

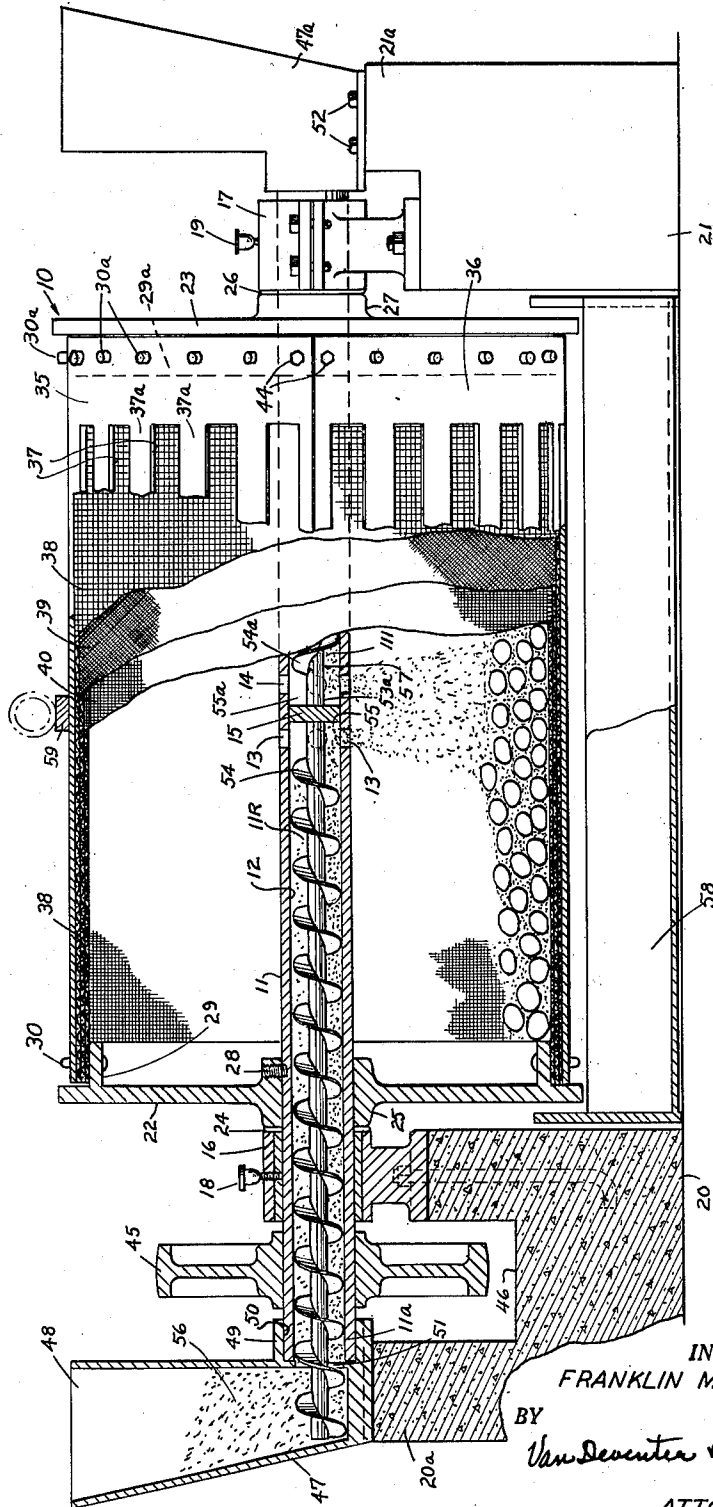
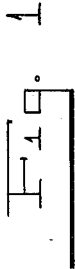
Nov. 21, 1950

F. M. CORNELL
SCREENING BALL MILL

2,530,862

Filed May 8, 1945

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

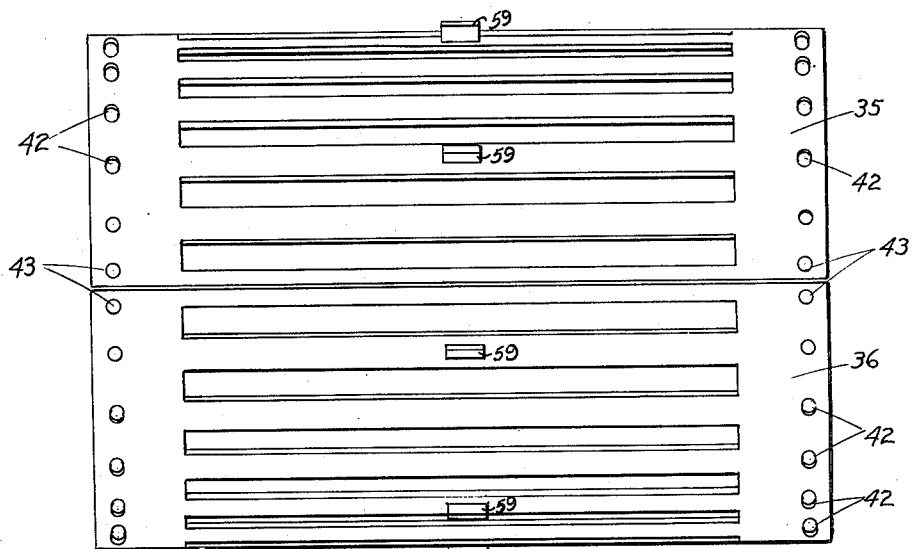


Fig. 3

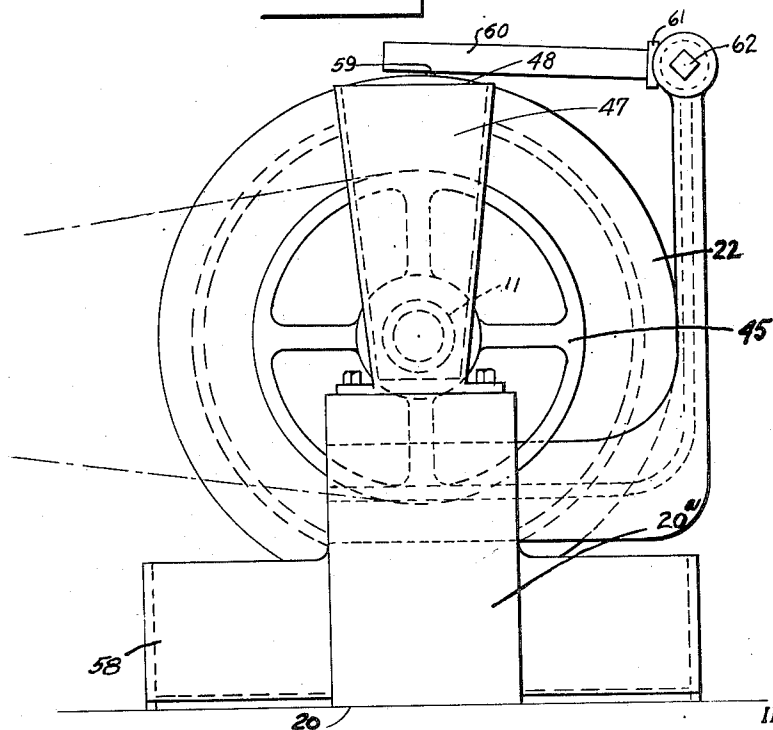


Fig. 2

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Fig. 4

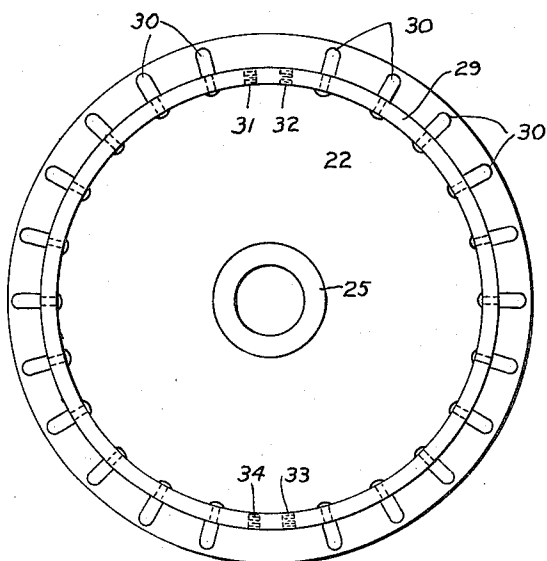


Fig. 5

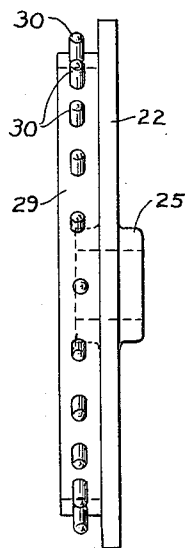


Fig. 7

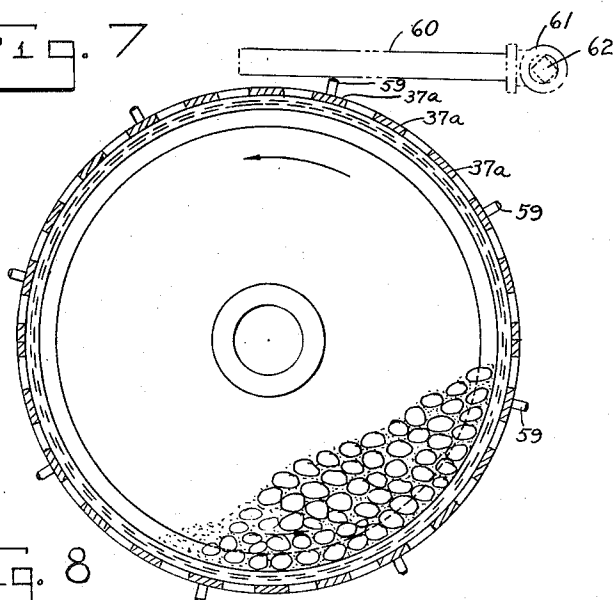


Fig. 8

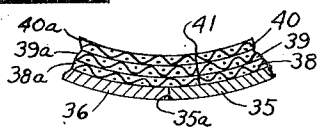
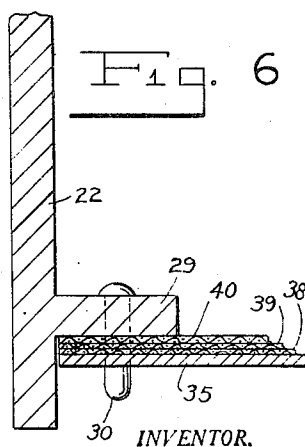


Fig. 6



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SCREENING BALL MILL

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Application May 8, 1945, Serial No. 592,672

3 Claims. (Cl. 241-91)

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This invention relates to combined mills and strainers and is directed more particularly to a ball type mill in which a rotating drum is provided with removable screens, and in which the material is fed into the drum via both ends of a hollow shaft on which the drum is mounted.

An object of the invention is the provision in a ball mill, of a screen of a desired fineness positioned between coarser screens which serve to reinforce and protect the fine screen.

Another object of the invention is the provision in a ball mill, of a drum having removable arcuate walls which carry the screens, whereby screens which are used to work any color or character of material may be quickly removed, the supporting parts cleaned, and other walls carrying screens for other materials or colors may be quickly substituted therefor.

Yet another object of the invention is the provision in a ball mill of a drum including a solid wall having elongated apertures formed therein, a screen of one coarseness lying next to the interior of said wall, a second screen of the desired fineness lying against first said screen, and a third screen coarser than said second screen overlying the interior of the latter and adapted to withstand the weight of the balls and the material, and also the action of the balls upon the material being processed.

Yet another object of the invention is the provision in a combined ball mill and strainer, of a drum having walls comprised of removable arcuate sections which may be quickly attached to or detached from annular flanges formed on the heads of the drum.

A further object of the invention is the provision in a ball mill, of a drum having end heads having annular flanges extending towards each other, said flanges carrying radial dowel pins, and arcuate side walls carrying screens, said side walls having dowel holes in each end thereof adapted to engage said dowel pins, and means to secure said walls to said flanges.

Other objects and advantages of the invention will appear as the following specification and the accompanying drawings are studied.

Referring to the drawings which are given by way of example:

Figure 1 is an elevation partly in section, of my new and improved combined mill and strainer;

Figure 2 is an end elevation of the same;

Figure 3 is a view showing the circumferential walls of the drum as formed of two halves;

Figure 4 is an end view of one of the heads of the drum;

Figure 5 is an elevation of the head shown in Figure 4;

Figure 6 is an enlarged fragmentary view showing the engagement of one of the dowels by the arcuate wall of the drum;

Figure 7 is a sectional view showing the drum in rotation and the action of the hammer; and

Figure 8 is a fragmentary sectional view showing the two halves of the circumferential wall of the drum as having the exterior portion of the walls abutting each other and the screens overlapping the line of contact of the exterior walls.

Referring first to Fig. 1, the new and improved mill is generally designated by the numeral 10 and includes a shaft 11 having an interior bore 12 formed therein. A series of radial holes 13 is formed in the shaft, and spaced apart therefrom is a second series of holes 14. A disc 15 is forced into the shaft with a press fit and is positioned between the sets of holes 13 and 14, thus dividing the interior 11 into two divided chambers 11R and 11L. The shaft 11 is journaled in bearings 16 and 17 which are provided with suitable oil cups 18 and 19 respectively. The bearings 16 and 17 may be supported in any desired manner.

However, in the embodiment shown in Fig. 1, I show the bearings bolted to concrete bases 20 and 21 respectively. Mounted on the shaft 11, adjacent to the bearing 16, is a head 22, and an identical head 23 is mounted on the shaft 11 adjacent to the bearing 17. A suitable thrust washer 24 is provided between the hub 25 of the head 22 and the bearing 16, and a similar thrust washer 26 is provided between the hub 27 of the head 23 and the bearing 17. The head 22 consists of a hub 25 having a hole formed therein to fit the shaft and secured to the shaft by means of set screws one of which is shown at 28. Continuous with the hub 25 is a circular web having an annular flange 29 formed integral therewith. The flange 29 is spaced inwardly from the outer periphery of the head so that the screws and other elements to be presently described will lie within the outer diameters of the heads 22 and 23. The flange 29 carries a series of radial dowel pins 30, as may best be seen in Figs. 4 and 5. The annular flange 29 also has threaded holes 31, 32 spaced apart from each other. Diametrically opposite the threaded holes 31, 32 are threaded holes 33, 34. The head 23 is identical with the head 22, so like parts on the head 23 will be designated by the same numeral with the addition of small *a*; for example, the annular flange 29 is designated on the head 23 as 29a, and the dowels on the head 23 are designated as 30a.

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The circular walls of my new and improved ball mill are formed in identical halves which, when mounted on the heads 22 and 23, form a continuous circular wall. Although the two half walls are identical they are designated as may best be seen in Fig. 3, by the numeral 35 for the upper half and 36 for the lower half. Each half consists of a semi-circular wall having a plurality of elongated slots 37 formed therein with webs 37a formed therebetween. Inside of and extending from end to end of the member 35 is a screen 38 which is preferably of a larger mesh than the fine screen to be presently described and consequently this screen 38 is formed of heavy wires which impart strength to the structure. Since the screen 38 extends from end to end inside the member 35, it is obvious that the screen covers all of the apertures 37 formed in the wall of the member 35. Lying next to the screen 38, the mesh of which is of a desired fineness, is a screen 39. Lying next to the screen 39 is a coarser screen 40 which has sufficient strength and body to properly support both the balls and the material being worked.

As may be seen in Fig. 8, the edges of the screens 38, 39, and 40, terminate on a line 41, which is spaced apart from the trailing edge 35a of the outer wall 35.

The outer wall 36 carries screens 38a, 39a, and 40a, which overhang the leading edge (abutting the trailing edge 35a) of the wall 36 and abutting the ends of the screens 38, 39, and 40. Diametrically opposite the arrangement is exactly the same so that when the two half walls are secured to the heads there is no leakage along the lines where the outer walls 35 and 36 abut each other. Each half wall 35 and 36 is provided with a series of elongated holes 42, and round holes 43 adjacent to the leading and trailing edges of the half walls 35 and 36. In applying the half walls 35 and 36 to the heads 22 and 23 one of them, say the wall 35, is positioned on the flanges of the heads with the dowels 30 and 30a engaging the dowel holes 42 and as the inner screen 40 comes in contact with the flanges 29 and 29a (as shown in Fig. 6) the holes 43 are aligned with the tapped holes 31, 34 in the flanges and the half wall is then secured to the heads by means of cap screws, two of which are shown at 44, in Fig. 1. The second half wall 36 may be applied to the flanges in the same manner as described above and it may also be secured to the flanges by means of cap screws 44 engaging the tapped holes 32, 33.

From the above description it will be evident that the half walls may be applied to or removed from the heads both easily and rapidly.

Referring again to Fig. 1, the shaft 11 has fixed thereto a pulley 45 which may be belted to a motor or other prime mover, suitable clearance 46 being provided for the pulley and the belt. The concrete base has a portion 20a upon which a special receptacle 47 is mounted. The receptacle has an open end 48 at the top thereof and has an annular boss 49 counterbored at 50 to receive the end 11a of the shaft. The wall of the receptacle also has a hole 51 concentric with the hole 50 which provides communication between the interior of the receptacle and the interior 12 of the shaft 11. The base 21 has a portion 21a which supports a receptacle 47a which is identical with the receptacle 47. The receptacles 47 and 47a are secured to the bases 20a and 21a respectively by means of cap screws 52 engaging threaded inserts (not shown) in the bases 20a and 21a so that when the cap screws 52 are re-

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moved the receptacles may be disengaged from the shaft 11 by moving them endwise. As the receptacles are moved endwise, the counterbores 50 in the annular bosses 49 become disengaged from the shaft and when the end of the boss 49 clears the end of the screw conveyor positioned in the shaft, the receptacle may be completely removed from its pedestal (28 or 21a). In replacing the receptacles, they are moved endwise until the end of the shaft engages the counterbore 50, following which the cap screws 52 are then caused to re-engage the threaded inserts above referred to. Obviously, the clearance holes in the flanges on these receptacles are larger than the diameter of the cap screws and the operator must make sure that the receptacles are not "cocked" so as to bind the shaft when the cap screws 52 are tightened down.

Positioned within and having its outer periphery frictionally engaging the hollow interior 11R of the shaft is a screw conveyor 52 which consists of a small shaft 53 about which a helical web 54 is disposed. The helical web 54 terminates at a point spaced apart from the plug or barrier 15 so as to form a chamber 55 adjacent to the holes 13 formed in the shaft 11. The left end of the screw conveyor terminates in the bottom of the receptacle 47 so that as the shaft 11 rotates the material 56 is fed to the right and is delivered to the chamber 55 within the shaft so that it may fall therefrom via the holes 13 and into the interior of the mill.

The outer edges of the helical web 54 frictionally engage the interior walls of the shaft sufficiently to cause the screw conveyor to positively rotate as the shaft is rotating. When the receptacle 47 is removed as above described, the left hand of the screw conveyor may be grasped and the conveyor may be bodily removed from the hollow interior 11R of the shaft. This enables every part of the mill with which the material being worked comes in contact, to be cleaned.

A similar screw conveyor generally designated by the numeral 57 is mounted in the hollow interior 11L of the shaft 11 and this screw conveyor is identical with the screw conveyor above described except that the helical web is disposed on the central shaft 53a in an opposite direction so that the material from the receptacle 47a will be fed to the left so as to deliver material to the chamber 55a.

Positioned between the supports 20 and 21 is a suitable receptacle 58 for receiving the finished product.

Mounted on some of the webs 37a is a series of lugs 59 which cam against a pipe, rod or other hammer, 60 as the drum is rotated in the direction shown by the arrow in Fig. 7. The hammer 60 may consist of a length of pipe which is screwed into a T 61. The T may be mounted on a cross rod 62 through which cotter pins (not shown) or any other suitable means may be provided for preventing the T from moving endwise on the cross rod 62.

Operation

As an example of the use of my new and improved ball mill, a charge of twenty to twenty-five pounds of balls may be placed in the mill and the mill may be filled about one-third full of methyloorange, then the mill may be closed by securing the second half wall to the flanges by means of cap screws 44. Following this the hammer is positioned to be contacted by the lugs

59 and the mill is started up. The hammer makes, according to the speed the drum is driven, twelve to twenty-five strokes or pulses per second. One charge of approximately one-hundred fifty pounds of methyloange dye may be processed in twenty to forty-five minutes depending upon the humidity of the atmosphere. Suppose it is desired to follow the orange dye with another color. I may remove the receptacles 47 and 47a, then withdraw the screw conveyors and clean them off, clean out the hollow interior 11R and 11L of the shaft and substitute other half screens for the half screens 35 and 36, replace the screw conveyors and the receptacles 47 and 47a, and thus change to another color or another material within a minimum of time.

From the above it will be seen that my new and improved mill has the following advantages. It may be opened or closed by handling a maximum of eight bolts; it may be very easily cleaned, it is very easy to change to screens of different degrees of fineness, it is very easy to change screens to handle different products or colors, and repairs may be effected very easily due to the complete accessibility of every part of the device.

Although I have herein shown and described by way of example one embodiment of my new and improved ball mill, it is obvious that many changes may be made in the arrangements herein shown and described without departing from the spirit of the invention as set forth in the following claims.

What is claimed is:

1. In a ball mill, a drum having heads with annular flanges formed integral therewith and extending toward each other, a hollow shaft supporting said heads in spaced relation and having apertures a series of radial holes formed therein communicating with the interior thereof and the interior of said drum between said flanges, a plurality of radial dowels carried on said annular flanges, a plurality of removable curved wall sections having dowel holes formed therein for co-operating with said dowel pins, other holes formed in said sections through which securing means may pass to engage said flanges, said wall sections carrying screens, bearings supporting said shaft, a material receptacle positioned on at least one end of said shaft and having an opening formed therein through which material may be delivered to the hollow interior of said shaft, means in said hollow interior for urging said material toward said apertures, a rod or hammer extending across the top of said drum, and lugs carried on said wall sections in a path to repetitively raise and drop said hammer.

2. In a ball mill, a drum carrying screens, a shaft supporting said drum, bearings for said shaft, said shaft having a hollow interior bore, a barrier positioned in said bore substantially intermediate the ends of said drum, a series of radial holes in said shaft to one side of said barrier, said holes communicating with said hollow interior and the interior of said drum, another series of radial holes formed in said shaft to the other side of said barrier and communicating with both the interior of said drum and said hollow interior, a removable right hand screw conveyor positioned in the hollow interior of said shaft to one side of said barrier and extending beyond the end of said shaft, a second removable left hand screw conveyor positioned in the hollow interior of said shaft to the other

side of said barrier and extending beyond the other end of said shaft, material receptacles positioned at each end of said shaft and having counterbores therein through which the extended portions of the respective screw conveyors may extend, both said screw conveyors being adapted to deliver material from said receptacles to the interior of said drum via said radial holes.

3. In a ball mill, a shaft, bearings for said shaft, a pair of heads carried on said shaft in spaced relation to each other and having annular flanges formed integral therewith and extending toward each other, a pair of walls of semi-circular cross-section demountably secured to said flanges thereby forming a drum, said walls each including a screen of a predetermined fineness sandwiched between coarser screens which serve to reinforce and protect said fine screens, said screens also being stepped at the edges where said walls joint one another, said shaft having a hollow interior bore, a barrier positioned in said bore substantially intermediate the planes of said heads, radial holes formed in said shaft to one side of said barrier and communicating with both the interior of said drum and said bore, other radial holes formed in said shaft on the other side of said barrier and communicating with both the interior of said drum and said hollow interior, a removable right hand screw conveyor positioned in the hollow interior of said shaft on one side of said barrier and extending beyond the end of said shaft, a second removable left hand screw conveyor positioned in the hollow interior of said shaft to the other side of said barrier and extending beyond the other end of said shaft, material receptacles positioned at each end of said shaft and having counterbores therein through which the extended portions of the respective screw conveyors may extend, both said screw conveyors being adapted to deliver material from said receptacles to the interior of said drum via said openings.

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