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APPARATUS HAVING ROTATABLE MEANS FOR FEEDING AERATABLE POWDERED MATERIAL FROM STORAGE AND DISPENSING SUCH MATERIAL

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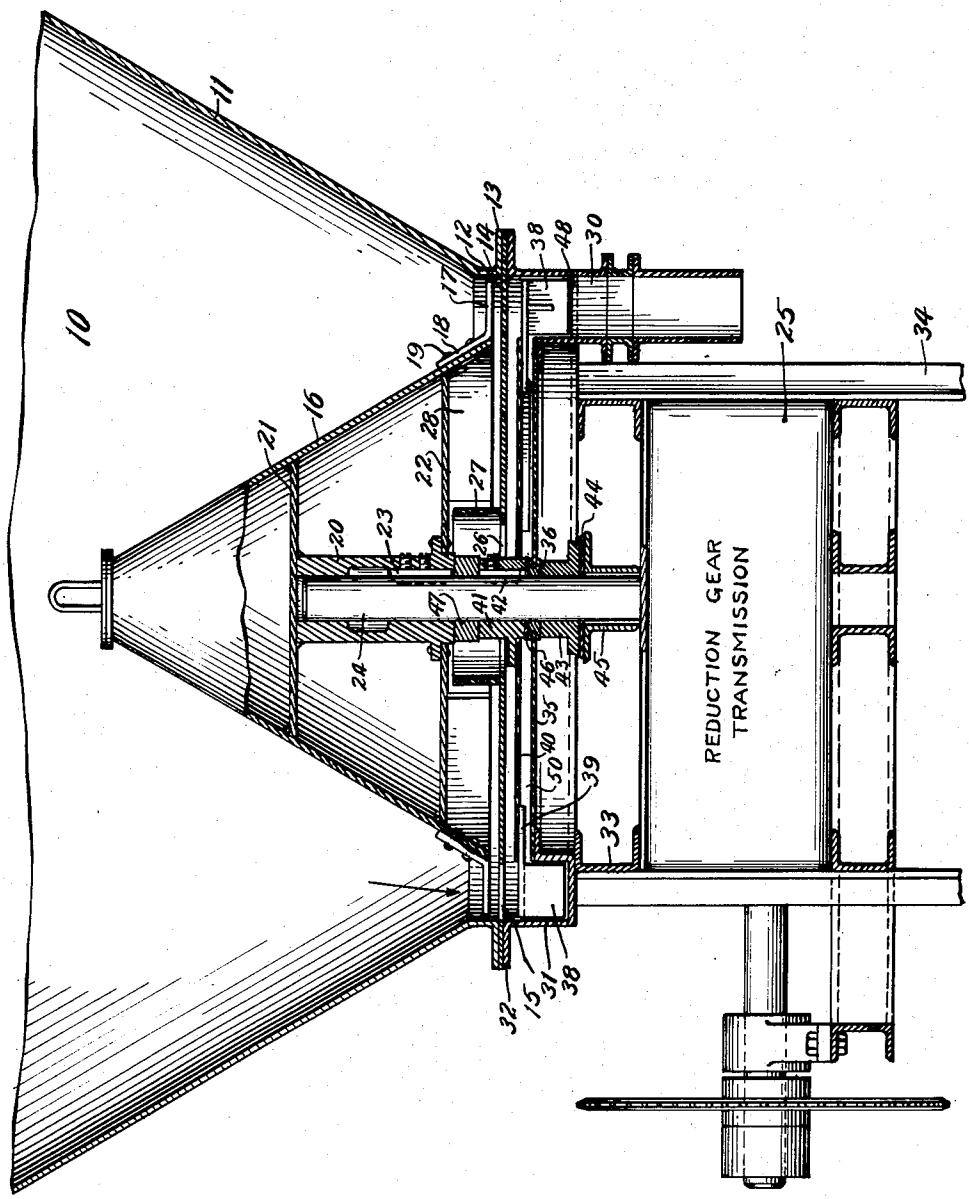

Fig. 1

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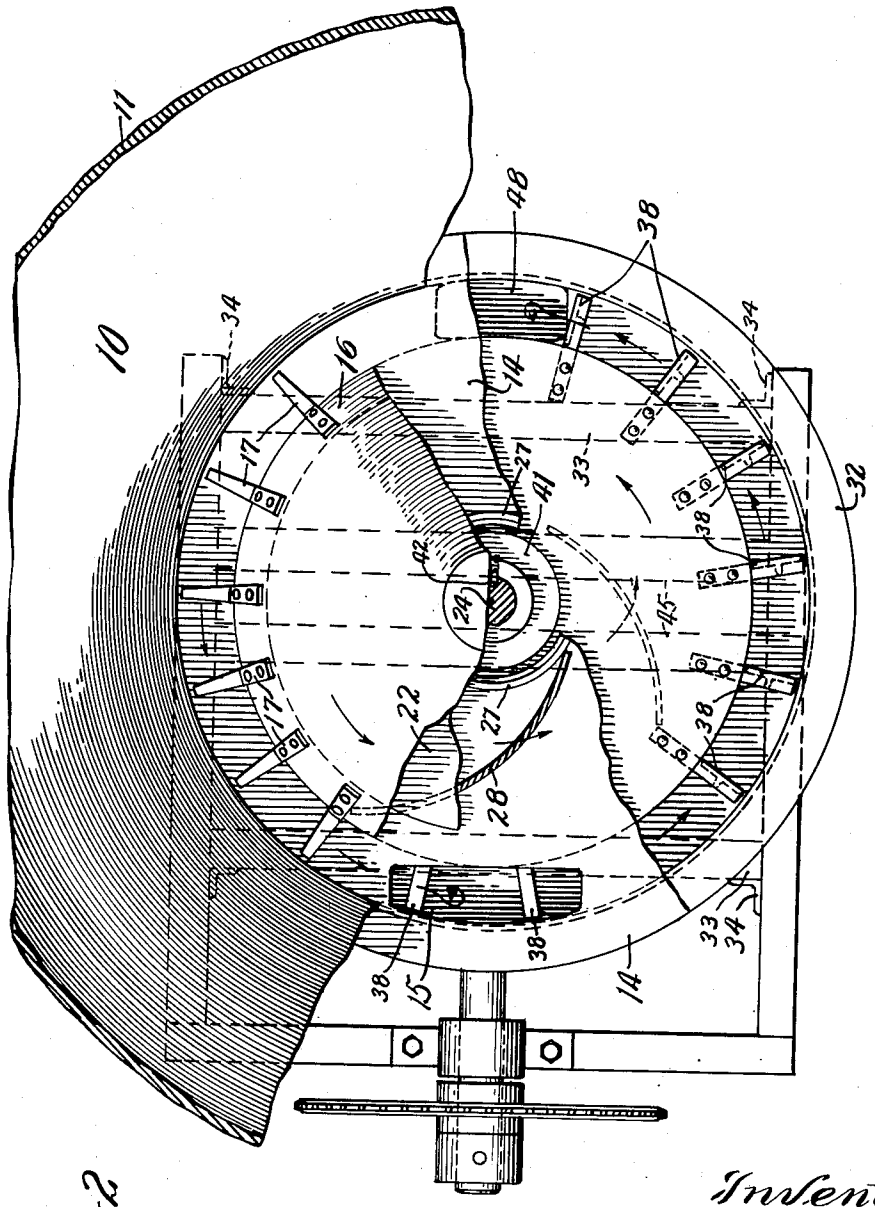

Fig. 2

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APPARATUS HAVING ROTATABLE MEANS FOR FEEDING AERATABLE POWDERED MATERIAL FROM STORAGE AND DISPENSING SUCH MATERIAL

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7 Claims. (Cl. 222—227)

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This apparatus is to take aeratable material from storage, as from a circular bin or a silo.

Many fine powders such as paper clay, Portland cement, pulverized starch, and light soda ash when mixed with air lose their characteristics as solids and flow like fluids. They will run through cracks like any liquid, go around bends, and even flow up through a trap like water in a plumbing system.

When those materials are stored in a circular bin or a silo, and attempt is made to draw them off from the bottom, they tend to arch over any bottom opening and thus stop the flow by leaving an air space below the arch.

Thereafter, when the arch is broken, the descent of the powdered material into the air beneath the arch aerates it and gives it the fluid characteristics. Then the material runs away like any light liquid until the air gets out of it when it recovers its characteristics of a powdered solid.

The principal object of this invention is to take aeratable material from storage at a measured, substantially uniform rate. Generally speaking, this is accomplished by a combination of two devices in tandem—the first breaking any arch in the material and feeding or discharging the material from storage; and the second, receiving the discharged material, preventing its running away if aerated, and feeding it at a uniform rate to a discharge outlet whether it is received in aerated condition or otherwise.

Specifically, there is here disclosed by way of example what will be called "Circular bin discharger" as the first device, and beneath it what will be called a "Circular volumetric feeder" for delivering the material in a definite volume per unit of time.

In the drawing:

Fig. 1 is a vertical section through the apparatus and the adjacent portion of a bin; and

Fig. 2 is a plan view with parts broken away in order to show the relation between the several elements of the two devices.

But these drawings and the corresponding description are used for the purpose of illustrative disclosure only.

Circular bin discharger

The storage bin indicated generally at 10 is shown as having a conical converging bottom portion 11 blending into a cylindrical portion 12 having a circular flange 13 resting upon and secured to a circular bottom plate 14 having an outlet 15 adjacent to the edge thereof.

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In the lower portion of the bin, above the bottom plate 14, is a rotatable cone 16 to the lower portion of which are secured twenty feeder fingers 17 adapted to sweep over the corresponding circular or annular portion of the bottom plate 14 and pass across the outlet 15. The feeder fingers are provided with arms 18, inclined to correspond with the inclination of the cone 16 and made fast thereto by rivets 19.

The cone has a hub 20 secured to it by circular discs or spiders 21 and 22, and the hub is keyed at 23 to a supporting and driving shaft 24 itself supported on a thrust bearing (not shown) in the transmission gear case generally indicated by 25.

The bottom plate 14 has an axial opening 26, surrounded by a circular flange 27, and the area between that flange and the rim of the base of the cone is constantly swept by spiral vanes 28 which serve to keep the powdered material from accumulating on the botom plate under the cone.

Operation of the circular bin discharger

As the shaft 24 is rotated counter-clockwise in Fig. 2, the powdered material in the bin 10 is agitated and worked to the discharge opening 15, through which it falls by gravity. The revolving cone 16 and the feeder fingers 17 keep the entire area of the lower part of the bin alive and moving, hence, any tendency to arch about the bottom of the bin and over the outlet 15 is constantly broken up, with the result that the material is fed to the outlet in a constant, regular supply.

Arching of the material will occur, but it cannot endure long enough to seriously interfere with the regular delivery from the bin. Any aeration caused by breaking an arch is taken care of by the second device in the combination.

Circular volumetric feeder

The circular volumetric feeder receives the powdered material from the outlet 15 and controls and forces its movement to a discharge outlet 30 by which it is delivered to a conveyor or the like.

This volumetric feeder includes an annular trough 31 concentric with the shaft 24 for the cone, and has a flange 32 underlying the rim of the bottom plate 14 and secured to it along with the flange 13 of the bin 10. The trough is stationary and rests upon the cross members 33 of a frame generally indicated by 34. Its inner edge is somewhat lower than its outer edge and is secured to a circular disc 35 having a central opening in which is fitted a ring 36 surrounding

the shaft 24. Closely fitted into the trough and sweeping it in regular series are twenty vanes 38 of generally rectangular form, having arms 39 made fast to a rotary disc 40 fixed to and driven by a hub 41 keyed on the shaft 24 at 42. The ring 36 is supported by a sleeve 43, which in turn is supported by a washer 44 on the cross-frame angles 45 of the main frame 34. The hub 41 is supported by the ring 36 through a lubricating washer 46, and between the hub 41 and the hub 20 is a ring 47.

The trough 31 has an outlet 48, here shown as located 180 degrees from the outlet 15, but of course, that location is subject to change to suit the conditions of any particular situation.

Operation of the volumetric feeder

The powdered material, falling through the outlet 15, collects in the trough 31, and the closely fitted vanes 38 divide it into measured volumes and force those volumes to travel around the trough until they reach the outlet 48 in succession, when they drop by gravity through the discharge 30. The vanes 38 fit the trough so closely that aerated powdered material cannot pass between and run around the trough to the outlet 48, either with or against the movement of the vanes. Thus, it will be seen that, regardless of the aerated or other condition of the powdered material passing through the outlet 15 from the bin discharger, it will be prevented from moving faster than the apparatus is designed to take, and will be forced to move in measured quantity at a definite rate determined by the speed of the shaft to the outlet 48 and the final discharge 30.

To prevent accumulation of powdered material between the rotary disc 40 and the stationary disc 35, the former is provided with spiral vanes 50 which constantly sweep the latter and work any powdered material towards the lower wall of the trough 31.

The diameter of the bin discharger should be such that the material to be handled cannot form an arch that will maintain itself long enough to interrupt the delivery. A possible variation from that condition is to have the diameter of the bin discharger smaller than the bottom of the conical portion 11, or of the bottom of the bin, and prevent the arching by the means forming the subject matter of my application No. 637,945, December 29, 1945, now abandoned.

Variations in the construction of the bin discharger will be selected from prior devices or made to suit particular conditions and that herein disclosed is deemed sufficient.

Variations in the volumetric feeder will be selected from prior devices or designs to suit particular conditions arising from the nature of the material to be handled or the characteristics of the final delivery sought to be made.

I claim:

1. In a device for taking aeratable material out of a bin, the combination of a bin having a bottom provided with an outlet, a circular bin discharger in said bin including a revolving cone and feeder fingers passing over said outlet, said cone having its axis vertically arranged and the cone being revoluble on such axis, and a feeder below said bin comprising an annular trough coaxial with said cone and having a portion arranged beneath said outlet to receive material passing therethrough, a plurality of relatively narrow spaced radial vanes each substantially coincident in size and shape to the cross-sectional area of said trough and arranged therein, and means for continuously rotating said vanes on said axis to move the material at a measured rate through the trough to a discharge spaced from said outlet.

2. In a device for taking aeratable material out of a bin, the combination of a bin having a bottom provided with an outlet, a circular bin discharger in said bin including a revolving cone and feeder fingers passing over said outlet, said cone having its axis vertically arranged and the cone being revoluble on such axis, and a feeder below said bin comprising an annular trough coaxial with said cone and having a portion arranged beneath said outlet to receive material passing therethrough, a plurality of relatively narrow spaced radial vanes each substantially coincident in size and shape to the cross-sectional area of said trough and arranged therein, said vanes being rotatable on said axis to move material through the trough to a discharge point spaced from said outlet, and a common shaft for continuously driving the cone and feeder fingers and the vanes.

3. In a device for taking aeratable material out of a bin, the combination of a bin, a circular bin discharger in said bin including a revolving cone having its axis vertically arranged, radial feeder fingers projecting outwardly from said cone, and a stationary plate beneath said cone and feeder fingers and having an outlet opening beneath the path of travel of said fingers, an annular stationary trough beneath said plate coaxial with said cone and above which said outlet is arranged to discharge material thereinto, a plurality of relatively narrow radial vanes corresponding in shape and size to the cross-sectional area of and arranged in said trough and rotatable on said axis to move material to a discharge circumferentially spaced from said outlet, and means for continuously rotating said vanes.

4. In a device for taking aeratable material out of a bin, the combination of a circular bin discharger including a revolving cone having its axis vertically arranged, radial feeder fingers projecting outwardly from said cone, a stationary plate beneath said cone and feeder fingers and having an outlet opening beneath the path of travel of said fingers, and means above said plate and rotatable with said cone for moving radially outwardly any material collecting on said plate beneath said cone, an annular stationary trough coaxial with said cone and above which said outlet is arranged to discharge material thereinto, and a plurality of radial vanes corresponding in shape and size to the cross-sectional area of and arranged in said trough and rotatable on said axis to move material to a discharge circumferentially spaced from said outlet.

5. In a device for taking aeratable material out of a bin, the combination of a circular bin discharger including a revolving cone having its axis vertically arranged, radial feeder fingers projecting outwardly from said cone, and a stationary plate beneath said cone and feeder fingers and having an outlet opening beneath the path of travel of said fingers, an annular stationary trough coaxial with said cone and above which said outlet is arranged to discharge material thereinto, a rotary plate beneath said stationary plate and rotatable on said axis, and a plurality of vertical radial vanes carried by the peripheral portion of said rotary plate and projecting below the plane thereof into said trough, said vanes corresponding generally in shape and size to the cross-sectional area of said trough to

move material therein from said outlet to a discharge circumferentially spaced therefrom.

6. In a device for taking aeratable material out of a bin, the combination of a circular bin discharger including a revolving cone having its axis vertically arranged, radial feeder fingers projecting outwardly from said cone, and a stationary plate beneath said cone and feeder fingers and having an outlet opening beneath the path of travel of said fingers, and means above said plate and rotatable with said cone for moving radially outwardly any material collecting on said plate beneath said cone, an annular stationary trough coaxial with said cone and above which said outlet is arranged to discharge material thereinto, a rotary plate beneath said stationary plate and rotatable on said axis, and a plurality of vertical radial vanes carried by the peripheral portion of said rotary plate and projecting below the plane thereof into said trough, said vanes corresponding generally in shape and size to the cross-sectional area of said trough to move material therein from said outlet to a discharge circumferentially spaced therefrom.

7. In a device for taking aeratable material out of a bin, the combination of a circular bin discharger including a revolving cone having its axis vertically arranged, radial feeder fingers projecting outwardly from said cone, and a stationary plate beneath said cone and feeder fingers and having an outlet opening beneath the path of travel of said fingers, an annular stationary trough coaxial with said cone and above which said outlet is arranged to discharge material thereinto, a rotary plate beneath said stationary plate and rotatable on said axis, a plurality of vertical radial vanes carried by the peripheral portion of said rotary plate and projecting below the plane thereof into said trough, said vanes corresponding generally in shape and size to the cross-sectional area of said trough to move material therein from said outlet to a discharge circumferentially spaced therefrom, a lower stationary plate beneath said rotary plate and connected at its periphery to said trough, and means between said rotary plate and said lower stationary plate for moving radially outwardly any material collecting on the latter plate.

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