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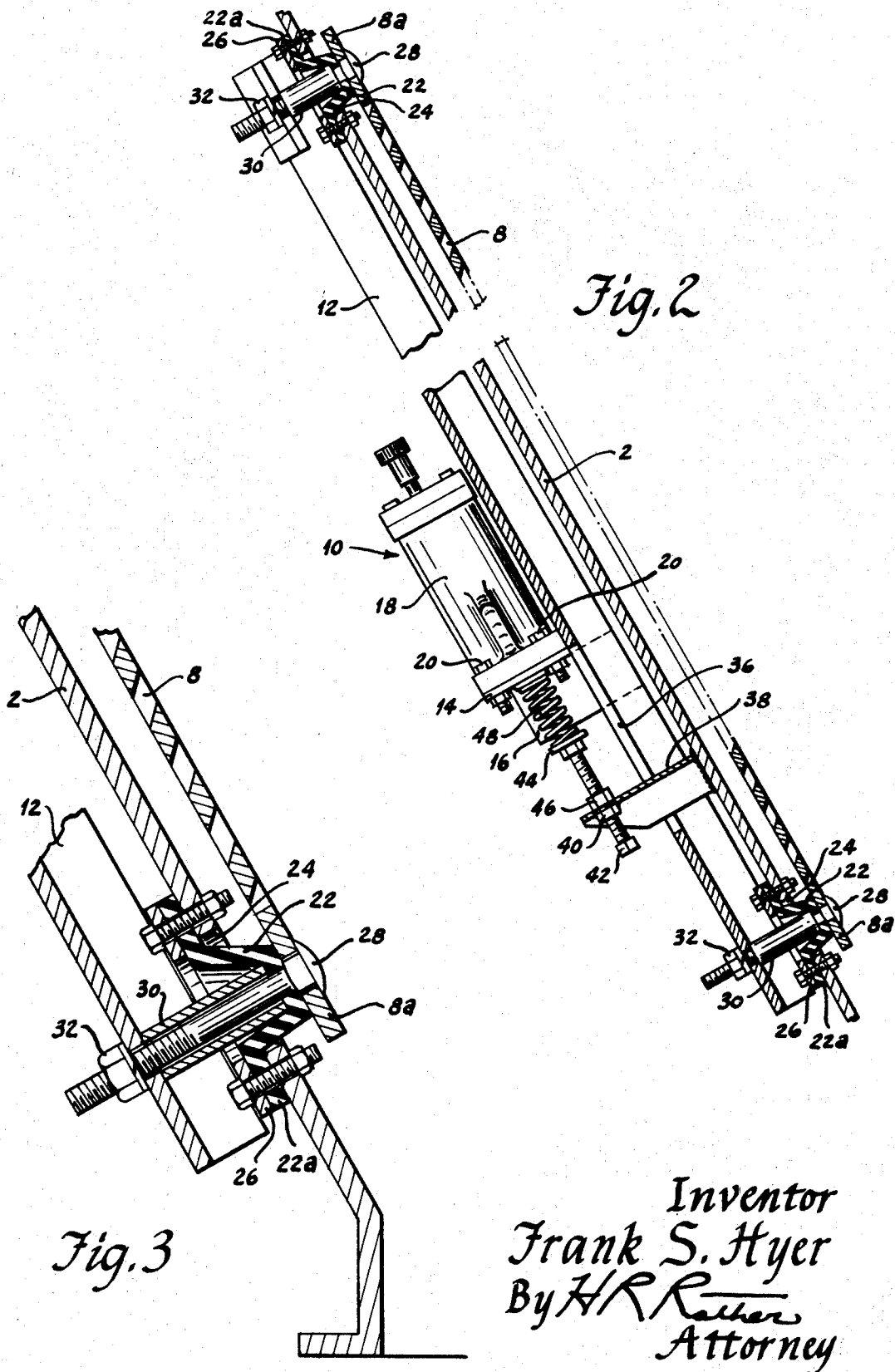
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AGITATOR ASSEMBLY FOR PARTICULATE MATERIAL HOPPER

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1

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## AGITATOR ASSEMBLY FOR PARTICULATE MATERIAL HOPPER

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### ABSTRACT OF THE DISCLOSURE

A gravity feed hopper has an agitator assembly comprising an internal screen and external vibrator rigidly joined in spaced apart relation by bolts passing through openings in the hopper wall. The bases of resilient conical bushings are secured to the wall adjacent the openings to surround and connect with the respective bolts and resiliently support the agitator assembly on the hopper. Resilient upward bias is provided the agitator assembly by a compression spring coacting between the vibrator and an adjustable platform on the exterior of the hopper to compensate for the weight of the agitator assembly and the load imposed upon the screen by the material in the hopper.

### BACKGROUND OF THE INVENTION

This invention relates to gravity feed hoppers for dispensing particulate material and more specifically to agitators used therein to assist in discharging the material at a uniform and continuous rate.

A hopper of the aforementioned type is disclosed in the F. L. Thayer et al. U.S. Pat. No. 2,905,365 issued Sept. 22, 1959 and assigned by mesne assignments to the assignee herein. The hopper disclosed therein includes an internal agitator screen operatively driven by an external vibrator to prevent the bridging of the hopped material over the hopper outlet. This invention comprises certain specific improvements to hoppers of the above type to increase the vibrational amplitude of the agitator assembly, increase the life of the mounting components for the agitator assembly and provide a means for compensating for the initial deflection of the mounting components due to the dead load weight of the material imposed upon the agitator screen and the weight of the agitator assembly itself.

### OBJECTS OF THE INVENTION

It is therefore a primary object of this invention to provide a gravity feed hopper having improved agitator means.

It is a further object of this invention to provide a gravity feed hopper having improved agitator means including resilient means biasing said agitator means upwardly against the dead load weight imposed thereon by the hopped material.

It is a still further object of this invention to provide a gravity feed hopper of the aforementioned type which further includes adjustable means for varying the amount of upward bias provided by said resilient means in accordance with the particularly bulk density value of the hopped material.

It is still another object of this invention to provide a gravity feed hopper of the aforementioned type having increased mechanical life of the mounting components for the agitator assembly.

These and other objects and advantages of this invention will become more apparent in the following specification and claims when read in conjunction with the accompanying drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of a gravity feed hopper

2

incorporating the improved agitator means of this invention;

FIG. 2 is a sectional view of the hopper taken along the irregular line 2—2 in FIG. 1;

FIG. 3 is an enlarged fragmentary view of one of the resilient mounts for the agitator assembly; and

FIG. 4 is a pictorial showing one preferred form of the adjustable dead load compensating means of this invention.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings and particularly to FIG. 1 there is shown a conical gravity feed hopper 2 having outwardly projecting I-beam segments 4 secured thereto at 120 degree intervals and in a common horizontal plane. In one mounting arrangement for the hopper, the I-beam segments 4 bear upon and are secured to the upper ends of cooperatively spaced columns 6 to mount the hopper 2 in the desired location. In another mounting version the upper peripheral flange of the hopper is bolted directly to a corresponding lower flange of a storage bin.

With reference also to FIG. 2 the agitator assembly of this invention includes an agitator screen 8 located at the interior of hopper 2 for direct contact with the material therein and a vibrator assembly 10 on the exterior of the hopper 2. Agitator screen 8 is formed in the shape of a conical segment to closely conform to the contour of hopper 2 and preferably comprises an expanded metal screen having a peripheral frame portion 8a for strength purposes, although a more rigid louvered or grated plate could be used in place of the screen.

Vibrator assembly 10 includes a T-shaped frame 12 fabricated by securing a rigid metal bar across the uppermost end of an upstanding channel member. An outwardly projecting plate or shelf 14 is formed on frame 12 intermediate the ends of the upstanding channel member by welding or otherwise fastening a pair of outwardly projecting side plates 16 to the opposite sides of the channel and similarly fastening the plate 14 across the upper edges of the plates 16 and to the front wall of the channel. A pneumatic vibrator motor 18 is rigidly mounted upon the shelf 14 by bolts 20 to become an integral portion of the vibrator frame 12.

The agitator assembly is resiliently mounted to hopper 2 upon three conical rubber bushings 22 fastened to the hopper wall adjacent openings 24 therein. As best seen in FIGS. 2 and 3, the bushings 22 have flanged base portions 22a clamped against the exterior surface of the hopper wall by bolted plates 26 and extend into the hopper 2 through the openings 24. The agitator screen 8 is positioned against the inner ends of the bushings 22 and is maintained there by carriage bolts 28 which extend through suitable square shaped openings in the frame portion 8a of agitator 8 and through openings formed in the respective ends of bushings 22. A spacer sleeve 30 positioned over the outwardly projecting shank of each bolt 28 supports the T-shaped vibrator frame 12 in spaced relation to the agitator screen 8. The shank portions of carriage bolts 28 extend beyond the ends of spacer sleeves 30 to project through respective openings formed in the T-shaped frame 12 at the outer extremities thereof and thereadably receive nuts 32 and suitable lockwasher means thereon to clamp the frame 12 and the inner ends of bushings 22 against the opposite ends of the spacers 30 to rigidly join the vibrator frame 12 and agitator screen 8 together and resiliently mount the agitator assembly upon the hopper.

The pneumatic vibrator motor 18 is connected to an air supply by means of a hose 34 (FIG. 1). When operated, motor 18 establishes vibrational movement of the

3

agitator assembly in a plane parallel to the wall of hopper 2 wherein the screen 8 continuously disturbs the hopped material along the hopper wall to prevent caking of the material therealong and more specifically, prevent the bridging of the material over the hopper outlet, either of which conditions serve to disrupt the uniform and continuous discharge of material from the hopper. The totally resilient mounting of the agitator assembly enhances the movement thereof and the use of softer, more resilient bushings 22 increases the amplitude of the agitator movement for still greater increases in hopper operation.

The rubber bushings 22 as disclosed herein are mounted in a reverse orientation to the arrangement disclosed in the aforementioned F. L. Thayer et al. patent wherein the bushings were utilized at the ends of the cross bar of the vibrator frame to extend outwardly of the hopper and have their smaller ends attached adjacent the cross bar. As seen in the drawings, the bushings 22 of this disclosure are mounted to extend into the hopper 2 to have the smaller ends thereof attached adjacent the agitator screen 8.

Inasmuch as the rubber bushings 22 serve as the total means of support for the agitator assembly of this invention, the weight of the agitator assembly and the weight of the hopped material exert forces which place the rubber bushings 22 in conditions of stress. Since the agitator assembly is mounted parallel to an oblique wall of hopper 2, the directly downward gravitational forces exerted by the weights upon the assembly are resolved into two component forces thereon, i.e.; a force component directed into the hopper wall at right angles thereto and another force component directed downwardly along the hopper wall parallel thereto. The latter force component represents a shear force on the several bushings and is equally present whether the bushings 22 are mounted to extend into or out of the hopper 2. The first mentioned force component, however, represents a compression force upon the several bushings 22 when mounted as shown herein as opposed to a tension force upon the same bushings if mounted to extend outwardly of the hopper 2. As a result the mechanical life of the bushings 22 is substantially increased when mounted as disclosed herein.

As mentioned hereinbefore, the vibrational amplitude and hence the operation of the agitator assembly are increased through the use of softer, more resilient rubber bushings 22. However, the more resilient are the bushings 22 the less resistance they offer to initial deflection of the assembly due to the forces imposed thereon, particularly the shear forces. In FIG. 3 of the drawings the lowermost bushing 22 is shown in a sagging condition which might occur when the dead load weight of the hopped material and the weight of the agitator assembly becomes too great for the particular bushings. It can be seen that the agitator assembly has been deflected downwardly along the hopper wall to distort the conical shape of rubber bushing 22 and cause the bolt 28 and spacer sleeve 30 associated therewith to be displaced close to the circular outline of the internal base opening of the bushing. It is to be understood that if the vibrator motor 18 were operated with the agitator assembly in this condition the increased amplitude afforded by the greater resiliency in the soft bushings 22 would be negated and limited by engagement of the sleeve 30 with the internal portion of the base 22a of the bushing.

This invention provides a means to compensate for the aforescribed deflection of the agitator assembly without adversely effecting the resilient mounting thereof. Additionally, the compensating means is made adjustable wherein a given set of soft bushings may be employed in a hopper which may be required to handle materials which vary in their particular bulk density.

Referring particularly to FIGS. 2 and 4 of the drawings, the channel member of vibrator frame 12 is provided with a window opening immediately below the shelf 14.

4

A channel member 38, rigidly attached to the exterior hopper wall by any suitable means such as welding, projects through the window 36. A threaded nut 40 is welded to the underside of channel 38 in alignment with a clearance opening provided in the channel and a headed bolt 42 is threaded upwardly therethrough. A platform 44 comprising a disc-shaped spring seat and attached threaded nut is securely threaded upon the upper end of bolt 42 and a jam nut 46 is provided on the bolt 42 at the upper side of the channel 38. A helical compression spring 48 has one end positioned on the spring seat portion of platform 44 and bears at its other end against the underside of shelf 14 on vibrator frame 12.

The coaction of spring 48 between channel 38 and shelf 14 provides an upward bias for the agitator assembly directed along a line parallel to the hopper wall to compensate for the weight forces imposed thereon and particularly to compensate and directly counteract the shear forces imposed thereon. By seating the spring 48 upon an adjustable platform 44, the amount of bias provided by spring 48 may be varied according to the bulk density of the particular material being hopped. To achieve maximum performance, the bolts 28 and spacer sleeves 30 should be centrally disposed within the circular internal outline of the base portions 22a of bushings 22. Accordingly, the platform 44 may be adjusted upwardly or downwardly to vary the working length of the spring 48 and thereby increase or decrease, respectively, the bias of spring 48 upon the frame 12 to respectively raise or lower the agitator assembly and center the bolts 28 and spacer sleeves 30 within the bushings 22. Although the design characteristics for the spring 48 may vary, it is important to the operation of the agitator assembly that the spring not be compressed solid or nearly solid at any time inasmuch as this would adversely effect the resilient mounting of the agitator assembly.

While a single preferred form of practicing the invention is disclosed in the foregoing, alternative methods of providing the resilient upward bias are contemplated within the spirit of the invention. Although not specifically shown in the drawings, the spring means 46 could be a tension spring connected to an adjustable platform on the hopper wall above the vibrator motor 18. The spring concept may further be abandoned in favor of an inflatable bellows, air cylinder or other form of pneumatic cushion located under the vibrator means, regulation of the air pressure therein serving as the adjustment means. It is also contemplated that the upward bias may be applied directly upward if so desired to directly oppose the gravitational weight forces upon the agitator assembly.

I claim:

1. In a fixed hopper having a reduced opening for discharging material therethrough, an agitator assembly for aiding in the flow of material through said reduced opening comprising, in combination:

agitator means within said hopper extending substantially parallel to a wall thereof;  
spaced openings in said wall of said hopper adjacent said agitator means;

vibrator means operable to vibrate said agitator means relative to said hopper and in a plane substantially parallel to said wall, said vibrator means being disposed exteriorly of said hopper;  
connecting means extending through said openings in said wall and firmly interconnecting said agitator means and said vibrator means;

primary supporting means for said interconnected agitator means and vibrator means comprising resilient means secured to said wall over said openings and surrounding the respective connecting means to resiliently support said interconnected agitator means and vibrator means on the wall of said hopper in spaced relation thereto; and

secondary supporting means externally of said hopper biasing said interconnected agitator means and

5

vibrator means to counteract displacement thereof relative to said hopper by the weight thereof and of the material in said hopper.

2. The combination according to claim 1 together with adjustment means for selectively varying the amount of bias provided by said secondary supporting means.

3. The combination according to claim 2 wherein said secondary supporting means acts in an upward direction substantially parallel to said wall of said hopper.

4. The combination according to claim 1 wherein said secondary supporting means comprises spring means.

5. The combination according to claim 4 together with adjustment means for selectively varying the amount of force with which said spring means acts upon said vibrator means.

6. The combination according to claim 5 wherein said adjustment means includes means operable to vary the effective length of said spring means.

7. The combination according to claim 6 wherein said adjustment means are mounted upon the exterior of said wall of said hopper.

8. The combination according to claim 7 wherein said spring means act upon said vibrator means in a direction substantially parallel to said wall to directly oppose and counteract the force component parallel to said wall of the force imposed upon said agitator by the material in said hopper.

9. The combination according to claim 5 wherein said adjustment means comprises a member rigidly affixed to the exterior of said wall and a platform adjustably mounted on said member to selectively vary the height of said platform with respect to said rigid member, and wherein said spring means coacts between said platform and said vibrator means.

10. The combination according to claim 9 wherein

6

said spring means acts upon said vibrator means along a line substantially parallel with said wall, said spring means directly opposing and counteracting the shear force imposed upon said agitator and imparted thereby to the resilient supporting means by the material in said hopper.

11. The combination according to claim 10 wherein said adjustment means further includes screw means mounted to said rigid member and connected to said platform, said screw means being rotatable with respect to said rigid member to effect movement of said platform along a line parallel to said wall.

12. The combination according to claim 11 wherein said resilient means comprise conical rubber bushings having the bases thereof attached to said wall and having the opposite ends thereof extending into said hopper to engage said connecting means at points adjacent said agitator means.

13. The combination according to claim 12 wherein said bushings are hollow, said spring means being adjusted to substantially center said connecting means within the interior base outlines of the respective bushings.

#### References Cited

##### UNITED STATES PATENTS

|           |        |               |           |
|-----------|--------|---------------|-----------|
| 2,905,365 | 9/1959 | Thayer        | 222—198   |
| 320,054   | 6/1885 | Downie et al. | 222—196   |
| 3,173,583 | 3/1965 | Wahl          | 222—200 X |

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