Oct. 29, 1968 R. K. McKIBBEN 3,407,542

AUTOMATIC UNLOADER FOR FINISHING MILLS

Filed June 29, 1964 2 Sheets-Sheet 1

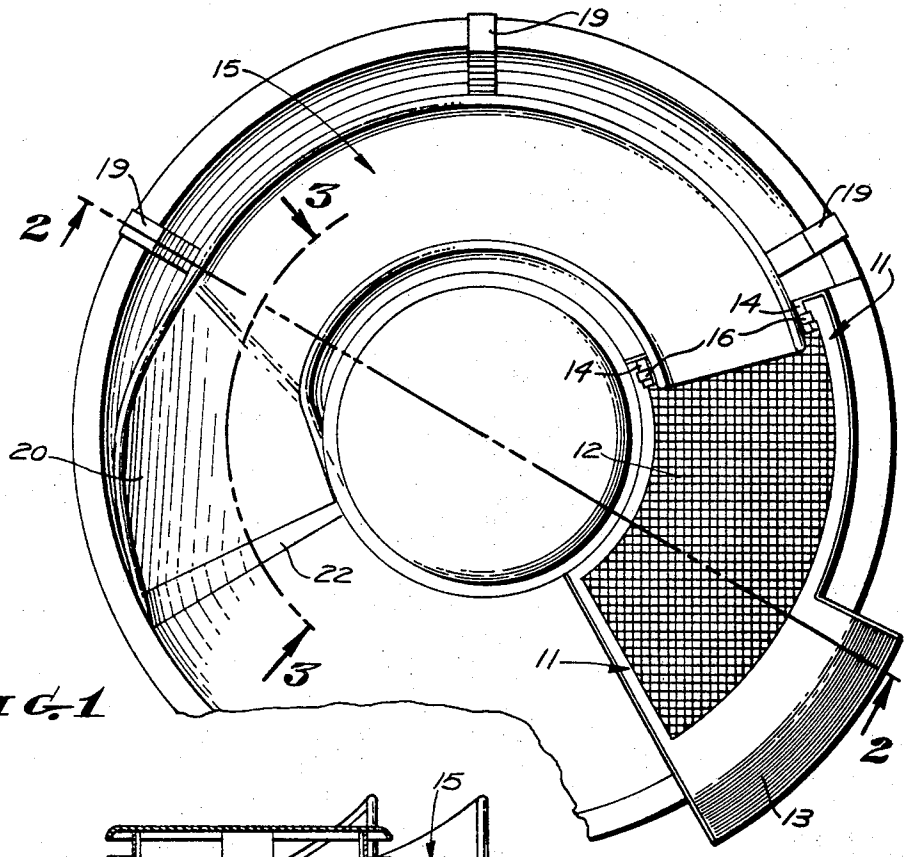


FIG. 1

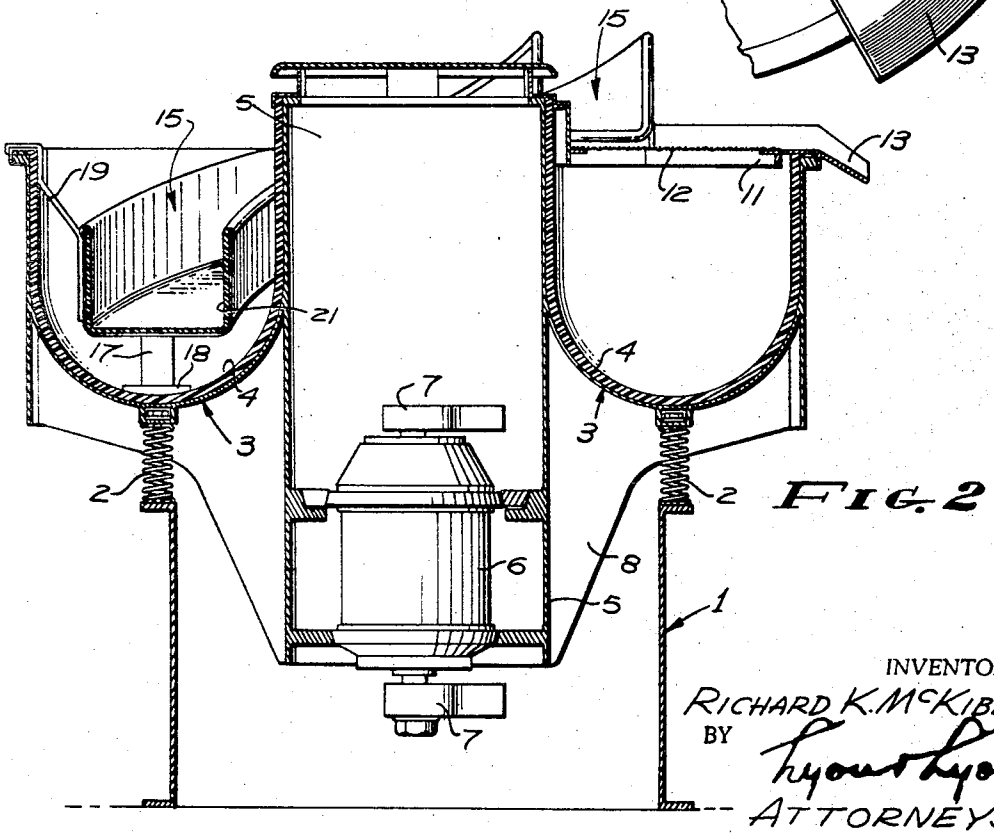


FIG. 2

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AUTOMATIC UNLOADER FOR FINISHING MILLS

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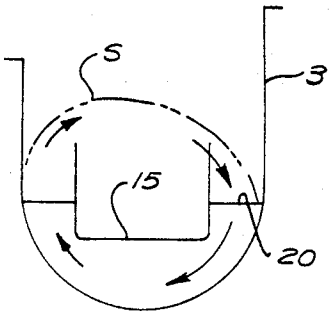


FIG. 4

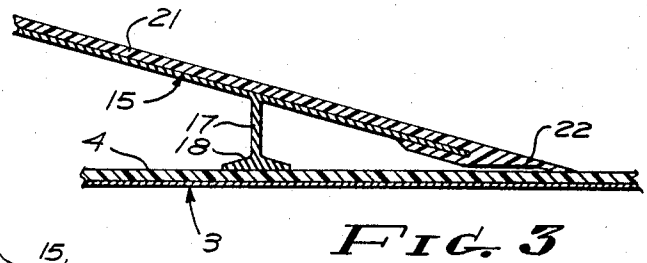


FIG. 3

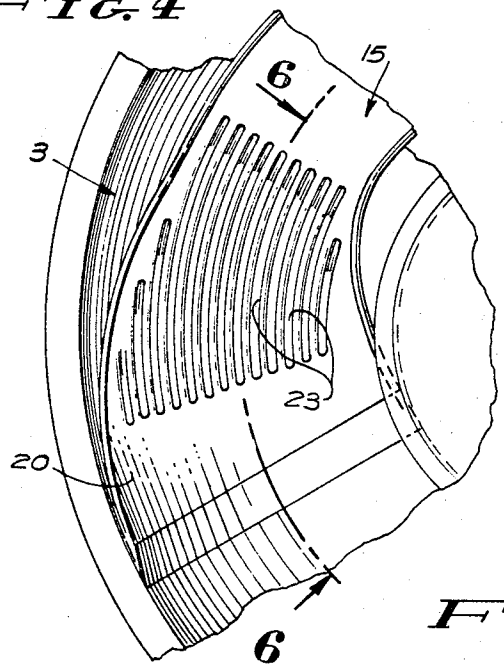


FIG. 5

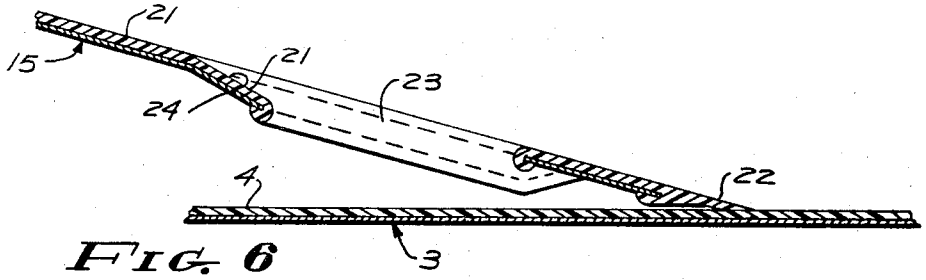


FIG. 6

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United States Patent Office 3,407,542 Patented Oct. 29, 1968

3,407,542

AUTOMATIC UNLOADER FOR FINISHING MILLS

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Filed June 29, 1964, Ser. No. 378,644
8 Claims. (Cl. 51—163)

This invention relates to an automatic unloader for finishing mills, and included in the objects of this invention are:

First, to provide an automatic unloader which is particularly adapted for use in conjunction with vibratory finishing mills of the type disclosed in Patent No. 3,100,-088, issued Aug. 6, 1963, to Henry Leveson Podmore, wherein the finishing mill is toroidal in plan and open at its upper side.

Second, to provide an automatic unloader for finishing mills which includes a separator screen and discharge chute fixed on the mill, and a ramp structure so arranged that it may be quickly placed in the mill when the finishing operation is completed in order that the workpieces and a portion of the finishing media may be elevated to the separator screen and the workpieces discharged, whereupon the ramp structure may be removed for the next operation of the mill.

Third, to provide an automatic unloader for finishing mills wherein a single ramp structure may be employed with a battery of finishing mills.

With the above and other objects in view, as may appear hereinafter, reference is directed to the accompanying drawings in which:

FIGURE 1 is a fragmentary plan view of a finishing mill with the unloader shown in place;

FIGURE 2 is a transverse sectional view taken substantially through 2—2 of FIG. 1;

FIGURE 3 is a fragmentary sectional view taken substantially through 3—3 of FIG. 1;

FIGURE 4 is a diagrammatical fragmentary transverse sectional view to illustrate the mode of operation of the unloader;

FIGURE 5 is a fragmentary plan view showing the receiving end of a modifier form of the unloader;

FIGURE 6 is a fragmentary sectional view taken through 6—6 of FIG. 5.

The type of finishing mill for which the unloader is especially adapted includes a cylindrical mounting base 1 which supports a ring of springs 2. Supported on the springs 2 is an annular or semi-toroidal container 3 having a lining 4 formed of a suitable tough and wear-resistant elastomer. Formed within the container is a central tube 5 which projects below the container and mouned in its lower portion is a motor 6 having eccentric weights 7 within its upper and lower extremities. The depending portion of the central tube and the container 3 is joined and reinforced by radial ribs 8. This type of mill is more fully disclosed in the aforementioned patent.

When the finishing mill is in operation, the motor and eccentric weights cause the container to vibrate in high frequency and relatively low amplitude. The vibratory forces are such that finishing media containing workpieces are caused to churn in the direction of the arrows shown in FIG. 4 and also to follow a spiral path so as to circulate in a clockwise direction, as viewed in FIG. 1. The upper surface defined by the media and the workpieces contained therein corresponds essentially to the broken line S shown in FIG. 4. The nature of the media varies greatly, depending upon the size and other properties of the workpieces. Quite often, the media include a liquid or a liquid and a detergent as well as particles of appropriate size.

Heretofore, it has been customary to fill the finishing

mill with a charge of appropriate media and a proportionate quantity of workpieces. The finishing mill is then operated for a predetermined length of time whereupon the media and workpieces are removed by bodily tilting the finishing mill or an appropriate opening is sometimes provided in the bottom of the mill and normally closed by a plug conforming to the interior surface of the container. In both cases, the media as well as the workpieces are removed from the mill and then must be separated from each other by other means. This involves a substantial handling problem.

In the exercise of the present invention, a segmental frame 11 bridges between the radically outer and radially inner walls of the container 3 and is covered by a separator screen 12. At its radially outer side, the frame 11 is provided with a discharge chute 13. At one circumferential end the frame 11 is provided with a pair of radially-spaced mounting bosses 14.

An arcuate ramp 15 is channel shaped in cross section. One end of the ramp is provided with radially-disposed supporting pins 16 which fit in recesses provided in the mounting bossess 14 so that the pins may rest in the mounting bosses and permit limited pivotal movement of the ramp 15. The underside of the ramp is provided with one or more struts 17 terminating in feet 18 which conform to and rest on the bottom of the container 3. The struts are preferably relatively flat and are oriented so as to afford minimum resistance to the spiral flow of the media and workpieces.

Attached to the radially outer side of the ramp 15 are several centering straps 19 which fit over the outer periphery of the container 3 and have portions which bear against the outer wall of the container.

The lower end of the ramp 15 is enlarged to form a flared receiving end 20 conforming to the curvature of the container 3. The bottom and inner sides of the ramp 15 are provided with a lining 21 formed of a wear-resistant, tough elastomer similar to that used in the container 3. The lining also covers the flared receiving end 20 and extends forwardly therefrom to form a flexible lip 22.

Operation of the unloader is as follows.

During the operation of the mill, the ramp 15 is removed from the container so that the finishing operation may take place without interference. On completion of the finishing operation, the arcuate ramp is placed in the container. While the mill may be stopped momentarily for this purpose, it is possible to install the ramp while the mill is in operation. Due to the vibration of the mill, the feet 18 and struts 17 as well as the ramp itself settle quickly until the feet 18 rest on the bottom of the container 3. The finishing media and the workpieces are caused, by the vibration produced by the motor and eccentric weights, to progress up the ramp and onto the separator screen 12. The workpieces discharge from the chute 13 while the media return to the container through the screen.

Inasmuch as the ramp is necessarily smaller than the container, it is desirable that only a predetermined portion of the contents move at any one time up the ramp. Preferably, the transverse section of the ramp is about one-half the transverse section of the charge of media and workpieces, as suggested diagrammatically in FIG. 4. Consequently, excess media and workpieces spill over the receiving end of the ramp, progress around the container, and again enter the ramp. With each circular travel, additional workpieces are removed.

The ramp is left in place until it appears, from the lack of workpieces discharging from the chute, that substantially all of the workpieces have been removed, whereupon the ramp is lifted free of the milling machine and the next charge of workpieces is added to the media.

It should be noted that in most cases it is undesirable

that the workpieces themselves strike each other. In a normal course of a finishing operation, the volume of media minimizes or cushions mutual engagement of the workpieces. Also, it is desirable that a substantial volume of the media be carried up the ramp so that mutual impact of the workpieces is minimized. Once the workpieces enter upon the screen **12**, they tend to be separated from each other and mutually engage only as they tumble into a container or conveyor placed under the discharge chute **13**.

Reference is now directed to FIGS. 5 and 6. In some instances, it is desirable to effect a partial separation of the media and workpieces in the bottom of the chute. This is accomplished by means of slots **23**, the walls of which are provided with a yieldable lining **21**. At the extremities of the slots toward which the end media and workpieces move, deflectors **24** are provided to raise projecting portions of the workpieces onto the bottom of the ramp **15**.

While the mill has been designated a "finishing" mill, it should be understood that the term is intended to include a "deburring" or "polishing" mill as well as other mills containing workpieces and media which are subjected to vibrating action.

Also, while the separator screen is shown as secured to the mill, it may be secured to the ramp and be removable therewith.

While a particular embodiment of this invention has been shown and described, it is not intended to limit the same to the exact details of the construction set forth, and it embraces such changes, modification, and equivalents of the parts and their formation and arrangement as come within the purview of the appended claims.

What is claimed is:

1. The combination with an annular finishing mill adapted to contain a charge of treating media and workpieces surrounded thereby, and means for vibrating said mill to cause the media and workpieces to progress in spiral path defining, essentially, a toroid, of an unloader, comprising:

(a) a separator screen covering a segment of said mill;

(b) a discharge chute leading from said screen;

(c) and a ramp extending arcuately from the bottom of said mill to said separator screen to carry said charge to said screen for discharge of said workpieces and return of said media to said mill.

2. The combination with an annular finishing mill adapted to contain a charge of treating media and workpieces surrounded thereby, and means for vibrating said mill to cause the media and workpieces to progress in spiral path defining, essentially, a toroid, of an unloader, comprising:

(a) a separator screen covering a segment of said mill;

(b) a discharge chute leading from said screen;

(c) and a ramp including an enlarged entrance end conforming to the bottom portion of said mill, and extending helically and arcuately upwardly therefrom to said separator screen to discharge said workpieces from said chute.

3. An unloader as set forth in claim **2**, wherein:

(a) the entrance end of said ramp is dimensioned to capture a predetermined proportion of the media and workpieces permitting the remainder to recirculate around said mill for recapture.

4. An unloader as set forth in claim **2**, wherein:

(a) the entrance end of said ramp is provided with a plurality of longitudinal slots for bypassing a portion of the media.

5. The combination with an annular finishing mill adapted to contain a charge of treating media and workpieces surrounded thereby, and means for vibrating said mill to cause the media and workpieces to progress in spiral path defining, essentially, a toroid, of an unloader, comprising:

(a) a removable ramp in the form of a helical arc and partially submergible in said charge of media and workpieces on vibration of said mill to form an entrance end below said charge and a discharge end above said charge;

(b) and a separator at the discharge end of said ramp for diverting said workpieces from said mill and returning said media to said mill.

6. The combination with an annular finishing mill adapted to contain a charge of treating media and workpieces surrounded thereby, and means for vibrating said mill to cause the media and workpieces to progress in spiral path defining, essentially, a toroid, of an unloader, comprising:

(a) a removable ramp of channel cross section and in the form of a helical arc, said ramp including an entrance end, a discharge end, and feet disposed between said ends to support said ramp on the bottom of said mill, said feet and entrance end being submergible in said charge on vibration of said mill;

(b) and a separator at the discharge end of said ramp for diverting said workpieces from said mill and for returning said media to said mill.

7. An unloader as set forth in claim **6**, wherein:

(a) said entrance end is enlarged and includes a flexible lip conforming to the transverse contour of said mill.

8. An unloader as set forth in claim **6**, wherein:

(a) said entrance end is enlarged and conforms to the transverse contour of said mill, at its extremity, and said entrance end is provided with bars for passage of said workpieces into said ramp, and slots therebetween for return of media to said mill.

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