

[54] HOIST PANS AND HOIST PAN HANDLING APPARATUS

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[22] Filed: Nov. 15, 1973

[21] Appl. No.: 415,990

Related U.S. Application Data

[62] Division of Ser. No. 206,568, Dec. 9, 1971, Pat. No. 3,791,539, which is a division of Ser. No. 825,862, May 19, 1969, Pat. No. 3,697,006.

[52] U.S. Cl. 214/17 C; 294/69 R

[51] Int. Cl. B65g 65/32

[58] Field of Search 214/17 C, 741; 294/69 R, 294/69 A, 70, 71

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Primary Examiner—Robert G. Sheridan
Attorney, Agent, or Firm—Lyon & Lyon

[57] ABSTRACT

A material handling system for vibratory finishing or grinding mills into which are placed materials and abrasive media and wherein the materials are operated upon. In a finishing mill the materials are parts which are finished, polished, or deburred, and in a grinding mill the materials usually are chemicals which are reduced in size. The system includes a vibratory mill into which such materials and media are placed, a vibratory screen separator for separating the materials from media after completion of the operation thereon, a hoist pan for handling the media or material and media, and a jib hoist system for moving and positioning the pan. Media or material and media are loaded into the pan, and same is lowered to the top of the finishing machine causing the load to be evenly dumped into the finishing machine. After the finishing operation, the material may be moved or transported in any suitable manner to any further operation stage, and the media is returned to the hoist pan. A pan driving mechanism is provided for rotating the pan as the media is supplied thereto from the separator or mill such that the pan is evenly loaded. Several bottom-dumping pan configurations are disclosed which provide a relatively even discharge of the media into the mill when the pan engages the mill.

4 Claims, 28 Drawing Figures

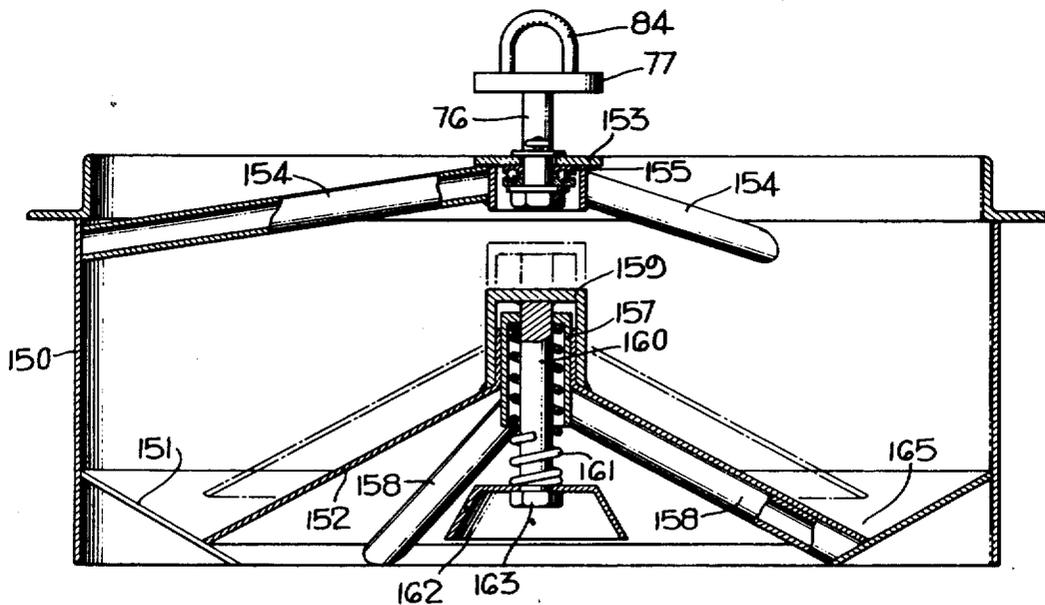


FIG. 1.

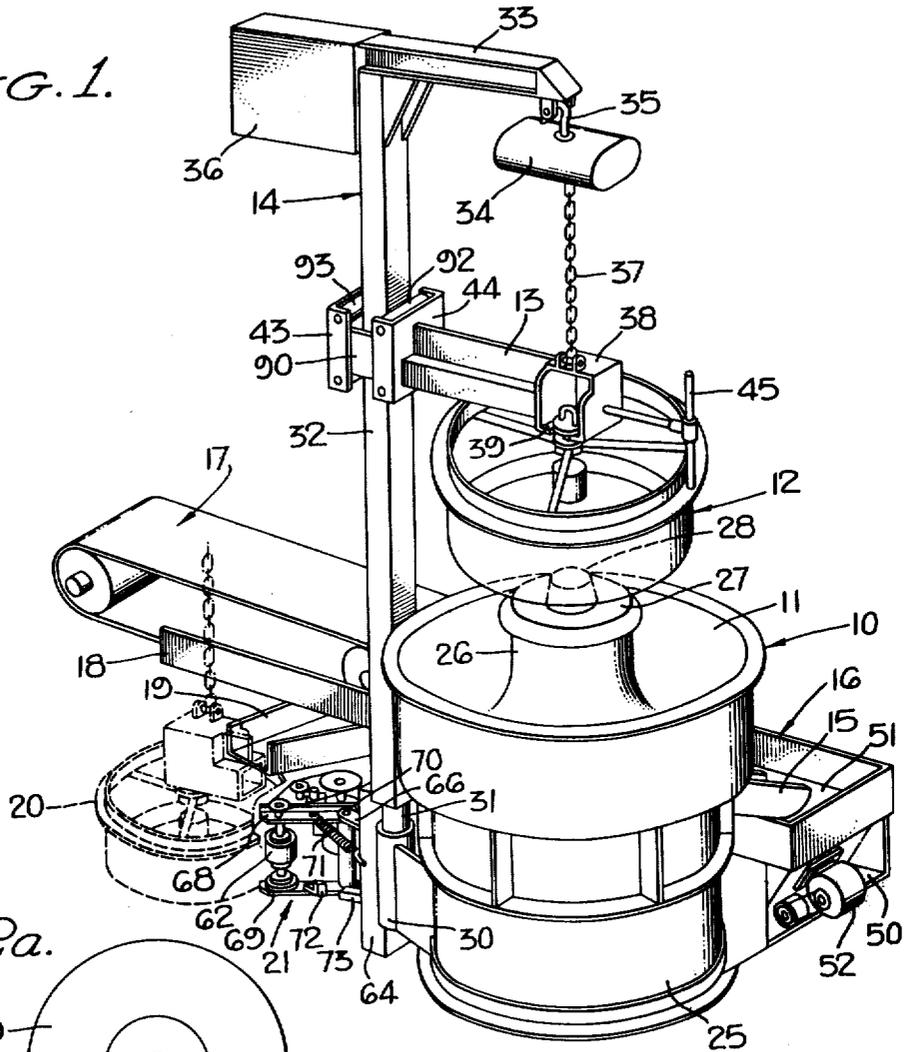


FIG. 2a.

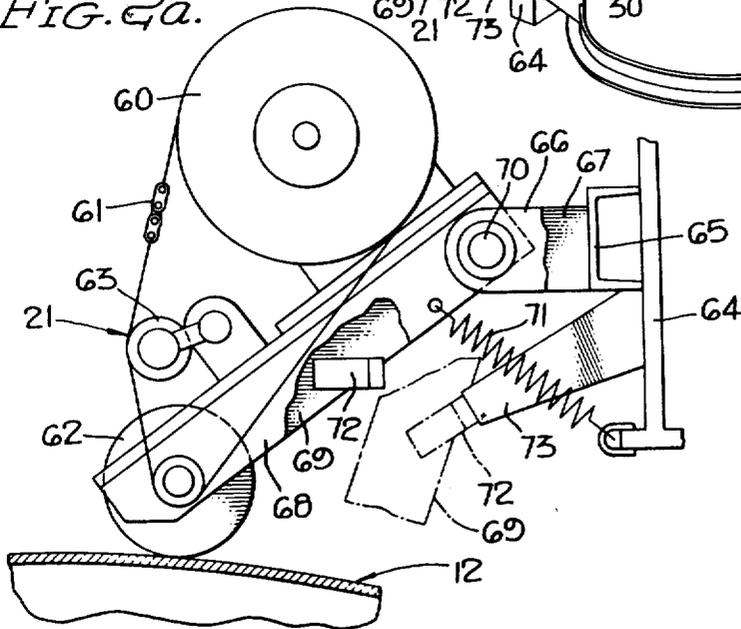


FIG. 2b.

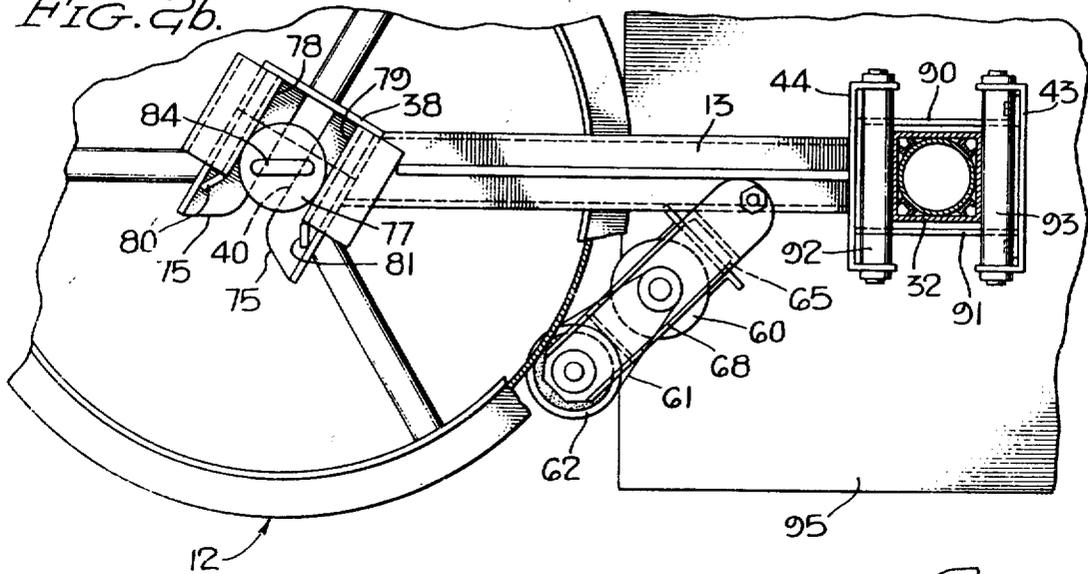


FIG. 2c.

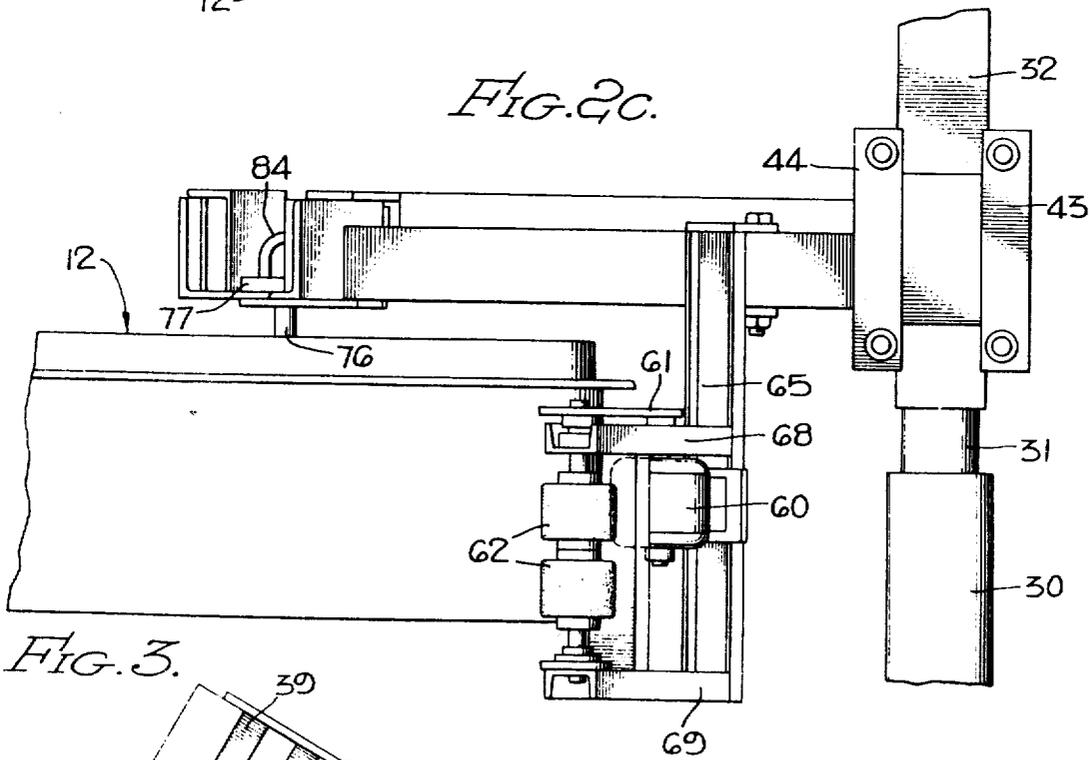
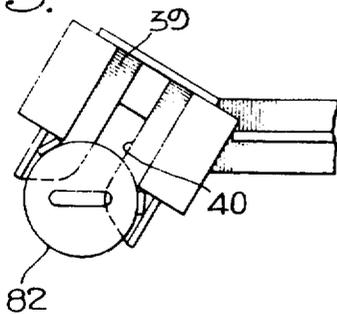


FIG. 3.



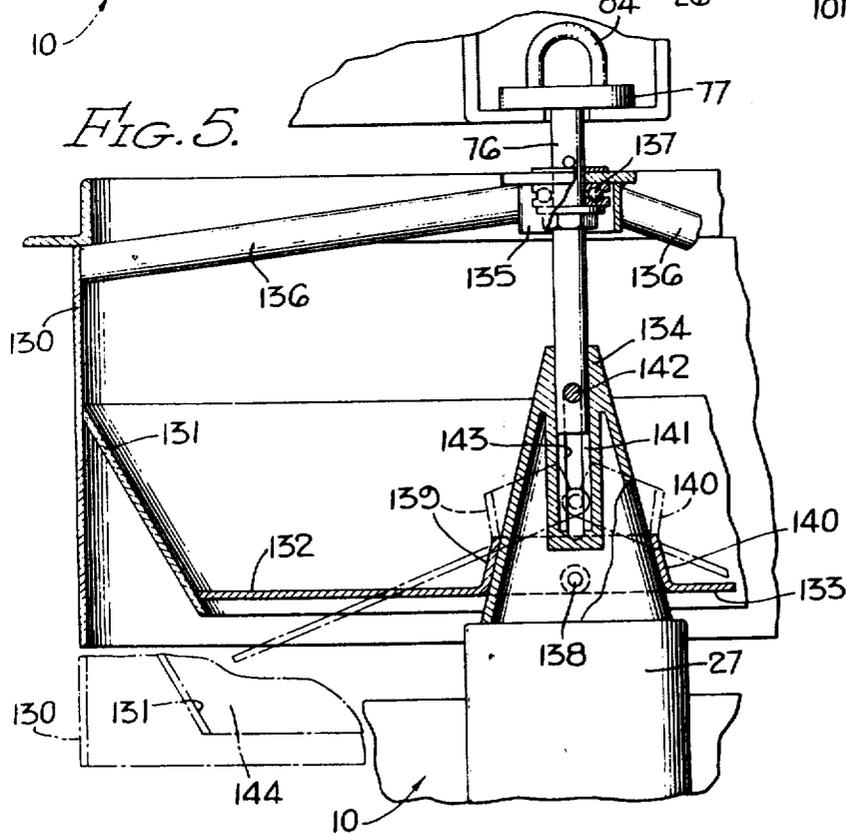
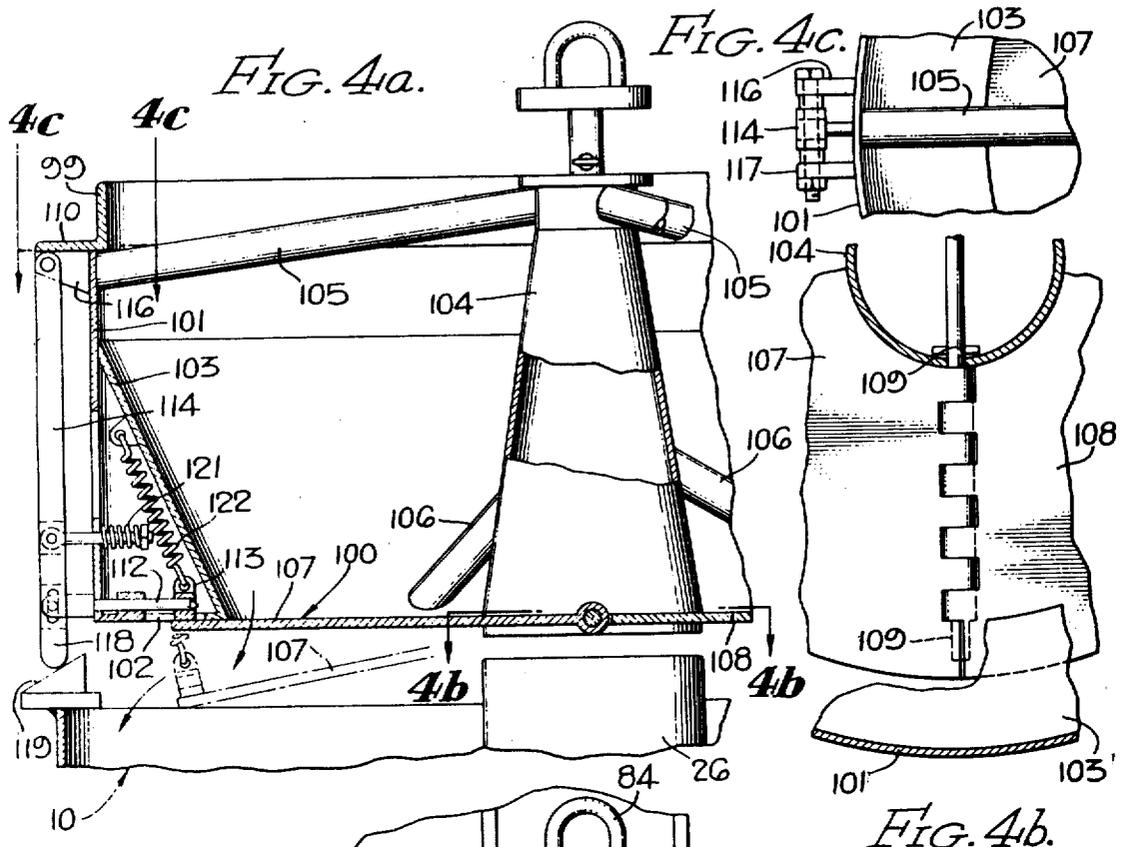


Fig. 6a.

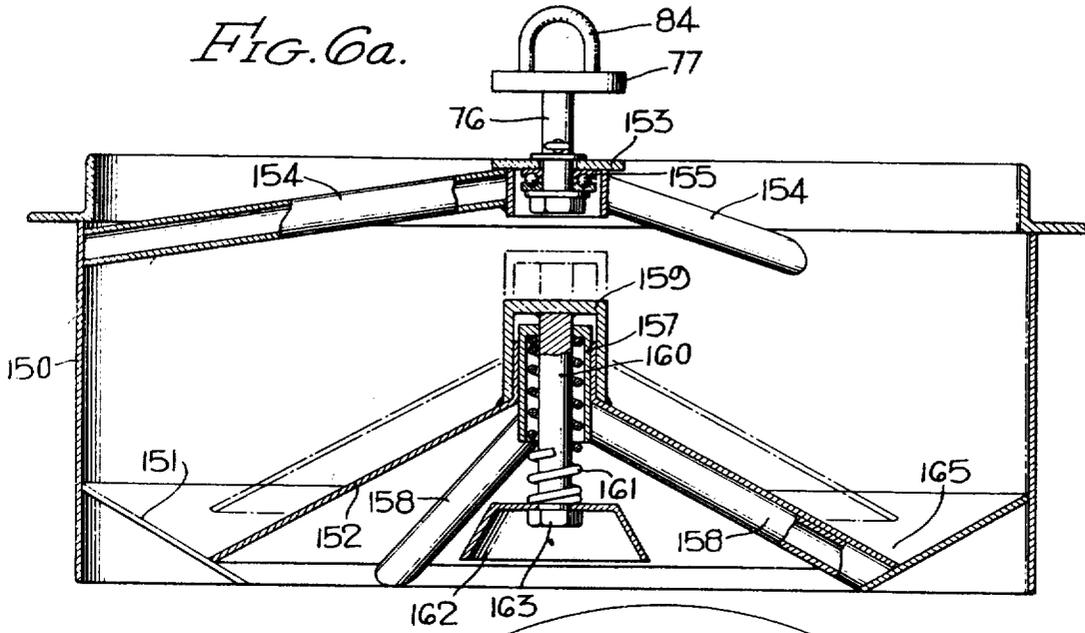


Fig. 6b.

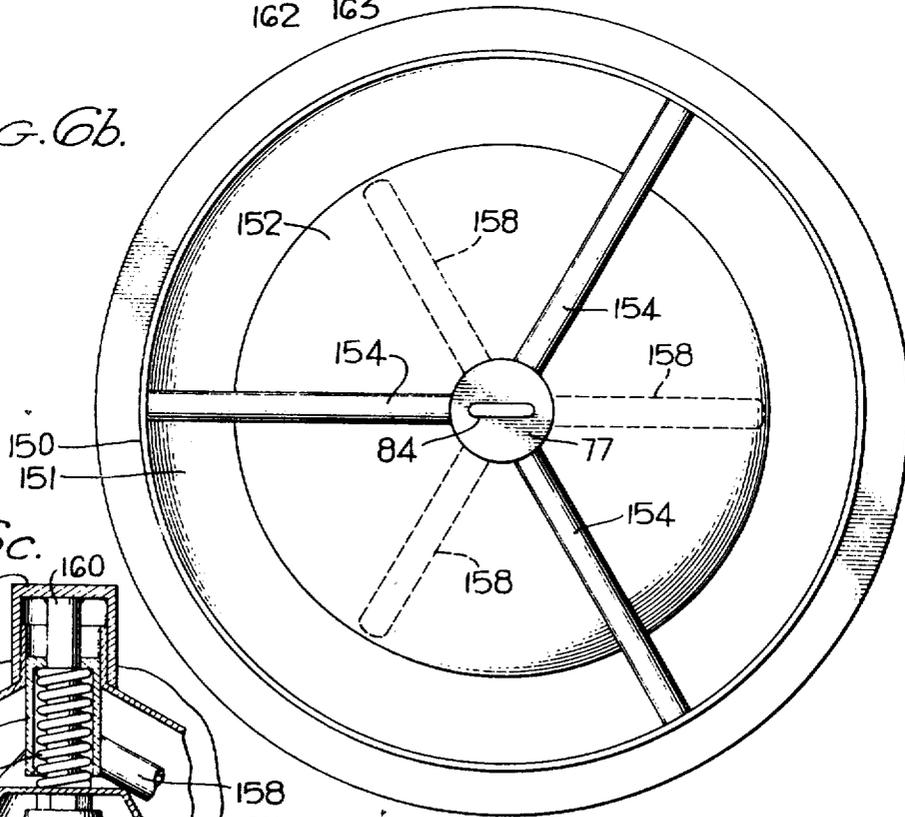
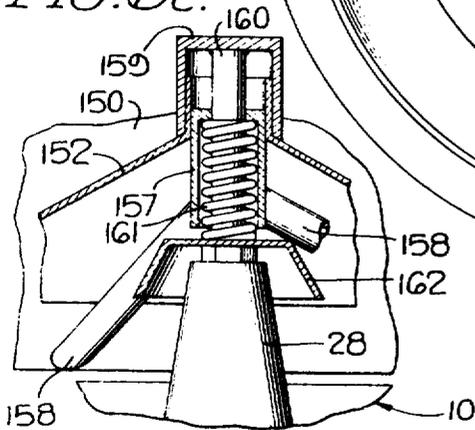


Fig. 6c.



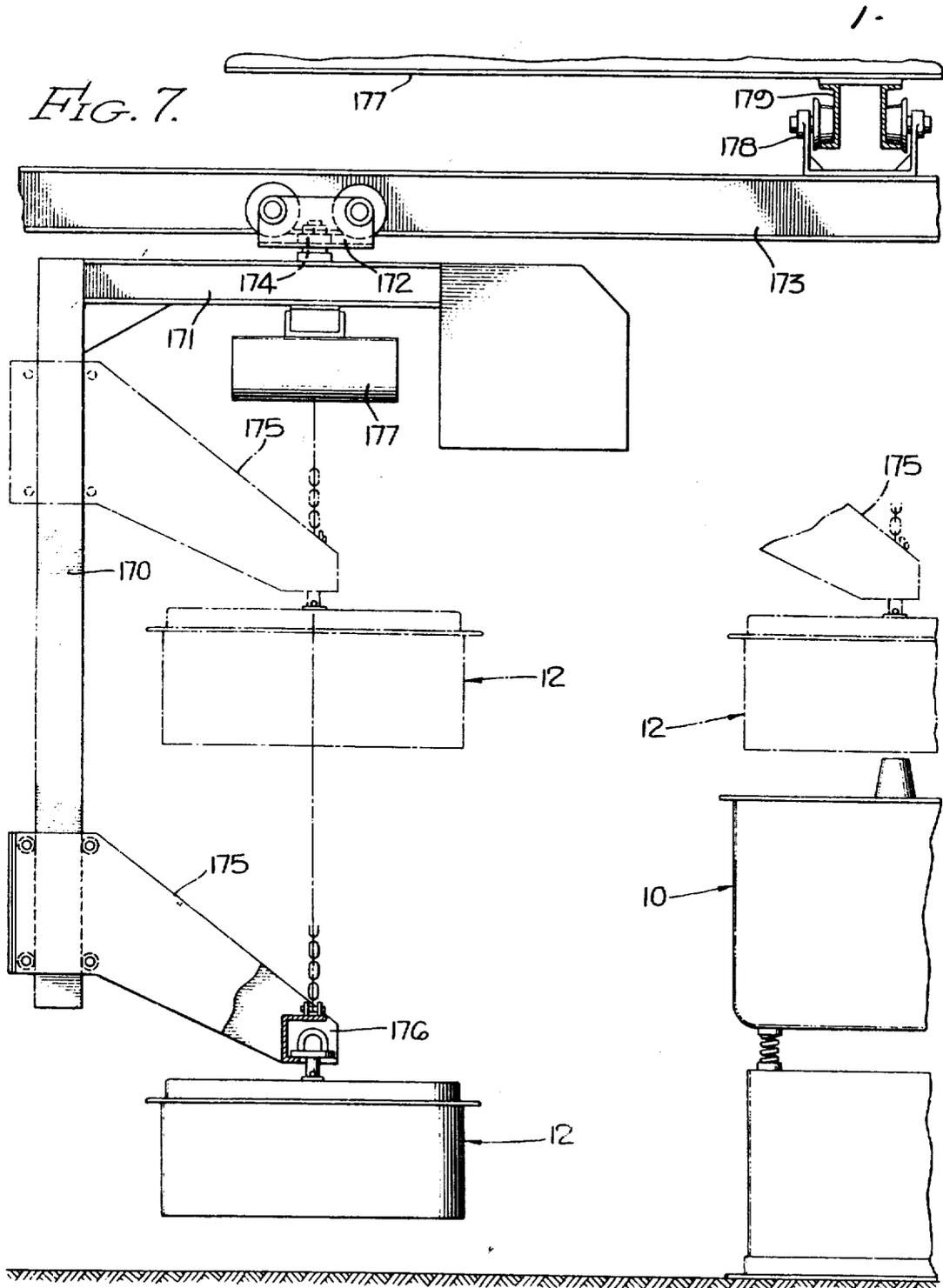


FIG. 8a.

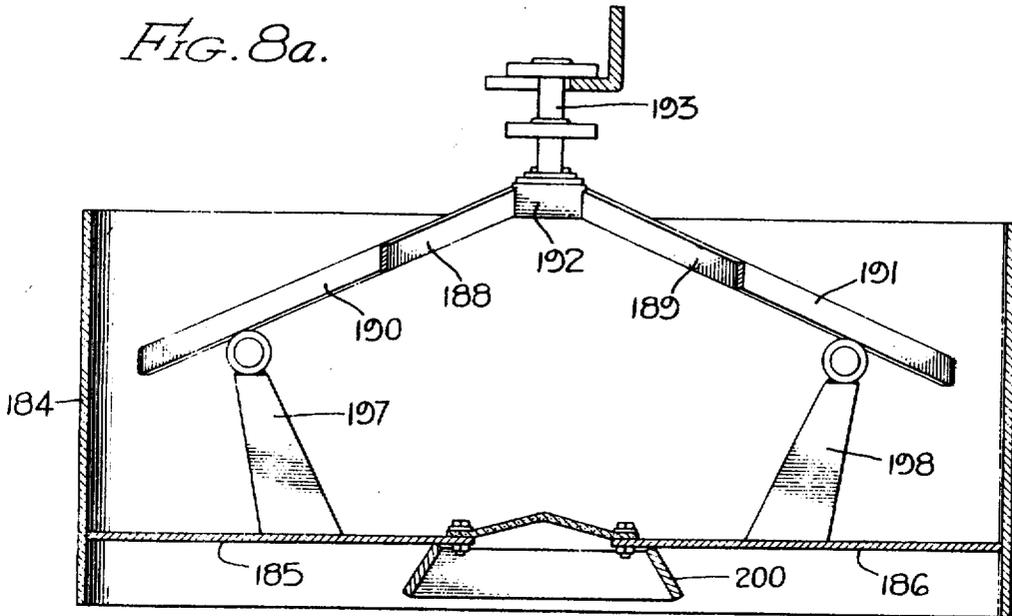
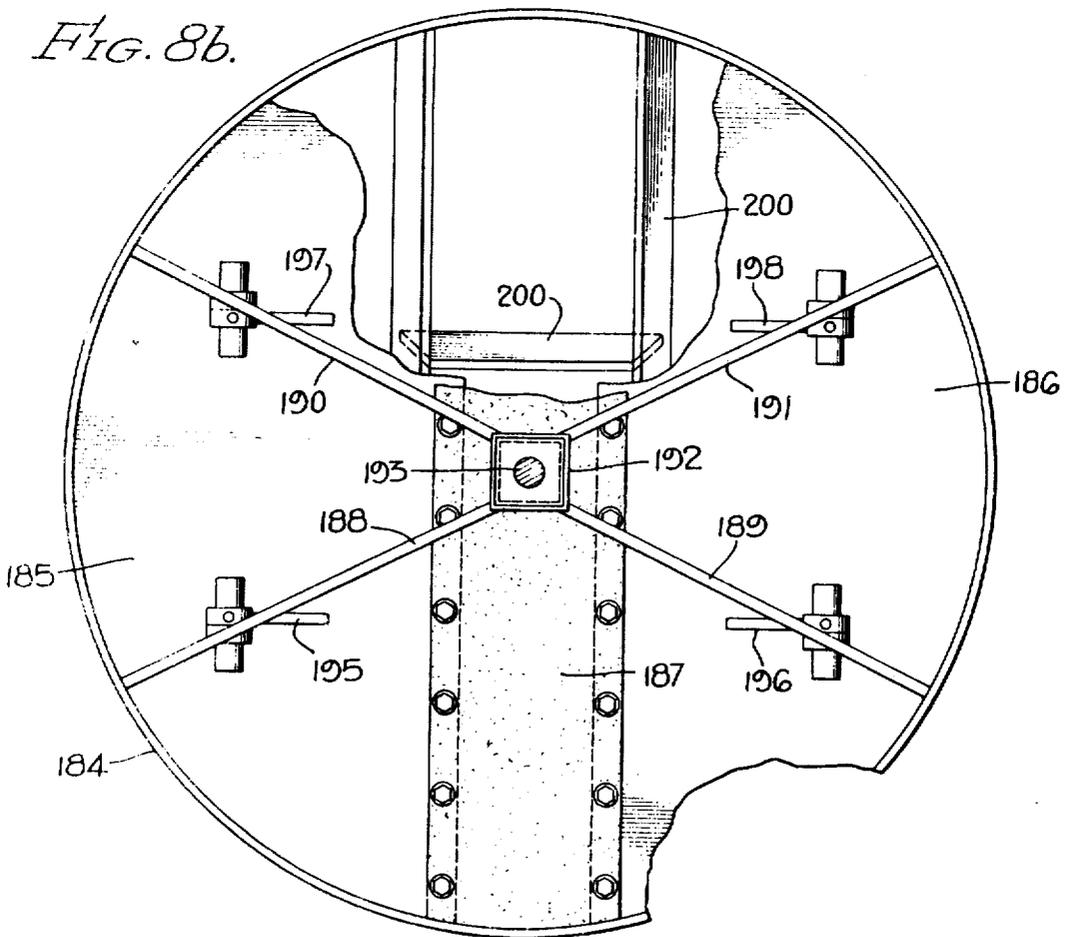


FIG. 8b.



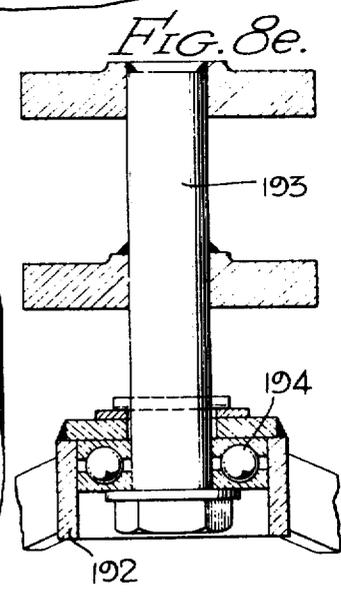
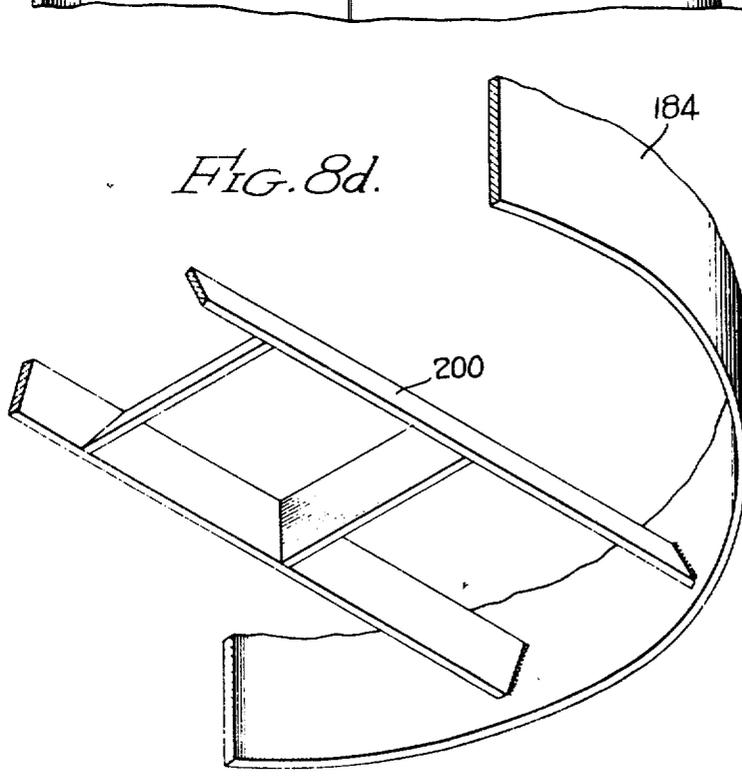
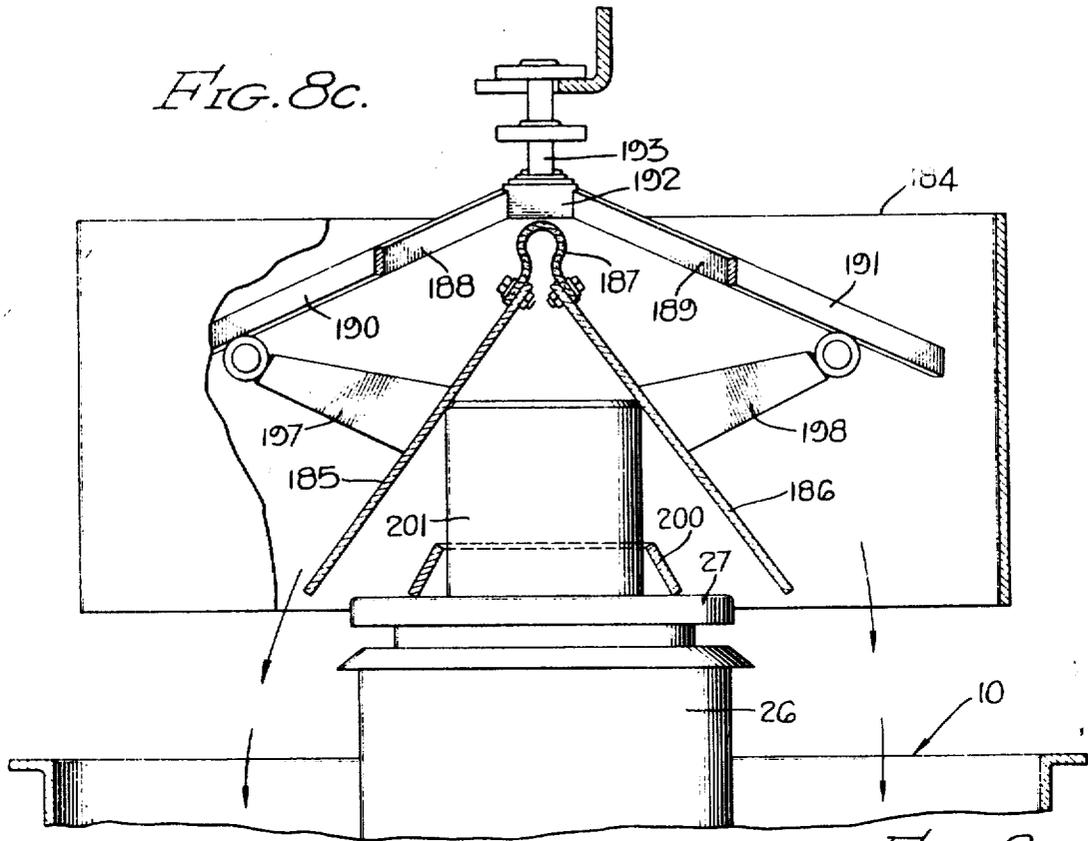


FIG. 9a.

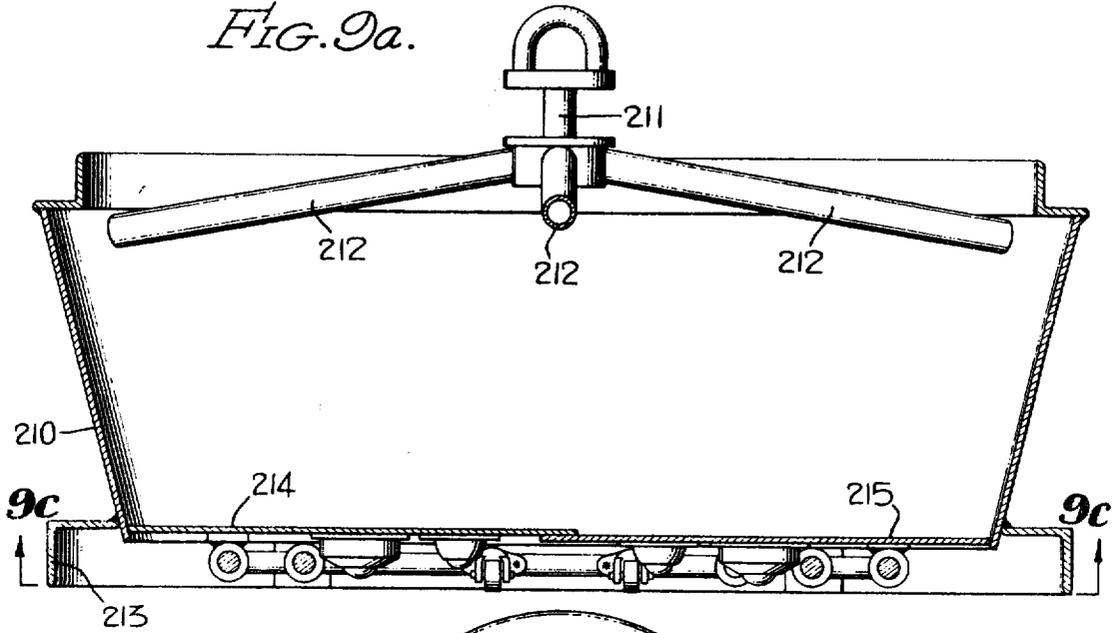


FIG. 9b.

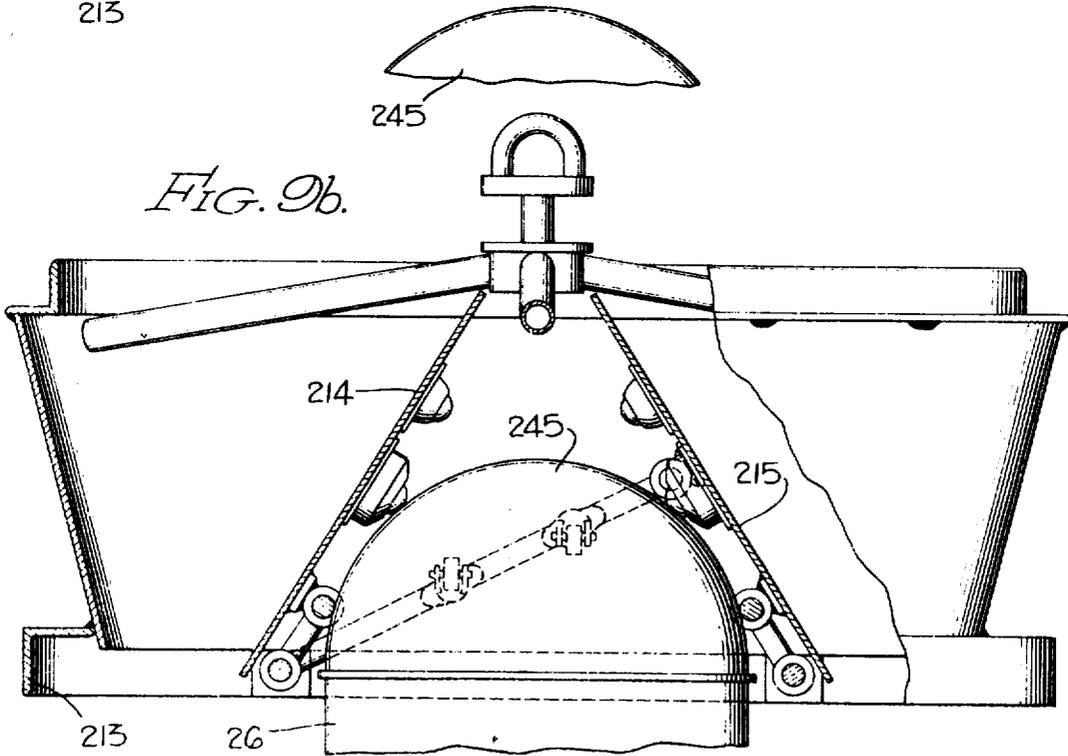


FIG. 10a.

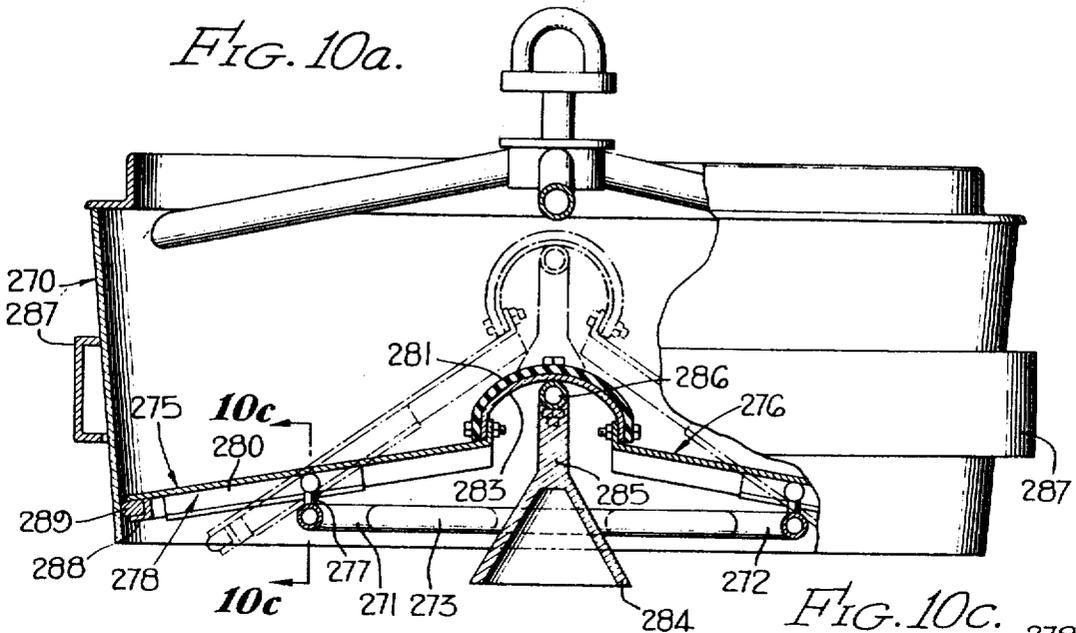


FIG. 10b.

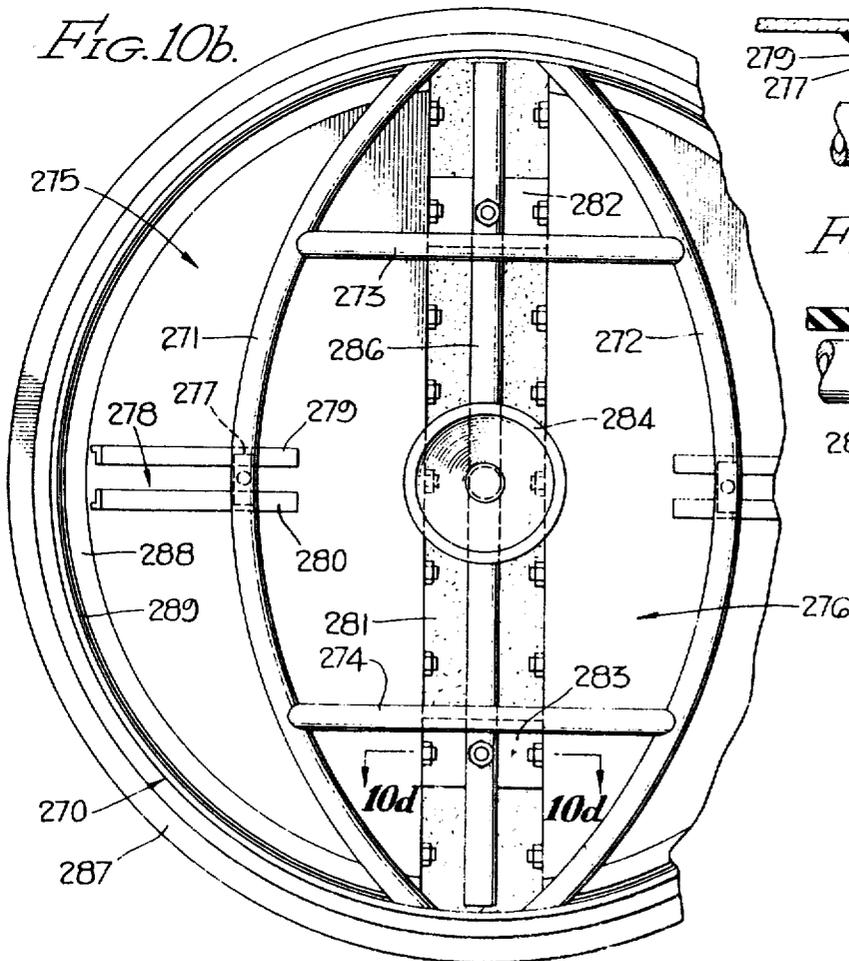


FIG. 10c.

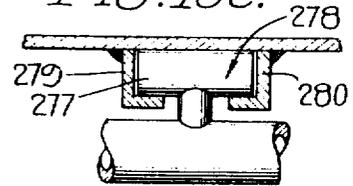
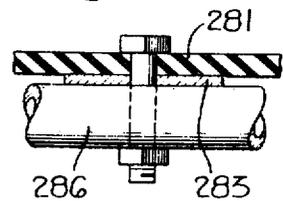


FIG. 10d.



HOIST PANS AND HOIST PAN HANDLING APPARATUS

This is a division of application Ser. No. 206,568, now U.S. Pat. No. 3,791,539 filed 12/9/71, which is a division of application, Ser. No. 825,862 filed 5/19/69, now U.S. Pat. No. 3,697,006.

The present invention relates to vibratory mills and a material handling system therefor, and relates more particularly to hoist pan constructions for use in such systems and structures for handling such hoist pans.

Although applicable to both finishing and grinding mills, the concepts of the present invention will be described with reference to finishing mills. Various types of finishing mills have been in use for a number of years for finishing, polishing and deburring. An example of the construction of a mill of this type is disclosed in Podmore et al. U.S. Pat. No. 3,100,088. This type of mill includes an annular bowl into which is loaded parts and abrasive media. Examples of such parts are casting of metal, plastic parts, and so forth. The mill may include a source of vibratory energy such as that described in Meinzer U.S. Pat. No. 2,284,671.

Conventionally, the media or parts and media are loaded into the mill manually. This has been accomplished through the use of a rectangular media receptacle having an opening at one end and suspended from an overhead hoist. Usually, two men, one holding the front end of the receptacle down while the other pushes the rear end of the receptacle up are necessary in order to redistribute the media load in the pan from carrying to a pouring position. The mill operator must be present in order to load the media into the mill, and the load media into the receptacle so as to properly distribute the media load in the receptacle to prevent uneven distribution thereof. It will be readily apparent that there are a number of disadvantages to media handling in this manner, not the least of which is the lack of ability to automate the operational steps required, and the complete reliance upon the adeptness of the men involved. Also, media generally is handled by bucket conveyors from which it is difficult to remove all media when it is desired to change to a different media. Consequently, undesirable mixing of different media can occur.

Although a round pan can be provided for evenly dumping the material into the vibratory mill, it is difficult to position the pan inasmuch as it tends to sway as the material is being dumped into the mill. Furthermore, it is desired that the pan have the necessary capacity while being as small as possible and also be able to efficiently dump the load of material into the mill.

Accordingly, it is a principal object of this invention to provide a new stabilizer arm arrangement for the hoist pan in a material handling system for vibratory mills.

Another object of this invention is to provide a jib hoist system, either self contained or mounted from a bridge crane, and which includes a stabilizing arm and supporting arrangement for positively securing and enabling accurate positioning of a hoist pan in a material handling system for vibratory mills.

A further important object of this invention is to provide new and novel hoist pans for use in a material handling system for vibratory mills.

A further object of this invention is to provide hoist pans for use in a material handling system for vibratory

mills, and which can easily be operated to efficiently dump material evenly into the mill.

These and other objects and features of this invention will become better understood through a consideration of the following description taken in conjunction with the drawings in which:

FIG. 1 is a perspective view of a material handling system for vibratory mills according to the present invention;

FIG. 2a is a simplified plan view of a drive arrangement for the round hoist pan used in the system of FIG. 1;

FIGS. 2b and 2c respectively are plan and elevational views of the pan and drive system;

FIG. 3 is a fragmentary view of an end of a stabilizer arm for supporting the hoist pan;

FIGS. 4a through 4c illustrate in more detail an embodiment of a round hoist pan having an opening bottom for dumping material into the vibratory mill;

FIG. 5 is a partial view of another embodiment of a round hoist pan;

FIGS. 6a through 6c illustrate a further round hoist pan embodiment,

FIG. 7 illustrates a monorail and bridge crane for the jib hoist system;

FIGS. 8a through 8c illustrate another and preferred embodiment of a round hoist pan;

FIGS. 9a through 9f illustrate another preferred embodiment of a round hoist pan; and

FIGS. 10a through 10d illustrate another preferred embodiment of a round hoist pan.

Turning now to the drawings, FIG. 1 illustrates a media handling system for vibratory mills incorporating the concepts of the present invention, and includes a vibratory finishing mill 10 of conventional construction having a toroidal chamber 11 into which parts and abrasive media are placed and vibrated such that the parts are finished, polished, deburred, and so forth. This mill may be, for example, a Model FM-10 mill manufactured by SWECO, Inc., of Los Angeles, Calif. The abrasive media or, parts and media if desired, is handled by a round hoist pan 12 which is supported, moved and positioned by a stabilizer arm 13 of a jib hoist or bridge crane system 14. The pan 12 is moved and centered above the machine 10 to dump the load within the pan into the bowl 11. After the finishing operation is completed, the parts and media are discharged through a chute 15 onto a vibrating screen separator 16 to separate the parts from the media. If the parts are of a metal susceptible to magnetic attraction, a moving belt magnetic separator 17 may be used to retrieve the parts rather than allowing them to discharge from an end 18 of the separator 16. The separator 16 includes a media discharge chute 19 for allowing the media to be returned to the pan 12 when it is moved to the dotted line position 20 as seen in FIG. 1. Alternatively a mill having its own separating means may be used without requiring the use of a separate separator 16.

As will be described subsequently, a drive system 21 is provided to rotate pan 12 when it is in the position 20 during discharge of the media from the chute 19 to evenly distribute the media in the pan. Rotation of the pan during loading thereof causes the material fed thereto to be evenly distributed therein. Uneven distribution of material would cause the pan to hang unbalanced and create difficulty in transporting, positioning

and dumping the pan, and discharge of material into the mill would be uneven. The drive system may be a friction drive such as a type employing a rubber surfaced wheel, but preferably is a magnetic drive system as described subsequently.

The separator 16 preferably includes different mesh screens such that reusable media can be separated from broken or chipped media, the latter being discharged through a chute (not shown). After the pan 12 has been reloaded with media from the separator 16, it may be suitable stored on the floor, in a rack, stacked with other pans, or again discharged into the mill 10 with a new load of parts. Additionally, the reloaded pan may be discharged into another mill of the nature of the mill 10 by the jib hoist system 14, or by another hoist system such as a bridge crane system. Another pan with a different size or type media may be picked up by the jib hoist system 14 and used with the mill 10. Thus, it will be apparent that various combinations of pans, media types and sizes, mills, and so forth may be incorporated into the system of FIG. 1.

Turning now to a more detailed discussion of the apparatus illustrated in FIG. 1, the finishing mill 10, as noted earlier, is a conventional unit. This mill 10 includes a base 25 from which is supported the bowl 11 by resilient members, such as springs (not shown). A vibratory source is mounted within the mill and coupled with the bowl to vibrate the same. The bowl includes a center column 26 which has been modified to include a cover 27 having a projection 28. The projection, as will be described subsequently, serves to open the bottom of the pan 12 to cause discharge of the material contained therein evenly into and around the interior of the bowl 11.

The jib hoist system 14 includes a stationary base 30 which is free standing or affixed in any suitable manner to the base 25 of the mill, such as by a pair of plates welded to both bases, or affixed to the separator base. The base 30 is provided with a vertical pivot or king pin 31 which supports a vertical column member 32 of the crane for rotation to allow proper positioning of the pan 12. A horizontal beam 33 is affixed to the upper end of the member 32 to support a hoist or winch 34 by means of a hook 35. A counterbalance 36 may be provided. A chain 37 is coupled between the winch 34 and a support bracket 38 on the outer end of the stabilizer arm 13. The bottom 39 of the bracket 38 has a slot 40 therein perpendicular (note FIG. 1) or angled (note FIG. 3) with respect to the arm 13 for receiving and supporting the pan 12 as will be described subsequently. The inner end of the arm 13 is coupled to a pair of flange members 43 and 44 which are coupled together by a pair of plates and encircle the support member 32. Rollers are provided on the inner sides (note FIG. 2b) of these flange members to allow the stabilizer arm to roll up and down the member 32 as the winch 34 is operated. A handle 45 is provided for rotating the hoist system about the pivot 31 to allow the pan 12 to be moved to above the mill 10 or to another closely adjacent mill, to be moved to the dotted line position 20 for reloading the pan with media, or for moving the pan to another position where it may be stored, stacked, or the like. The pan has a diameter slightly smaller than the inside diameter of the bowl 11.

The vibrating screen separator 16 may be a conventional unit including a base 50 which may be affixed to the base 25 of the mill, and a screening chamber 51.

The screening chamber includes one or more screens and is vibrated by means of a motor and vibratory drive system 52. The screening chamber may include an upper coarse mesh screen for enabling the parts to be separated from the media, and a lower fine mesh screen to enable reusable media to be separated from broken and chipped media. The separator may also include a suitable washing system (not shown) for washing or treating the media and/or parts. As noted earlier, the reusable media is discharged through the chute 19 into the pan. Although the parts may be removed in any convenient manner from the upper screen of the separator, as noted earlier, a magnetic belt separator 17 may be employed for picking up certain metallic parts.

Considering now the drive system 21 as more completely illustrated in FIGS. 2a through 2c, the same includes an electrical motor 60 coupled by a chain 61 to a magnetic roller or rollers 62. An idler 63 maintains proper tension of the chain 61. One or more of the rollers 62 may be provided, and a typical roller is 4 inches in diameter. A metal wheel or pulley may be mounted on the motor shaft and directly contact and drive the rollers 62 thereby obviating the need for a chain drive 61. This drive assembly may be mounted to the overall system in one of several ways. As illustrated in FIGS. 1 and 2a, a support bracket 64 may be affixed to the base of the separator 16, or alternatively, may be affixed to the base 30 of the crane or to the base 25 of the mill. A channel member 65 as best seen in FIG. 2a is affixed to the bracket 64, and has extending therefrom a pair of bracket plates 66 and 67. These bracket plates may in turn pivotally support a pair of bracket arms 68 and 69 for supporting the motor 60 and roller 62 at a pivot 70. A spring 71 is coupled between the arm 69 and the bracket 64, and stop plates 72 and 73 are respectively affixed to the arm 69 and bracket 64 for siding in release of the pan from the magnetic-drive as will be described subsequently.

The magnetic roller or rollers 62 serve two purposes. As the round pan 12 is moved into position, the roller pulls the pan into engagement therewith, and drives the pan. Typically, the pan is driven at a speed of 15 to 20 revolutions per minute to enable uniform distribution of the media into the pan from the separator. As the pan is being loaded, there is a tendency for the first gush of media to move the pan off center and away from the driving roller 62, but this is overcome by the magnetic attraction of the roller. Additionally, problems of friction and pressure in driving the pan are eliminated by the use of the magnetic drive. The pan may be separated from the roller by moving the pan backward (clockwise about the pivot 70) thereby extending the retention spring, and then pulling the pan forward briskly until the stop plates 72 and 73 engage such that the momentum of the pan snaps it away from the roller. If desired, discharge of parts or parts/media may be made directly from the finishing mill into the pan by physically rearranging the drive arrangement such that the pan is properly positioned with respect to the mill for receiving the material therefrom.

FIGS. 2b and 2c illustrate an alternative arrangement for mounting the drive assembly 21 wherein the channel member 65 thereof is pivotally secured to the stabilizer arm 13. The drive assembly may be biased clockwise as viewed in FIG. 2b by suitable means, such as a spring (not shown) to maintain the rollers 62 against the periphery of the pan 12. In the arrangement of FIG.

2b-2c, the bracket arms 68 and 69 are affixed directly to the channel member 65. It will be apparent that the rollers 62 illustrated in FIGS. 1 and 2 are journaled for rotation by suitable bearings or bushings.

As noted earlier, the support bracket 38 of the stabilizer arm 13 has a slot 40 in the bottom thereof. This slot may have the configuration illustrated in FIGS. 2b and 3 wherein it flares outwardly at 75 to enable the support stud 76 (note FIG. 2c) and flange 77 of the pan to be guided into engagement with the arm 13. The bracket may be in the form of a box as shown in FIG. 1, or may be open as shown in FIGS. 2b, 2c and 3 with sides 78 and 79 and inclined faces 80 and 81 to guide and receive the flange 77.

FIG. 2b illustrates a flange 77 of 1 diameter for one size pan, and illustrates the manner in which the flange and support stud 76 may be positioned in the support bracket 38 at the center line of the stabilizer arm 13. FIG. 3 illustrates the manner in which another size pan having a larger flange 82 is supported and retained slightly off center. This support configuration enables different diameter pans to be rotated by the magnetic drive arrangement. The chain 37 from the winch 34 may be directly coupled with a hook 84 of the pan, or alternatively, may be coupled near the outer end of the arm 13.

FIGS. 2b and 2c also illustrate in greater detail the manner in which the flanges 43 and 44 of the arm 13 are coupled together by means of plates 90 and 91 and include pairs of upper and lower rollers, only the upper rollers 92 and 93 being seen in the drawings. These rollers bear against the faces of the column member 32 to allow the stabilizer arm 13 to freely move up and down the member 32 as described earlier. Additionally, a base plate 95 may be provided for supporting the base 30 of the jib crane, and may also have secured thereto the bases of the finishing mill and separator if desired.

Turning now to a consideration of the specific embodiments of the round hoist pan 12, FIGS. 4a through 4c illustrate a pan 99 which includes a latching-type bottom 100 which is unlatched and caused to open as the bottom of the pan engages the top of the mill 10. This pan includes a cylindrical housing or wall 101 with a bottom flange 102, and a frusto-conical insert 103 secured to the housing and flange. A central cone 104 is provided and is secured at the top thereof by a plurality of rods 105 extending to the interior wall of the body 101, and near the bottom thereof by a plurality of rods 106 extending to the insert 103. The bottom 100 of the pan 99 comprises a pair of semicircular bottom segments 107 and 108 which are hinged together by a pin 109 which extends through the bottom of the central cone 104. A flange 110 may be secured at the top of the housing 101 to reinforce the housing.

The bottom segments 107 and 108 are maintained in their normally closed position by a pair of latch mechanisms, only the left hand mechanism being shown for simplicity of illustration. Each latch mechanism includes a bolt 112 which releasably engages a bracket 113 affixed to the respective bottom segment. The bolt is coupled to a release arm 114 which is pivoted at 115 by a pair of brackets 116 and 117. As the bottom 118 of the arm 114 engages a cam face 119 mounted at the top of the mill 10, the bolt 112 is pulled from the bracket 113 allowing the respective bottom segment to lower as illustrated in dashed lines in FIG. 4a. The arm 114 is normally biased to close the bolt 112 with the

bracket 113 by means of a spring 121, and a spring 122 is provided to return the bottom segments 107 and 108 to their closed positions after the media has been dumped from the pan 99. Latching mechanisms as just described are provided for both of the bottom segments 107 and 108. It further will be apparent that the construction of the pan 100 dumps the media in a substantially annular pattern into the interior of the bowl 11 of the mill 10 to provide a relatively even distribution of the media around the bowl. No particular configuration is required at the top of the center column 26 to cause dumping of this pan embodiment.

FIG. 5 illustrates another round pan construction including a cylindrical housing 130, a conical insert 131 and a pair of semi-circular bottom segments or doors 132 and 133. The central stud 76 extends down into the pan and is coupled with the top of a cone 134. A central flange 135 is affixed to the inner wall of the housing 130 by means of a plurality of radially extending rods 136. A ball thrust bearing 137 is provided, and FIG. 5 shows the configuration thereof which is also used with the pan of FIG. 4a. The bottom segments 132 and 133 are hinged by a pin 138 in a manner similar to the bottom segments 107 and 108 in FIGS. 4a-4b; however, the hinge pin 138 is not coupled with the cone 134, and the bottom segments 132 and 133 are free to move up and down with respect to the cone 134. Additionally, a pair of arcuate guides 139 and 140 are coupled at the inner circular edges of the respective bottom segments 132 and 133. When the cone 134 is in its lower position, the central portions of the bottom segments 132 and 133 are supported thereon and the outer edges are supported on the insert 131, and these segments assume the closed (full-lined) position. The weight of the media on the segments maintains the bottom of the pan closed. The lower end of the stud 76 extends into a cylindrical guide 141 in the cone 134, and the stud and cone are coupled together with a pin 142. The pin 142 rides in a slot 143 in the guide. In this manner the cone may move freely up and down on the stud 76.

As the pan is lowered to the mill, the bottom of the cone 134 engages the cover 27 of the center column of the mill 10 thereby preventing the cone 134 from lowering further, while allowing the body 130 to lower to the dashed lines position as seen in FIG. 5. This action allows the central portions of the bottom segments 132 and 133 at the guides 139 and 140 to rise up with respect to the cone 134 because of the moment caused by the weight of the media at the outer edges of the segments 132 and 133 causing the segments to fold, thereby providing a substantially annular aperture 144 at the bottom of the pan for discharge of media. After the media is discharged, the pan is raised thereby allowing the cone to move down and the bottom segments to again assume the flat closed position. If necessary, the bottom segments may be closed manually.

Alternatively, the center column may include a remotely actuated mechanism, such as an air cylinder and piston, which can be operated to extend upwardly and engage the actuator of the pan. With this arrangement, the pan is merely lowered to above the mill and does not have to be lowered into engagement with the cover 27.

FIGS. 6a through 6c illustrate another configuration of a round hoist pan providing an annular discharge of media. This pan includes a housing 150 having a conical insert 151 affixed thereto, and a moving conical

bottom 152. The pan is supported by means of a central bracket 153 which is secured to the housing 150 by radially extending rods 154. A ball thrust bearing 155 is provided for the support stud 76, and the same type of bearing is used with the pan of FIGS. 4a and 5. A central support column 157 is rigidly secured to the interior wall of the insert 152 by means of rods 158. The movable bottom 152 is affixed to a central cap 159 which in turn is secured to a stud 160 which extends through the column 157. A spring 161 is provided on the stud and is retained by means of an actuator 162 and nut 163. The spring 161 serves to normally bias the actuator 162 and stud 160, and thus the bottom 152, downwardly to the full-lined position shown in FIG. 6a. When the actuator 162 engages the cover of the center column of the mill, the bottom 152 is raised to the dashed-line position shown in FIG. 6a to provide an annular aperture 165 for discharge of media evenly into the bowl of the finishing mill. The bottom of the actuator 162 is above the bottom of the pan thus enabling the pan to be placed on a floor for storage or loading without causing the bottom 152 to open. With each of the pans disclosed herein, resilient gaskets may be used at the edges of the movable bottoms to provide a good seal with the interior sides of pans.

FIG. 7 illustrates an alternative arrangement for raising, lowering and transporting the pan 12 similar to that shown in FIG. 1, but employing a monorail system. Additionally, the monorail system may be mounted on a bridge crane system. A vertical support column 170 like the column 32 in FIG. 1 is provided, but is affixed to a horizontal beam 171 which in turn is mounted by means of a trolley 172 onto a monorail beam 173. The beam 171 is mounted on the trolley 172 for rotation about a pivot 174 to thereby allow the stabilizer arm 175 to be rotated about the pivot 174 or to be moved to and fro along the monorail 173. The stabilizer arm 175 is coupled to the column 170 by a roller arrangement like that shown in FIGS. 1, 2b and 2c. Similarly, the holder 176 may be as shown in FIG. 1 or FIG. 2b. As was the case with the arrangement shown in FIG. 1, a winch 177 is provided for raising and lowering the arm 175.

A monorail type system is particularly suitable for a small, inexpensive and manually operated material handling system. For example, the monorail may replace the jib hoist arrangement and be arranged with one mill, separator, pan driving assembly and hoist pan. The rail may be hung from the ceiling 177 or floor supported, and has the advantage that it may be curved to relatively easily feed a second mill on the reverse side of the separator, or other arrangements may be provided as desired. Two mills may be positioned in a straight line and discharge into a single separator, and with a straight monorail, media can be received from the separator and fed to either one of the two mills.

Furthermore, instead of mounting the monorail 173 on the ceiling 177, the same can be mounted on trolleys which in turn are mounted on rails affixed to the ceiling to provide a bridge crane system. Only a single trolley 178 and ceiling rail is illustrated in FIG. 7 for simplicity of illustration, it being understood that at least an additional trolley and rail would be mounted near the other end (to the left as viewed in FIG. 7) for proper support and movement of the monorail 173. With the bridge crane system the entire area of a building may be serviced, and this system lends itself well to full automa-

tion. The bridge may be mounted onto the ceiling 177, or may be floor mounted if desired. The bridge crane system is particularly advantageous for large installations employing multiple mills and multiple medias.

5 FIGS. 8 through 10 illustrate further preferred embodiments of round hoist pans. These pans may be moved and transported in the same manner described above, and can be used with the magnetic drive arrangement.

10 The pan embodiment illustrated in FIG. 8a through 8c includes an outer cylindrical housing or body 184 and movable bottom segments or doors 185 and 186. These doors are semi-circular and do not extend all the way to the center of the pan, but are hinged together and joined by a flexible member 187 such as a rubber impregnated belt. Four rods 188 through 191 are affixed to the inner wall of the cylindrical body 184, the other ends of which terminate in a support bracket 192. A support stud 193 is rotationally coupled with the support bracket 192 by a bearing 194 as seen in FIG. 8c to allow the pan to be rotated by the magnetic drive assembly. Four hinge legs 195 through 198 are pivotally coupled with the respective support arms 188 through 191. The lower ends of the legs 195 and 197 are affixed to the door 185 and the lower ends of the legs 196 and 197 are affixed to the door 186. The legs 195 through 198 may be pivotally coupled with the support rods 188 through 190 in any suitable manner such as by means of small stub shafts or rubber torsion bushings. A guide 200 may be affixed near the bottom of the body 184 as best seen in FIG. 8d to provide a guide for a projection 201 (FIG. 8c) from the cover 27 of the center column 26 of the mill 10. As is seen in FIG. 8c, as the pan is lowered onto the mill 10, both doors 185 and 186 pivot and rise to evenly dump the contents of the pan into the mill 10. The hinge member 187 tends to return to a flat configuration and therefore acts both as a sealing hinge impervious to jamming by media and also acts to force the doors 185 and 186 to the closed position against the inside wall of the body 184 as shown in FIG. 8a.

A typical pan as illustrated in FIGS. 8a and 8b, which are approximately to scale, has an outside diameter of 40 inches and a height of 17 inches, with the doors in the closed position being 3 inches above the bottom extremity of the body 184. The central edges are spaced apart by 6 inches, with the flexible member being eight inches wide to provide 1 inch along each side thereof for attachment to the door edges.

The hoist pan embodiment illustrated in FIGS. 9a through 9f includes a frusto-conical housing 210 which is rotatably supported from a support stud 211 by a bearing similar to the bearing 193 in FIG. 8c, and by means of a plurality of rods 212. The pan may include a base flange 213 for protecting the bottom control linkage arrangement to be described subsequently.

A pair of semi-circular bottom doors 214 and 215 are provided at the bottom of the housing 210 and may slightly overlap as indicated in FIG. 9a. These doors are coupled to the body 210 by a linkage arrangement as best seen in FIG. 9c. A pair of shafts 217 and 218 are affixed to brackets welded to the inner wall of the housing 210. Shafts 219 and 220 are coupled respectively to the doors 214 and 215. Shafts 221 and 222 also are affixed to the respective doors 214 and 215. The shafts 217 and 219 are intercoupled by means of stub shafts 224 and 225 and bushings 226 through 229. Similarly, shafts 218 and 220 are intercoupled by stub shafts 231

and 232 and bushings 233 through 236. This arrangement allows the doors 214 and 215 to rotate about the respective shafts 217 and 218 and to rotate about the respective shafts 219 and 220. Control arms 238 and 239 are respectively coupled between the shafts 218 and 221 and between the shafts 217 and 222 by means of bushings 240 through 243. These shafts control the arc of movement of the doors 214 and 215 as the same open and close. Thus, it will be apparent that the doors may fold inwardly as illustrated in FIG. 9b when the bottoms of these doors engage a projection 245 at the top of the center column 26 of the finishing mill. A plurality of bail type rollers 247 through 250 and 251 through 254 are secured to the bottoms of the doors 214 and 215 as shown in FIGS. 9b and 9c and roll against the dome shaped projection 245 to reduce friction and accomplishing efficient opening of the doors. Casters 256 and 257 are secured to the control arm 238 and casters 258 and 259 are secured to the control arm 239, and these casters along with the rollers aid in centering and facilitating the proper opening of the bottom of the pan.

FIGS. 9a-9d are approximately to scale, and the pan shown therein may have an outside diameter at the top thereof of 41½ inches tapering to 34½ inches at the lower extremity of the body 210. A typical height of the body is approximately thirteen inches, the upper and lower flanges adding approximately two inches each. The door segments have a diameter of 17¼ inches. The center lines of the shafts 217-218 are each 10 inches from the center of the pan, the center lines of the shafts 219-220 are each 3 inches from the center lines of the respective shafts 217-218, and each of the arms 238-239 is 17 inches between the pivot points thereof (e.g., arm 238 is 17 inches from the respective center lines of shafts 218 and 221).

The pan illustrated in FIGS. 10a through 10d is similar to that illustrated in FIG. 8 and described above, but the bottom segments or doors are mounted and operated differently. In this embodiment, the pan includes a frusto-conical housing or body 270 which is supported for rotation in a manner similar to that of FIGS. 8 and 9. Arcuate rods 271 and 272 are welded at the bottom of the housing, and cross rods 273 and 274 are welded thereto. The bottom segments or doors 275 and 276 are pivotally coupled with the rods 271 and 272. This is accomplished for each door by means of a T-shaped stud member 277 as best seen in FIG. 10c which is welded or pinned to the rod 271, the arms of which ride within a chamber 278 formed by a pair of L channels 279 and 280 welded to the bottom of the door 275. The door 276 is similarly coupled with the rod 272.

The central edges of the doors 275 and 276 are hinged together by a flexible member 281 similar to the arrangement shown in FIG. 8c. Spring steel bands 282 and 283 also are affixed to those edges of the doors. An actuator comprising a conical member 284 which is welded to a spacer 285 which is in turn welded to a cross rod 286 is provided for opening the doors 275 and 276 upon engagement of the conical member 284 with the projection of the cover of the center column of the mill. The rod 286 is affixed to the bands 282 and 283 and the flexible member 281 as best seen in FIGS. 10b and 10d. A U-shaped channel member 287 may be welded to the periphery of the housing 270 to provide a circular surface for engagement with the magnetic roller for rotating the pan. A channel 288 may be

welded to the lower outer edges of each door to retain a resilient gasket 289 as best seen in FIG. 10a.

As noted earlier, the concepts of the present invention also are applicable to grinding mills wherein material, such as chemical compounds, paint pigments, and so forth, and media are loaded into the mill to grind the material, or otherwise reduce the material in size.

What is claimed is:

1. A hoist pan for use in a material handling system for mills comprising
 - a housing having at least a circular peripheral portion,
 - means coupled with said housing for supporting said housing for rotation about the central axis thereof, said means comprising a bearing assembly and arm means coupled between said bearing assembly and said housing,
 - an insert mounted within said housing near the lower extremity thereof,
 - a movable bottom mounted within said housing comprising a substantially conical member mounted for up and down movement within said housing, the outer periphery of which engages said insert to close said pan, and
 - spring biasing means coupled with said movable bottom of said insert for normally closing said bottom,
 - said spring biasing means comprising a spring housing mounted substantially coaxially within said housing and coupled with said insert, said spring housing containing a spring therein, and said conical member including a shaft extending through said spring housing and terminating in an actuator near the central lower extremity of said pan means for engaging a central projection of a mill for causing said bottom to raise and dump the contents of said pan means into said mill.
2. A hoist pan for use in a material handling system for mills, comprising:
 - a housing having at least a circular peripheral portion,
 - means coupled with said housing for supporting said housing for rotation about the central axis thereof, said means comprising a bearing assembly and arm means coupled between said bearing assembly and said housing,
 - an insert mounted within said housing near the lower extremity thereof,
 - a movable bottom mounted within said housing comprising a substantially conical member mounted for up and down movement within said housing, the outer periphery of which engages said insert to close said pan, and an actuator connected to said conical member and located near the central lower extremity of said pan means for engaging a central projection of a mill for causing said bottom to rise and dump the contents of said pan means into said mill, and
 - spring biasing means coupled with said movable bottom of said insert for normally closing said bottom.
3. A hoist pan as in claim 2 wherein said actuator includes a rigid shaft extending downwardly from a central location of said substantially conical member to an actuator plate.
4. The hoist pan as in claim 3 wherein said spring biasing means comprises a spring housing mounted substantially coaxially within said housing and coupled with said insert, a spring positioned within said spring housing and mounted coaxially about said shaft.

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