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Gessler

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[54] **SILO CONTAINER**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**.....**B65g 65/46**

[58] **Field of Search**.....214/17 R, 17 DA; 222/459; 193/32

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[57] **ABSTRACT**

A silo container with a substantially tubular upright portion having friction brake means with lateral marginal areas connected to the inner wall surface of said tubular portion so as to form obtuse angles therewith.

18 Claims, 6 Drawing Figures

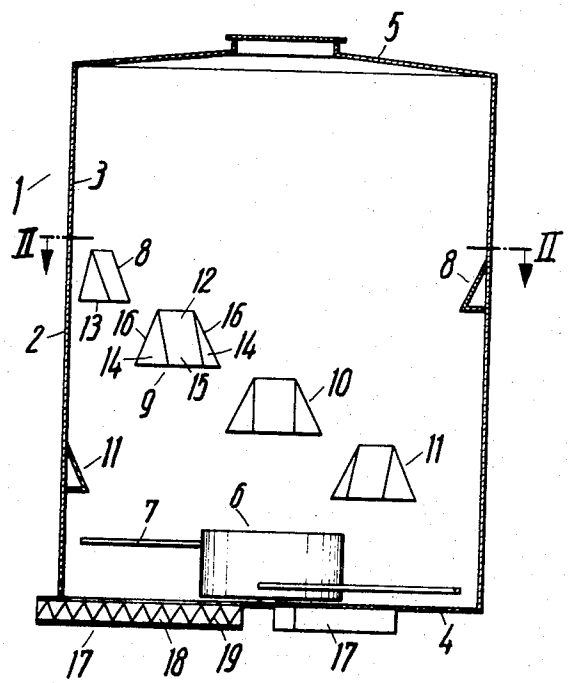


Fig. 1

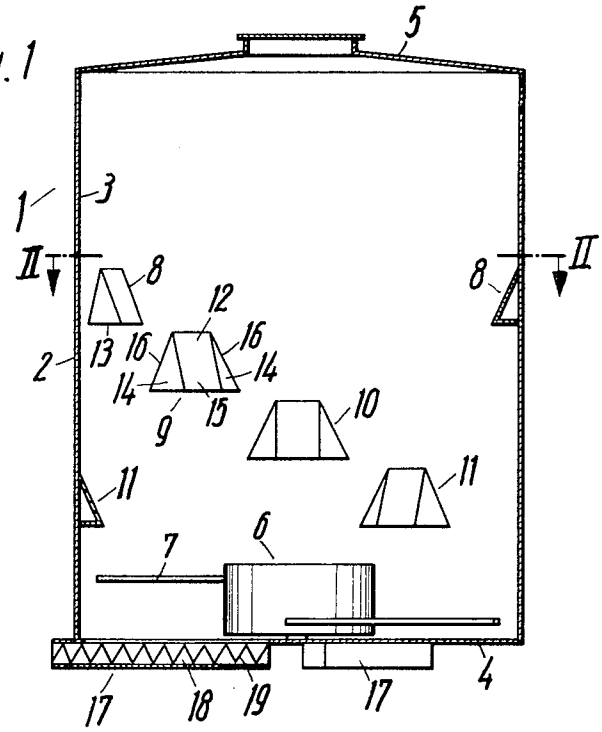


Fig. 3

Fig. 4

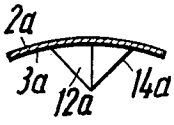


Fig. 5

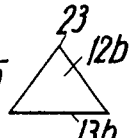


Fig. 6

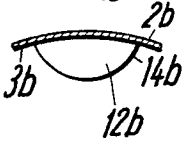
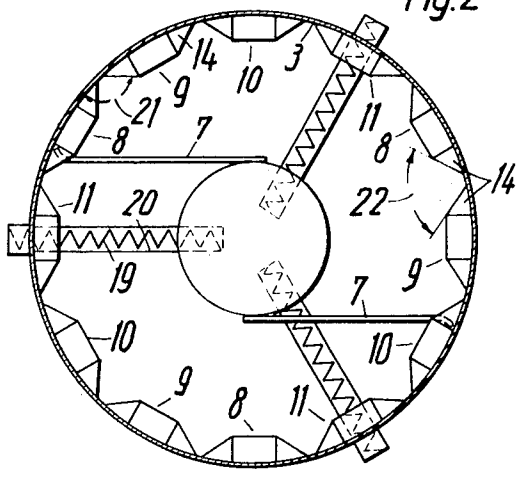


Fig. 2



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SILO CONTAINER

The present invention relates to a device for preventing the bridge building of silo material in silo containers with at least one friction brake which is provided on the inner surface of the silo container and which includes a braking surface protruding into the silo container.

It is an object of the present invention so to design a device of the above mentioned general type that the material in the silo will be prevented from depositing on the marginal areas of the friction brake.

This object and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing, in which:

FIG. 1 diagrammatically illustrates a vertical section through a silo equipped with a device according to the invention.

FIG. 2 represents a section taken along the line II—II of FIG. 1.

FIGS. 3 and 4 respectively illustrate in view and top view a further embodiment of a friction brake according to the invention.

FIG. 5 is a view of still another friction brake according to the invention, and

FIG. 6 is a top view of FIG. 5.

The device according to the present invention is characterized primarily in that the marginal areas of the friction brake protruding into the silo container and adjacent to the inner wall of the container form obtuse angles with the inner wall of the container. In view of this design, the material in the silo is prevented from depositing in the corners formed by the marginal area of the brake surface and the inner surface of the silo container.

Expediently, the friction brake is so designed that its two lateral marginal areas converge in horizontal section in the direction to the center of the container. In this way the marginal areas similar to the central region form supporting surfaces which on one hand reduce the pressure of the material upon the container bottom and on the other hand prevent the formation of supporting bridges. Preferably, the marginal areas are located symmetrically with regard to the vertical central plane of the brake surface.

In order, when providing more than two friction brakes at the same level, to prevent depositing or sticking of the material in the silo between adjacent friction brakes, the lateral marginal areas of adjacent friction brakes which marginal areas face each other converge in horizontal section in the direction toward the center of the container while forming preferably acute angles with each other.

According to a further development of the invention, the lateral marginal areas of the friction brakes are plane. This greatly facilitates the manufacture and mounting of the friction brakes.

Expediently, the lateral marginal areas of the friction brake form obtuse angles in the central region of the friction brake so that the entire braking surface can in a simple manner be made as a development.

The effect brought about by the device according to the invention as described above may also be realized 00652by making the angle defined by the two marginal areaof the braking surface greater than the arc angle of the braking surface. In order to assure a collapse of any

bridges being formed, the braking surface of the friction brake is expediently inclined downwardly toward the center of the container. Particularly in this instance it is advantageous when at least one marginal area of the friction brake is in view triangular with upwardly directed triangle tip so that also the width of the marginal area increases in downward direction.

In order to assure a braking effect in the entire inner region of the silo container, a plurality of braking surfaces in lateral spaced arrangement to each other are provided at different levels. With a silo container having at least one conveying element provided at the bottom side, for instance, a conveyor worm, at least one friction brake may be provided approximately vertically above each conveying element. As a result thereof, that region of the container which is located directly above the conveying element is freed from the pressure of the material, and the discharge opening pertaining to the conveyor element cannot clog up.

Referring now to the drawing in detail, the silo illustrated in FIGS. 1 and 2 comprises a silo container 1 with a cylindrical vertically arranged mantle 2 forming the inner surface 3 of the silo container 1. The mantle 2 has its lower portion provided with a plane bottom 4 while its upper portion is provided with a conical cover wall 5 forming an obtuse angle. Directly above the bottom 4 there is provided a rotor 6 for rotation about the central axis of the silo container 1. The circumference of the rotor 6 is equipped with tangentially arranged spring arms 7 located at different heights. The free ends of said arms 7 are located in the immediate vicinity of the inner surface 3 of the silo container 1.

The inner surface of the silo container 1 has connected thereto a plurality, for instance twelve, friction brakes 8-11 which are uniformly distributed over the inner circumferential surface of the container 1. In the particular embodiment shown in FIGS. 1 and 2, all friction brakes 8-11 are of identical design and are located in spaced relationship to each other. However, if desired, the friction brakes may also be of different designs with respect to each other.

Each friction brake 8, 9, 10, 11 is formed of sheet metal which is bent so as to have a wedge shape or the shape of a box and is connected to the inner surface 3 of the mantle 2 of the container 1 in any convenient manner, for instance, by welding. The largest surface 12 of each of said friction brakes is directed toward the central axis of the silo container 1 and is arranged in a plane inclined to the axis in such a way that the upper marginal area of this surface 12 is spaced from the central axis of the silo container 1 by a distance which is greater than the distance between the lower marginal area and the central axis of the container 1. The upper marginal area of the surfaces 12 is directly adjacent the inner surface 3 of the mantle 2. The lower marginal area of each braking surface 12 is formed by the corner zone between said surface and the bottom surface 13 of the respective pertaining friction brake, said bottom surface 13 being horizontal or perpendicular to the central axis of the silo container 1.

The friction brakes 8–11 are arranged at different levels on the silo mantle 2 in such a way that three groups are formed with respective adjacent friction brakes 8–11. The friction brakes 8-11 of each group are arranged at equal vertical distances, these distances

being greater than the height of the friction brakes. In this way the adjacent friction brakes **8, 11** of each two groups are vertically spaced to a greater extent than adjacent friction brakes **8, 9; 9, 10; 10, 11** within the respective group. Furthermore, the arrangement is such that every three corresponding friction brakes **8, 9, 10, 11** offset by 120° with regard to each other are located at the same height. The lowermost friction brakes **11** have a shorter vertical distance from the rotor **6** than the uppermost friction brakes **8** have from the ceiling wall **5** of the container **1**. The width of the braking surfaces **12** of the friction brakes **8-11** and the number of the friction brakes are determined primarily by the size of the silo container **1**; the angle of inclination of the braking surface **12** which may be different with regard to the friction brakes **8–11**, and the radial extension of the braking surfaces **12** depend on the bulk weight and the moisture content of the material in the silo.

During the downward movement of the material in the silo container **1**, the material is within the region of the mantle **2** of the container braked by the friction brakes **8–11** so that the bridge formation will be prevented and the static bottom pressure of the silo material will be reduced.

As will be evident from FIGS. **1** and **2**, each braking surface **2** has two lateral marginal areas **14** which in horizontal section merge at an obtuse angle with the area **15** of the braking surface **12** therebetween. All areas **14, 15** of the braking surface are plane. The marginal areas **14** are in view according to FIG. **1** and in top view according to FIG. **2** of triangular shape while the tips of the triangles are with the smallest angle directed upwardly. Each marginal area **14** extends with its edge **16** which faces away from the central region **15** to the inner surface **3** of the container mantle **2** so that also inwardly extending corners between the central region **15** of the braking surface **12** and the inner surface **3** are filled or bridged. The marginal area **14** together with that section of the inner surface **3** of the container **2** which merges with the area **14** defines an obtuse angle **21** which opens toward the center of the container so that silo material which might pass into this corner zone will drop out.

The bottom side of the bottom **4** of the container **1** is equipped with three conveying devices **17** which are uniformly distributed over the circumference and which in the particular embodiment shown are formed by a conveyor worm **19** arranged in a worm trough **18**. The worms **19** extend radially with regard to the silo container **1** while above each conveyor worm **19** a corresponding opening **20** is provided in the bottom **4** of the container **1** through which opening the silo material drops into the respective worm trough **18**. The conveying devices **17** or friction brakes **8–11** are so arranged that those friction brakes **11** which are located farthest downwardly are respectively located vertically above a conveyor worm **19**. The number of the groups of friction brakes thus corresponds to the number of the conveying devices **17** on the silo container **1**.

As illustrated in FIG. **2**, the marginal areas **14** which face each other and respectively pertain to adjacent friction brakes are so arranged that in horizontal section they define an acute angle **22** which opens toward the center of the container.

As shown in FIGS. **3** and **4**, the braking surface **12*a*** may prismatically be so simplified that it is formed only by two surface sections which in horizontal section angularly merge with each other in a V-shaped manner. These surface sections form the central region and also the marginal regions **14*a*** of the braking surface **12*a*** which marginal regions **14*a*** merge with the inner surface **3*a*** of the mantle **2*a*** at an obtuse angle. In this way the braking surface **12*a*** forms with its upper end a wedge-shaped tip. In the illustrated embodiment, the two plane surface sections forming the braking surface **12*a*** are in horizontal section and in top view located at a right angle with regard to each other.

FIGS. **5** and **6** illustrate a modified friction brake in which the braking surface **12*b*** is formed by the segment of a conical mantle surface the central axis of which expediently intersects the inner surface **3*b*** of the mantle **2*b*** at the upper tip **23** of the brake surface **12*b*** and from there extends downwardly at an inclination in outward direction in such a way that at the level of the bottom surface **13*b*** of the friction brake it has a greater distance from the center of the mantle **2*b***. The central axis of the conical segmental surface **12*b*** which central axis is located in the axial plane of the mantle **2*b*** is also provided with an acute angle with regard to the central axis of the mantle **2*b***. The lateral zones of the conical mantle surface **12*b*** form the marginal areas **14*b*** which merge at an acute angle with the inner surface **3*b***.

It is, of course, to be understood that the present invention is, by no means, limited to the particular showing in the drawing but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. An apparatus to assure against formation of bridges of fibrous silo material in a silo container having a substantially tubular upright portion with a bottom, which includes: multiple friction brake means with lateral marginal areas connected to the inner wall surface of said tubular portions so as to form obtuse angles therewith, and friction surface means inclined downwardly on each friction brake means, said lateral marginal areas extending along substantially the entire height of said friction surface means of respective friction brake means, said lateral marginal areas of adjoining friction brake means where directed toward each other extending in horizontal section in a direction toward the middle of the silo container.

2. An apparatus in a silo container according to claim **1**, in which the lateral marginal areas of said friction brake means when seen in a horizontal section converge in the direction toward the central axis of said container.

3. An apparatus in a silo container according to claim **2**, in which the lateral marginal areas of said friction brake means and symmetrically located with regard to the vertical central plane of said friction brake means.

4. An apparatus in a silo container according to claim **1**, in which said friction brake means includes more than two friction brake bodies at substantially equal level, those lateral marginal areas which face toward each other when viewed in horizontal section diverging in the direction toward the central axis of the container.

5. An apparatus in a silo container according to claim 4, in which those lateral marginal areas which face each other form an acute angle with each other.

6. An apparatus in a silo container according to claim 1, in which said lateral marginal areas are plane.

7. An apparatus in a silo container according to claim 1, in which the inner wall surface of the silo container is cylindrical.

8. An apparatus in a silo container according to claim 1, in which the lateral marginal areas of said friction brake means merge with the central region thereof while forming therewith obtuse angles.

9. An apparatus in a silo container according to claim 1, in which the brake surface area of each of said friction brake means is formed by two surface sections which when viewed in a horizontal section intersect each other so as to form a V.

10. An apparatus in a silo container according to claim 1, in which the brake surface area of each of said friction brake means is conical.

11. An apparatus in a silo container according to claim 1, in which the brake surface area of each of said friction brake means is of a pyramidal segmental shape.

12. An apparatus in a silo container according to claim 1, in which the central axis of the brake surface of each of said friction brake means is in upward direction inclined toward the central axis of the silo container.

13. An apparatus in a silo container according to claim 12, in which the central axis of the brake surface intersects the inner surface of the container mantle surface at the upper tip of the brake surface area.

14. An apparatus in a silo container according to claim 1, in which the angle defined by the two marginal areas of the friction brake means exceed the arc angle of the pertaining brake surface area.

15. An apparatus in a silo container according to claim 1, in which the brake surface area of each friction brake means is downwardly inclined toward the central axis of the silo container.

16. An apparatus in a silo container according to claim 1, in which at least one marginal region of said friction brake means when considered in view is of triangular shape with the tip of the triangle pointing upwardly.

17. An apparatus in a silo container according to claim 1, in which said friction brake means includes a plurality of friction brakes laterally spaced from each other and respectively arranged at different levels.

18. An apparatus in a silo container according to claim 1, in which said bottom is provided with passage means, and which includes conveyor means arranged below the bottom of the silo container and communicating through said passage means with the interior of said container, at least one friction brake means being located vertically above each of said conveyor means.

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