Aug. 3, 1954 C. S. STEINER 2,685,388

SOAP ANTIBRIDGING

Filed Oct. 3, 1949

Fig. 1

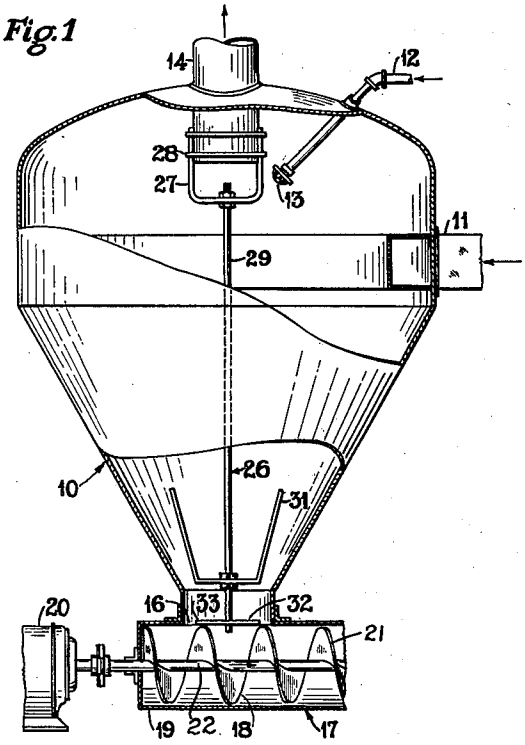


Fig. 2

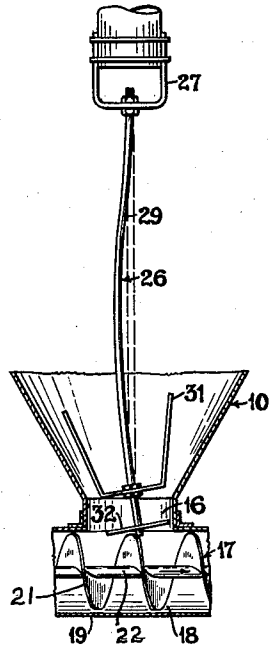
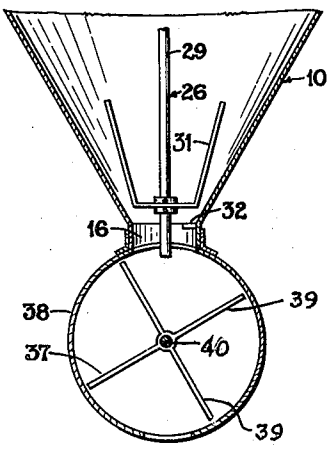


Fig. 3



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Patented Aug. 3, 1954 2,685,388

UNITED STATES PATENT OFFICE

2,685,388

SOAP ANTIBRIDGING

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Application October 3, 1949, Serial No. 119,333

8 Claims. (Cl. 222—200)

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The present invention relates to a device for eliminating the bridging of a particulate material across an outlet opening in a container from which opening it is desired to have the material discharged.

The principal object of the present invention is to provide a simple and inexpensive device to prevent the desiccated material in a spray drying chamber or the like from projecting across the outlet opening thereof and causing a blockade of the flow from the chamber.

There have been many attempts to solve the problem of preventing the self-construction of a powder or granular material to gravity flow through an opening. One common expedient has been to utilize a "doctor blade" which is rotated about the upper portion of the opening to break up any bridge that starts to form. In many instances this provides a satisfactory solution for the problem while, in other instances, the rotating shaft with its accompanying bearings and other parts further complicates the situation by introducing additional maintenance, cleanliness, etc., problems.

In many of the instances where the problem arises a star wheel or a screw conveyor is used at the outlet opening of the drying chamber to obtain measured quantities or to seal that opening against the passage of gaseous fluids. Inasmuch as it is at this opening that the bridging occurs, I have devised a novel device to eliminate bridging by taking advantage of the force available at the star wheel or screw conveyor.

The invention utilizes a resiliently mounted member, preferably a resilient rod, as the basis of an agitator. An additional feature of the present invention is the ability to store an unusually high amount of energy in the resilient rod before it is released. This is achieved by a complex stressing of the resilient rod. When the rod is suddenly released from this stressed condition it seeks its unstressed position with a violent oscillatory return motion that thoroughly cleans the outlet opening.

Additional objects and advantages of the invention include: the ability to incorporate the instant invention in an existing apparatus where such problems occur; substantially no maintenance problem nor expense; low initial cost; the inclusion of a suitable device for extending the area of agitation of the resilient rod; and the fact that the device is sufficiently small in the volume occupied so as not to obstruct the normal functioning of the dryer or the like to which it is attached.

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Further objects and advantages will be apparent from the following description taken in conjunction with the drawings in which:

Fig. 1 is a sectional elevation of a spray dryer illustrating the present invention;

Fig. 2 is a view of the lower portion of the apparatus shown in Fig. 1 with the agitator being stressed; and

Fig. 3 is a section of another type of dryer illustrating a different embodiment of the present invention.

The spray dryer, generally 10, illustrated in Fig. 1 and Fig. 2 includes an air supply means 11 for introducing a blast of hot dry air and a fluid supply means 12 having a spray head 13 for introducing the material which is to be dried. Discharge pipe 14 is used to carry off the waste drying gases. As is well known, in such devices the majority of the dried material settles to the bottom of the drying chamber 10 which is made in the form of an inverted cone with an opening at the bottom end thereof through which opening the dried material may be withdrawn.

To prevent the discharge through the bottom opening 16 of the drying air which is introduced through pipe 11 under pressure a sealing means which may be in the form of a screw conveyor, generally 17, is provided. The conveyor 17 consists of a worm or screw 18 within a housing 19 and rotated by a suitable power means 20. Screw 18 has a plurality of turns 21 about a central portion or axle 22. A discharge opening (not shown) in housing 19 is formed and positioned so that screw 18 will push the dried material into the opening. The opening is sufficiently small so that the dried material will pack up behind the opening or in the screw to form a seal and prevent the discharge of the drying fluid from dryer 10 except by way of pipe 14.

When such a dryer is in operation, the dry material, particularly if it is at all sticky, tends to build up across opening 16 instead of falling down through the opening and into the conveyor 17. The present invention is adapted to keep the material readily flowing to the conveyor 17. In the illustrated embodiment it comprises an agitator, generally 26, which is securely mounted at the upper end to a suitable portion of dryer 10 with the lower end projecting through opening 16. While various methods may be employed for this mounting, the agitator illustrated in Fig. 1 is provided with a support or pronged upper end 27 adapted to fit around and be secured to discharge pipe 14 by means of clamps 28. The pronged support 27 gives adequate stability with-

out seriously obstructing the discharge of the drying air from chamber 10. Projecting downwardly from support 27 is a resilient rod 29 with the lower end thereof extending below the top of the projections, i. e. turns 21, of screw 18 and above the top of the central portion 22.

Wing pieces 31 are secured to rod 29 adjacent the lower end thereof and serve to increase the effective area of agitation. Also above the lower end of rod 29 is affixed a bumper 32 which serves as a fulcrum over which a complex stressing of the rod 29 is obtained. A rebound bumper 33 is attached to the reverse side of the rod. In some specific installations the rebound bumper may be eliminated.

The operation of the agitator 26 is extremely simple. As the screw 18 is rotated to move the dried material to outlet opening 22, the lower end of rod 29 of the agitator will be engaged by the projections of the screw and the rod will be moved to the right in Fig. 1. During the course of this movement, bumper 32 will contact the side of chamber 10 adjacent opening 16 and thereafter will serve as a fulcrum for the complex stressing of rod 29.

As the screw 18 continues to move the lower end of rod 29 to the right after bumper 32 has begun to act as a fulcrum, the rod 29 will be twisted much in the shape illustrated in Fig. 2. The upper end of the rod 29 is firmly held in a fixed position by pipe 14, thus requiring a reverse bend in rod 29 as the lower end is bent over the fulcrum. The rod 29 is sufficiently short so that after it has been well stressed by being bent as illustrated in Fig. 2, the upper part of screw 18 works by the lower end of the rod releasing the rod to seek its static position.

While hunting for its unstressed position, the rod goes through a series of violent oscillatory movements during which time the rod 29, wings 31, and bumpers 32 and 33 are violently moved about the inner portion of dehydrating chamber 10 with some banging against the walls of the chamber. These movements act to break up any bridges that might start to form across opening 16 and to loosen any accumulations of dried material found about the walls adjacent the opening.

In some types of dehydrators a star wheel 37 within a circular housing 38 is used in place of the screw conveyor 17 as is illustrated in Fig. 3. Star wheel 37 has a plurality of arms 39 forming projections outwardly from a central portion or axle 40. The instant invention is readily adaptable for use with the star wheel valve or conveyor. A further modification is illustrated in Fig. 3 in that the bumper 32 is secured to the wall of chamber 10 rather than to rod 29. While such a structure may be used, it is less desirable than that illustrated in Fig. 1.

The principal objection to the reversed position of the bumper is that the line of movement of rod 29 towards the wall of chamber 10 will vary and as a consequence the bumper 32 must be made considerably wider to insure that it attain a firm contact with rod 29 for the desired fulcrum action. Additional guide means may be used for the same purpose. The increased size of bumper 32 or additional guides will further interfere with the flow of material through opening 16. In addition, when the bumper 32 is secured to rod 29, it will also act as an area extending device in a manner similar to that of wings 31.

From the foregoing description certain modifications of the described structure will be apparent to those skilled in the art. For example, not only may the invention be useful in connection with dryers or dehydrators but it also is suitable for many devices having similar problems, such as, dispensing apparatus where a structure like star wheel 37 is used as a measuring instrument at the bottom of a storage container. Other movable means, such as a slide valve, may be used in place of screw 18 or star wheel 37 with equally good results being obtained. Instead of a resilient rod, a stiff rod or other member may be used with a suitable spring mounting to obtain the energy storage action of the resilient rod. For this reason the foregoing description should not be construed as imposing unnecessary limitations upon the appended claims, but it merely a compliance with Section 4888 of the Revised Statutes.

I claim:

1. In a spray drier the combination of a chamber means for receiving a particulate material, said chamber means having an opening in a bottom portion thereof through which said particulate material is discharged, a rotary member below said opening to move said particulate material from the chamber means, said rotary member having a central portion with a plurality of material handling projections thereon with spaces between said projections, and a device for preventing said material bridging across said opening, said device including a resilient rod means projecting downwardly within said chamber means, the upper end of the rod means being mounted from said chamber means in a relatively rigid position, with the lower end of the rod means extending below the top of said projections and into the space therebetween and spaced from said central portion and said projections when said space defined by said projections is below said opening whereby as the rotary member moves said projections will contact said lower end to move said lower end toward one side of the opening, and a bumper attached to one of said means and projecting toward the other of said means above the lower end of the rod means, said rod means being sufficiently short to slip by said rotary member after said bumper has contacted said other means.

2. In a spray drier the combination of a chamber means for receiving a particulate material, said chamber means having an opening in a bottom portion thereof through which said particulate material is discharged, a rotary member below said opening to move said particulate material from the chamber means, said rotary member having a central portion with a plurality of material handling projections thereon with spaces between said projections, and a device for preventing said material bridging across said opening, said device including a resilient rod projecting downwardly within said chamber means, the upper end of the rod being mounted from said chamber means in a relatively rigid position, with the lower end of the rod extending below the top of said projections and into the space therebetween and spaced from said central portion and said projections when said space defined by said projections is below said opening whereby as the rotary member moves said projections will contact said lower end to move said lower end toward one side of the opening, and a bumper attached to said rod adjacent the lower end of the rod and projecting toward the side of said chamber means, said rod being sufficiently short to slip by said rotary

member after said bumper has contacted the side of the chamber means.

3. In a spray drier the combination of a chamber means for receiving a particulate material, said chamber means having an opening in a bottom portion thereof through which said particulate material is discharged, a rotary member below said opening to move said particulate material from the chamber means, said rotary member having a central portion with a plurality of material handling projections thereon with spaces between said projections, and a device for preventing said material bridging across said opening, said device including a resilient rod means projecting downwardly within said chamber means, the upper end of the rod means being mounted from said chamber means in a relatively rigid position, with the lower end of the rod means extending below the top of said projections and into the space therebetween and spaced from said central portion and said projections when said space defined by said projections is below said opening whereby as the rotary member moves said projections will contact said lower end to move said lower end toward one side of the opening, a bumper attached to one of said means and projecting toward the other of said means above the lower end of the rod means, said rod means being sufficiently short to slip by said rotary member after said bumper has contacted said other means, and area extending means attached to said rod means adjacent the lower end thereof and movable therewith, said area extending means projecting outwardly from said rod means into said chamber.

4. In a spray drier the combination of a chamber means for receiving a particulate material, said chamber means having an opening in a bottom portion thereof through which said particulate material is discharged, a rotary member below said opening to move said particulate material from the chamber means, said rotary member comprising a screw having the turns of the screw formed about a central axle with spaces between the turns of the screw, and a device for preventing said material bridging across said opening, said device including a resilient rod means projecting downwardly within said chamber means, the upper end of the rod means being mounted from said chamber means in a relatively rigid position, with the lower end of the rod means extending below the top of the turns of the screw and into the space therebetween and spaced from said central axle and said turns of said screw when said space defined by said turns is below said opening whereby as the rotary member moves said screw will contact said lower end to move said lower end toward one side of the opening, and a bumper attached to one of said means and projecting toward the other of said means above the lower end of the rod means, said rod means being sufficiently short to slip by the turns of said screw after said bumper has contacted said other means.

5. In a spray drier the combination of a chamber means for receiving a particulate material, said chamber means having an opening in a bottom portion thereof through which said particulate material is discharged, a rotary member below said opening to move said particulate material from the chamber means, said rotary member comprising a screw having the turns of the screw formed about a central axle with spaces between the turns of the screw, and a device for preventing said material bridging across said opening, said device including a resilient rod projecting downwardly within said chamber means, the upper end of the rod being mounted from said chamber means in a relatively rigid position, with the lower end of the rod extending below the top of the turns of the screw and into the space therebetween and spaced from said central axle and said turns of said screw when said space defined by said turns is below said opening whereby as the rotary member moves said screw will contact said lower end to move said lower end toward one side of the opening, a bumper attached to said rod adjacent the lower end of the rod and projecting toward the side of said chamber means, said rod being sufficiently short to slip by the turns of said screw after said bumper has contacted the side of the chamber means, and area extending means attached to said rod adjacent the lower end thereof and movable therewith, said area extending means projecting outwardly from said rod into said chamber.

6. In a spray drier the combination of a chamber means for receiving a particulate material, said chamber means having an opening in a bottom portion thereof through which said particulate material is discharged, a rotary member below said opening to move said particulate material from the chamber means, said rotary member comprising a star wheel having a central axle with a plurality of material handling projections thereon with spaces between said projections, and a device for preventing said material bridging across said opening, said device including a resilient rod means projecting downwardly within said chamber means, the upper end of the rod means being mounted from said chamber means in a relatively rigid position, with the lower end of the rod means extending below the top of said projections and into the space therebetween and spaced from said central axle and said projections when said space defined by said projections is below said opening whereby as the rotary member moves said projections will contact said lower end to move said lower end toward one side of the opening, and a bumper attached to one of said means and projecting toward the other of said means above the lower end of the rod means, said rod means being sufficiently short to slip by said rotary member after said bumper has contacted said other means.

7. An anti-bridging device for use in a spray drying chamber means having a bottom opening below which is a rotary member with a plurality of material handling projections about a central portion with spaces between said projections to move a particulate material from the chamber means, said device including a resilient rod means projecting downwardly within said chamber means, the upper end of the rod means being mounted from said chamber means in a relatively rigid position, with the lower end of the rod means extending below the top of said projections and into the space therebetween and spaced from said central portion and said projections when said space defined by said projections is below said opening whereby as the rotary member moves said projections will contact said lower end to move said lower end toward one side of the opening, and a bumper attached to one of said means and projecting toward the other of said means above the lower end of the rod means, said rod means being sufficiently short to slip by said rotary member after said bumper has contacted said other means.

8. An anti-bridging device for use in a spray

drying chamber means having a bottom opening below which is a rotary member with a plurality of material handling projections about a central portion with spaces between said projections to move a particulate material from the chamber means, said device including a resilient rod projecting downwardly within said chamber means, the upper end of the rod being mounted from said chamber means in a relatively rigid position, with the lower end of the rod extending below the top of the turns of the screw and into the space therebetween and spaced from said central portion and said turns of said screw when said space defined by said turns is below said opening whereby as the rotary member moves said screw will contact said lower end to move said lower end toward one side of the opening, a bumper attached to said rod adjacent the lower end of the rod and projecting toward the side

of said chamber means, said rod being sufficiently short to slip by the turns of said screw after said bumper has contacted the side of the chamber means, and area extending means attached to said rod adjacent the lower end thereof and movable therewith, said area extending means projecting outwardly from said rod into said chamber.

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