided material, which is provided with means for discharging the material by rendering it fluent by the introduction of air. In the new apparatus, the amounts of air introduced into the material for fluidizing purposes are varied inversely with the steepness of the inclination to the horizontal of the surfaces, through which the air is introduced, and the air consumption in the new apparatus is thus considerably less than would be required, if the air were employed in accordance with present practice. The new apparatus may be advantageously employed on trucks, in which the finely divided material is conveyed to a point of use and the air for fluidizing is provided by a compressor driven by the truck engine, and an embodiment of the invention for such use will be illustrated and described for purposes of explanation.

It is common practice to discharge finely divided material from a container, such as a tank or silo, by introducing air into the material to render it fluent, after which the material will flow from the container by gravity. If the material is to be conveyed through a pipe line, the container may be made air-tight, so that the air introduced into the material to fluidize it builds up a pressure above the material within the container and the pressure on the fluent material forces it through the line. In installations of the kinds referred to, the air for fluidizing is introduced into the material adjacent the bottom of the container through either nozzles or porous blocks and a large amount of air is required for the purpose. The use of such large quantities of air is expensive and it is difficult to supply the air, when the container is a tank on a truck and the only available source of the air is a compressor operated by the truck engine.

The present invention is, accordingly, directed to the provision of apparatus for holding and discharging finely divided material, in which air is employed to render the material fluent and the air is used with greater efficiency than in prior similar apparatus, so that less air is required. In the new apparatus as used on a truck, the container is a tank mounted on the truck chassis and elements are mounted within the tank to form one or more channels extending along the bottom of the tank to the outlet. The elements vary in inclination to the horizontal and the bottom of the channel may be horizontal. Fluidizing air is introduced through the elements into the material and the amount of air supplied to the elements per unit of area thereof decreases with an increase in steepness of the elements. The supply of air in this manner may be effected in various ways, which will be described.

For a better understanding of the invention, reference may be made to the accompanying drawings, in which

2

Fig. 1 is a view in side elevation of a truck equipped with one form of the apparatus of the invention;

Fig. 2 is a view in side elevation of a truck equipped with a modified form of the apparatus of the invention; and

Figs. 3 and 4 are sectional views on the lines 3—3 of Fig. 1 and 4—4 of Fig. 2, respectively.

The form of the apparatus of the invention shown in Fig. 2 comprises a tank 10 of generally cylindrical form mounted in inclined position on a truck 11, illustrated diagrammatically. The tank has an inlet 12 at its top for the material and an outlet 13 leading from its lower end and provided with a hose 14. At its top, the tank is also provided with an air outlet 15 containing a filter. An air compressor 16 mounted on the truck chassis and driven by the truck engine supplies air through a line 17 to air distributing devices indicated at 18 in Fig. 1 and shown in detail in Fig. 3.

The air distributing devices 18 are made up of elements 19, 20, and 21 of porous material, which form the upper closures of compartments 22, to which air from pipe 17 is supplied through a header 23 and branches 24. The compartments are mounted directly on the bottom of the tank and the elements form a channel, which leads downwardly to the outlet at an inclination determined by the inclination of the tank. The surfaces of elements 21, which lie farther up the sides of the tank than elements 20, are more steeply inclined to the horizontal than the surfaces of elements 20 and, similarly, the surfaces of elements 20 are more steeply inclined to the horizontal than the surface of element 19. The porous material, of which the elements are made, varies in density directly with the steepness of the inclination of the elements to the horizontal, so that elements 21 are less permeable by air than elements 20 and elements 20 are, in turn, less permeable than element 19. Accordingly, since the pressure of air supplied to all the compartments is the same, the flow of air into the material through the surfaces of elements 21 will be less than the flow through the surfaces of elements 20 and more air will be introduced into the material through element 19 than through elements 20. The material will thus be fluidized in varying amounts, in accordance with the steepness of the surface with which it is in contact, and the material will flow freely over the surfaces of varying inclination with the injection of less air than would be required, if all the elements were of the same porosity.

When it is desired to empty the tank 10, the hose 14 may be disconnected from the outlet 13, and the air outlet 15 is opened. When compressor 16 is driven to deliver air under pressure to compartments 22, the air escapes through the porous tops of the compartments and enters the material to render it fluent. Upon opening outlet 13, the material flows out by gravity, and air, which passes upward through the material, escapes through air outlet 15.

When material is to be delivered for a substantial distance through the hose 14 connected to outlet 13, the material is first fluidized as described and outlet 15 is then closed, while the admission of air into the material through the porous elements is continued. In due course, the air collecting in the tank above the material builds up a pressure, which is sufficient to force the material through the outlet and against the resistance imposed by hose 14 and any static head.

Since the amount of air required for fluidizing the material in the new apparatus is substantially less than that, which would be required in an ordinary installation, it is possible to operate the compressor 16, while the truck is moving, so that the material is fluidized in transit and can be discharged as soon as the truck reaches

3

its destination. When the discharge is made through hose 14, a greater load is imposed upon the compressor during discharge than during fluidizing, but the discharge takes place only when the truck is at rest and the entire power of the engine is then available for driving the compressor.

In the installation shown in Fig. 2, the tank 25 is supported in horizontal position on truck 26 and is provided with a central outlet 27. Within the bottom of the tank are provided two air distributing means indicated generally at 28, 29 and arranged to form two channels leading downwardly from the ends of the tank to the central outlet. Each channel is formed of porous elements 30, 31, 32, and elements 31 and 32, which are more steeply inclined to the horizontal than element 30, may be less permeable than element 30, in accordance with the construction above described, or, all three elements 30, 31, 32, may be of the same permeability. The lateral edges of the elements engage the curved surfaces of the tank and form the top closures of compartments 33, to which air is separately supplied by a header 34 connected to the line 35 leading from compressor 36. When the elements are all of the same porosity, the compartment 33 below element 30 receives air at full pressure from header 34 through branch 37 and the compartments below elements 31, 32 are supplied through a sub-header 38 connected to header 34 and having branches 39 leading to the compartments. A valve 40 in the sub-header ahead of branches 39 throttles the air supply, so that less air enters the material through the elements 31 and 32 than through element 30.

The apparatus shown in the drawings is of the mobile type and the greatest advantage of the invention is obtained in such an installation. However, the invention is also applicable to stationary containers. In the two forms of the apparatus shown, the air for fluidizing is introduced into the material through porous elements, which may be filter stones, felt, or canvas, but, if desired, the air may be supplied through a multiplicity of small nozzles, in accordance with common practice.

I claim:

1. An apparatus for holding and discharging finely divided material, which comprises a container having an inlet and an outlet for the material, the lower part of the space within the container being defined by porous elements having surfaces in contact with the material and leading to the outlet, at least one of the surfaces being more steeply inclined to the horizontal than an-

4

other, and means for introducing air in a multiplicity of fine streams into the material through said surfaces to render the material fluent, said means and elements causing less air per unit of area to be passed through the more steeply inclined surface than through the other surface.

2. An apparatus for holding and discharging finely divided material, which comprises a container having an inlet and an outlet for the material, the lower part of the space within the container being defined by elements permeable by air and having surfaces in contact with the material and leading to the outlet, said surface on at least one of the elements being more steeply inclined to the horizontal than the surface on another element, and means for introducing air at substantially the same pressure through all said elements, the air entering the material in a multiplicity of fine streams and rendering the material fluent, said element having the steeper surface being less permeable than said other element.

3. An apparatus for holding and discharging finely divided material, which comprises a container having an inlet and an outlet for the material, elements within the lower part of the container defining a channel leading to the outlet, said elements being permeable by air, and means for introducing air in a multiplicity of fine streams into the material within the channel through the elements, the elements varying in permeability inversely with the steepness of their inclination to the horizontal.

4. An apparatus for holding and discharging finely divided material, which comprises a container having an inlet and an outlet for material, the lower part of the space within the container being defined by porous elements leading to the outlet and having surfaces in contact with the material, the surfaces varying in inclination to the horizontal, and means for introducing air through said elements in a multiplicity of fine streams into the material, said means being controlled to vary the amounts of air introduced per unit of area through respective elements inversely with the steepness of their inclination to the horizontal.

References Cited in the file of this patent

UNITED STATES PATENTS

544,969	Dodge	Aug. 20, 1895
1,971,853	Thlefeldt	Aug. 28, 1934
2,589,968	Schemm	Mar. 18, 1952