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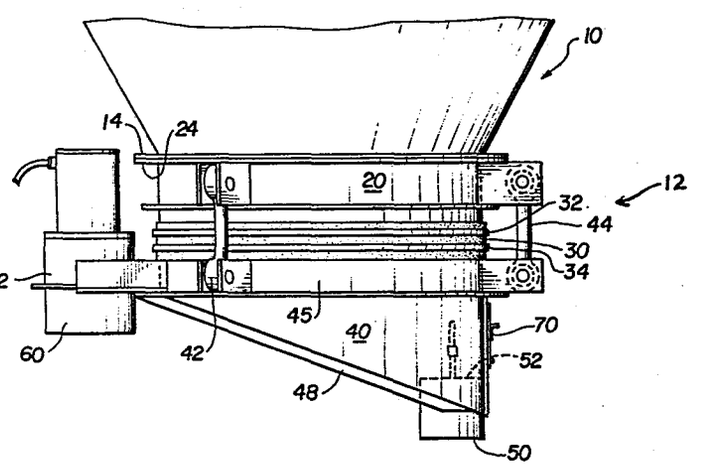
(54) Bin activator.

(57) An apparatus for attachment to supply bins which promotes positive flow of particulate material therefrom is provided comprising a segmented material receiving member (12) whose lower surface (48) lies along a slight slope with respect to the horizontal, a beaded flexible sleeve (30) between segments (20, 40) of the material receiving member, a gyrator (60) attached to the lower segment (40), and a three-point, forged hanger suspension system (42, 44, 46) connecting the upper and lower segments (20, 40). The upper segment (20) serves as a mounting ring for the associated supply bin (10). The lower segment (40) includes an adjustable baffle (52) for a bottom discharge opening (50) and a side discharge opening (70) with an adjustable gate (72). The gyrator (60) may have a motor speed controller so as to permit vibratory thrust variation and, thus, variation in material feed rate. A continuous external reinforcing ring (45) surrounds the lower segment (40) of the material receiving member (12) to provide strength under vibration.



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Bin activator

The present invention relates generally to storage bins, and more particularly to an improved bin activator for vibratory attachment at the bottom of a storage bin so as to induce and control the flow of material therefrom.

In the handling of powdered, granular, pulverized, or similar materials, a common problem arises when feeding such material from overhead supply bins: the material being fed becomes packed under compressive forces within the supply bin and "bridges" over the discharge opening. This reduces flow of material from the supply bin and prevents material supply rate control. Several devices have been produced which attempt to solve this problem by a technique called "bin activation". Devices of this type are shown in U.S. Patents 3,078,015; 3,151,782; 3,173,583; 3,261,508; and 3,853,247.

While these prior devices have been effective in preventing material bridging and maintaining continuous controlled flow from the storage bins, they have required the use of complicated and expensive machinery. Prior devices have also often required individualized field installation welding to ensure proper alignment of the bin activator to the supply bin. However, factory installation and assembly is preferred as much as possible so as to maintain product quality control and reduce installation costs and time. An object of the present invention is to overcome these deficiencies in the prior art and provide a simplified and reliable, low-cost bin activator.

An object of an aspect of the present invention is the provision of an improved and simplified bin activator attachable to a supply bin to promote the discharge of material therefrom. Another object of another aspect of the present invention is to provide an inexpensive and reliable bin activator which may be employed alternatively

as a variable rate, controlled feeder. The bin activator is desirably of low cost and has simplified on-site installation requirements, whilst providing reliable discharge of bulk materials.

According to one aspect of the present invention there is provided an apparatus for promoting and controlling the flow of material from a vertically extending supply bin having a discharge opening at its bottom, said apparatus comprising:

a segmented material receiving member including an upper segment and a lower segment, said upper segment having a flange means thereon adapted to be secured adjacent to and surrounding said discharge opening of said supply bin;

a flexible sleeve connected between said upper segment and said lower segment such that material contained within said segmented material receiving member is not permitted to leak therefrom and such that said lower segment is permitted to freely vibrate with respect to said upper segment;

a gyrator means attached to said lower segment so as to provide vibratory thrust thereto;

three forged hanger suspension means spaced about the circumference of said lower segment so as to provide for equal distribution of material weight within the lower segment and serving to support said lower segment beneath said upper segment while substantially reducing the transmission of vibration from said lower segment to said upper segment;

a continuous, external reinforcing ring which surrounds and overlays a portion of said lower segment;

said lower segment including a lower surface lying at a slope with respect to the horizontal and having a lowest portion adjacent one side of said lower segment, a discharge opening at said lowest portion of said lower

surface, and an adjustable baffle over said lower segment discharge opening so as to remove headload and thus prevent said lower segment discharge opening from clogging.

The gyrator may have a motor speed controller so as to permit vibratory thrust variation and, thus, variation in material feed rate.

According to another aspect of the invention there is provided an apparatus for promoting and controlling the flow of material from a supply bin having a discharge opening at its bottom, said apparatus comprising:

a material receiving member disposed below said discharge opening so as to receive material therefrom and including a vibratable portion;

a gyrator means for selectively providing vibrational thrust to said vibratable portion;

means to sealingly secure said material receiving member to said supply bin and prevent transmission of vibration to said supply bin when said vibratory portion is subject to vibrational thrust; and

a lower discharge opening in said material receiving member, having an adjustable baffle means for removing headload and material packing, and a side discharge means in said material receiving member, having an adjustable gate, such that said material receiving member may be employed alternatively as a variable rate discharger or material feeder.

In the accompanying drawings:

Figure 1 is a side elevational view of an embodiment of bin activator according to the present invention;

Figure 2 is a top view of the bin activator shown in Figure 1; and

Figure 3 is a partial view of another side of the bin activator shown in Figure 1 showing the adjustable gate of the side discharge opening.

The embodiment of bin activator shown in the drawings comprises a segmented material receiving member 12 which is attachable to the lower portion of supply bin 10 by

means of mating flange 14 and flange 24 of an upper segment 20 of the material receiving member 12. Typically, mating flange 14 may be secured to supply bin 12 without damage to coatings, polished surfaces, or bin finishes. Many conventional means of attachment are available depending upon the size, material composition stored within, and the particular structural features of supply bin 10. Mating flange 14 and flange 24 may be provided with drilled holes 16 which permit securing of these flanges together by bolts or rivets. Prior art bin activators often required field welding for installation to supply bins. Sealing means (not shown in the figures), such as an annular gasket or sealant compound, are provided between flanges 14 and 24 and between the securing rivets or bolts and the metallic surfaces of these flanges.

A flexible, beaded sleeve 30 seals the gap between the upper segment 20, which serves as the mounting ring, and lower segment 40 of material receiving member 12. Sleeve 30 may, for example, be formed from a reinforced "Nordel" elastomer or other materials which possess high tear resistance and durability when exposed to high temperatures, acids, alkalis, and pressures. The essential requirements for sleeve 30 are that it prevent material leakage from supply bin 10 and material receiving member 12 and yet provide a flexible joint for unrestricted movement of lower segment 40 when subject to vibration. Sleeve 30 is held in place by clamp bands 32 and 34. Raised edges may be provided on sleeve 30 to prevent it from sliding or slipping beneath these clamp bands.

Lower segment 40 is supported on upper segment 20 by means of three equally spaced hanger means 42, 44, and 46 about its circumference. Each such hanger means may be made from a single piece of forged steel so as to provide proper support and safety at minimum cost. Elastomeric

bushings (not shown in the figures) are employed with the forged hangers to assist in isolating the vibration of lower segment 40 from supply bin 10. Prior art bin activators have employed threaded rods as hanger means and these are inherently less secure over long periods of use. The unique, three-point suspension system provides for a more efficient transmission of vibration through lower segment 40 and a more equal distribution of material weight therein than has been found in other suspension systems having four or more hangers.

Electromechanical gyrator means 60 is secured to lower segment 40 and serves to provide vibratory thrust thereto. Suitable gyrator means are generally described in U.S. Patents 3,272,042; 3,277,732; and 3,344,293. Gyrator means 60 for small bin activators according to the present invention may be an oil lubricated motor capable of delivering 1000 lb. (4450 N) thrust forces continuously for long periods of time (of the order of 20,000 hours).

Lower segment 40 has a lower surface 48 inclined slightly with respect to the horizontal. The use of a slight incline permits increased material storage space per apparatus volume as well as causing the horizontal thrust exerted by gyrator means 60 to be resolved into vertical impulses extending far up into supply bin 10. Since surface 48 is relatively flat, it supports material from supply bin 10 with significantly less packing and bridging as material is discharged than prior conical supply bin dischargers. The vertical impulses deflecting up from surface 48 serve to break up or prevent what little bridging does occur.

Bottom discharge opening 50 is provided adjacent the lowest portions of lower surface 48. Since surface 48 is inclined, these lower portions are found at the side of lower segment 40. Bottom discharge opening 50 is, thus, not along the central longitudinal axis of material

receiving member 12. As material flows through opening 50 from supply bin 10, this off-centre alignment is less likely to result in bridging. An adjustable baffle 52 is provided in conjunction with discharge opening 50 so as to remove headload from that outlet and prevent material packing which would clog discharge opening 50. Baffle height may be adjustably set to handle different materials or material grades.

A side discharge opening 70 with an adjustable gate 72 may also be provided in lower segment 40 so as to permit alternative use of the bin activator as a variable rate discharger/feeder. In combination with the shallow slope of surface 48, side opening 70 produces almost instant cessation of material flow when gyrator means 60 is turned off since without vibration, the material will quickly cake. This feature eliminates the need for additional shut off gates and makes the bin activator ideal for batching operations. This variable rate feature may be enhanced by the inclusion of motor speed controller 62 for gyrator means 60 to provide variable thrust. When the bin activator is used as a side opening discharger, baffle 52 or external gates may be provided to prevent material flow through bottom discharge opening 50.

Unlike earlier bin activators, which required internal cross members for unit strength, a continuous external reinforcing ring 45 surrounds and overlays the upper portion of lower segment 40 for strength under vibration. This reinforcing ring is welded or secured by other conventional means to the upper portions of lower segment 40. The segmented assembly may be readily preassembled at the factory so as to ensure proper hanger alignment and reduce installation costs and time. Prior bin activators often welded hangers and hanger fittings directly to supply bins at the installation site and suffered from misalignment problems.

As the references cited above discuss the operation of bin activators generally in detail, only a brief description of the operation of the present invention will follow. Segmented material receiving member 12 supports material from supply bin 10 on surface 48. Gyrator means 60 supplies horizontal thrusts to lower segment 40 so as to vibrate that portion of the bin activator, but not supply bin 12. Material in lower segment 40 is positively displaced and responds by falling through either openings 50 or 70 or both.

CLAIMS:

1. An apparatus for promoting and controlling the flow of material from a vertically extending supply bin having a discharge opening at its bottom, said apparatus comprising:

a segmented material receiving member including an upper segment and a lower segment, said upper segment having a flange means thereon adapted to be secured adjacent to and surrounding said discharge opening of said supply bin;

a flexible sleeve connected between said upper segment and said lower segment such that material contained within said segmented material receiving member is not permitted to leak therefrom and such that said lower segment is permitted to freely vibrate with respect to said upper segment;

a gyrator means attached to said lower segment to as to provide vibratory thrust thereto;

three forged hanger suspension means spaced about the circumference of said lower segment so as to provide for equal distribution of material weight within the lower segment and serving to support said lower segment beneath said upper segment while substantially reducing the transmission of vibration from said lower segment to said upper segment;

a continuous, external reinforcing ring which surrounds and overlays a portion of said lower segment;

said lower segment including a lower surface lying at a slope with respect to the horizontal and having a lowest portion adjacent one side of said lower segment, a discharge opening at said lowest portion of said lower surface, and an adjustable baffle over said lower segment discharge opening so as to remove headload and thus prevent said lower segment discharge opening from clogging.

2. An apparatus according to claim 1, wherein a sealing means is provided between said upper segment flange and said mating flange, and a speed controller is provided for said gyrator means.

3. An apparatus for promoting and controlling the flow of material from a supply bin having a discharge opening at its bottom, said apparatus comprising:

a material receiving member disposed below said discharge opening so as to receive material therefrom and including a vibratable portion;

a gyrator means for selectively providing vibrational thrust to said vibratable portion;

means to sealingly secure said material receiving member to said supply bin and prevent transmission of vibration to said supply bin when said vibratory portion is subject to vibrational thrust; and

a lower discharge opening in said material receiving member, having an adjustable baffle means for removing headload and material packing, and a side discharge means in said material receiving member, having an adjustable gate, such that said material receiving memebr may be employed alternatively as a variable rate discharger or material feeder.

4. An apparatus according to claim 3, wherein said lower discharge opening and said side discharge means are both disposed in said vibratable portion.

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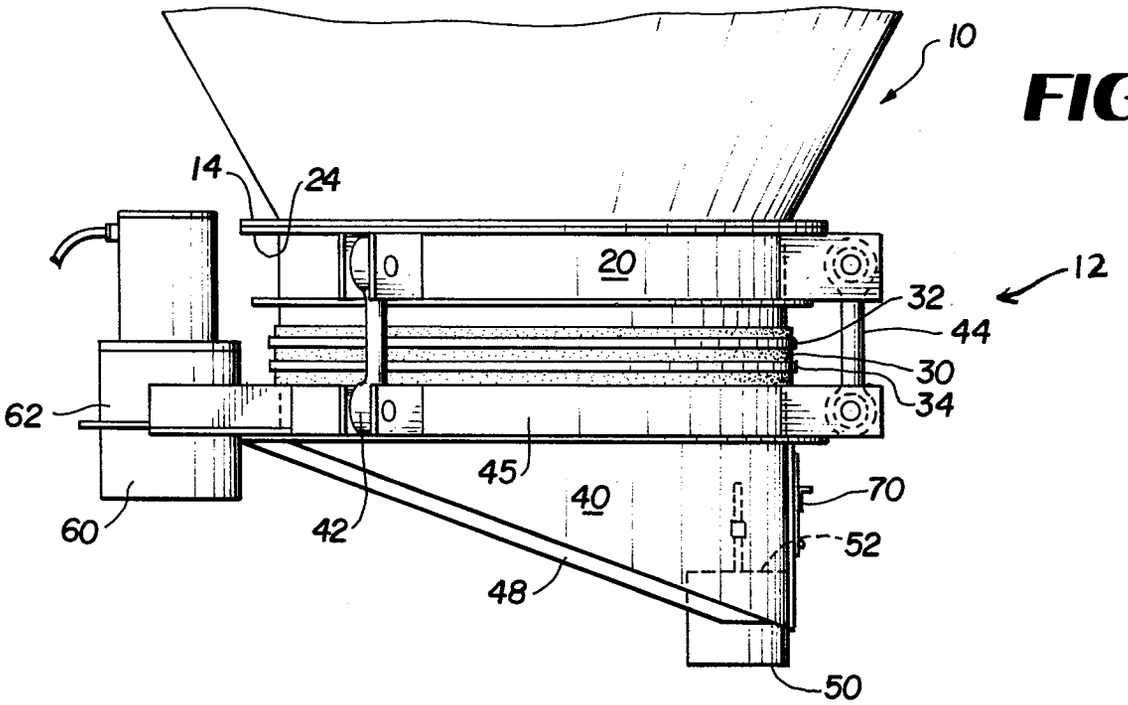

FIG.1

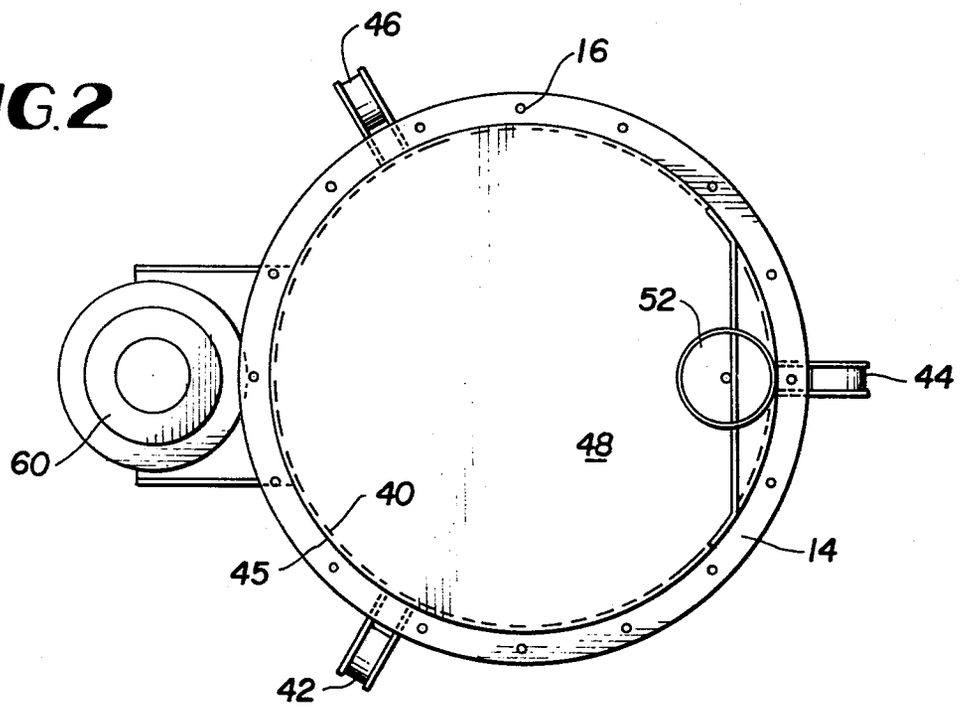

FIG.2

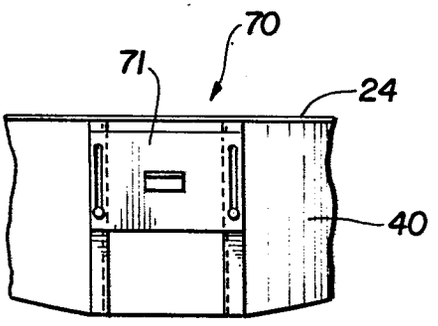

FIG.3

European Patent Office

EUROPEAN SEARCH REPORT

Application number 0130255

EP 83 30 6789

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
A	US-A-3 744 676 (DUMBAUGH) * Column 4, lines 28-62; figures 1, 2 *	1,3	B 65 D 88/66
A	US-A-3 785 529 (DUMBAUGH) * Column 3, lines 9-14; figure 2 *	1,3	
D,A	US-A-3 173 583 (WAHL) * Figure 6 *	1	
A	GB-A- 964 758 (GAUCET) * Page 2, lines 11-22; figures 1, 2 *	3	
A	GB-A-1 442 671 (GEB. BUEHLER AG.)		TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
D,A	US-A-3 853 247 (WAHL)		B 65 D 88/00
D,A	US-A-3 261 508 (WAHL)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	22-10-1984	SIMON J J P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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T : theory or principle underlying the invention
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