

United States Patent

Brown

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[54] SANDMILL VESSEL

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[51] Int. Cl.B02c 17/16

[58] Field of Search.....241/65, 46.15, 74, 170, 171, 241/172, 182

[56]

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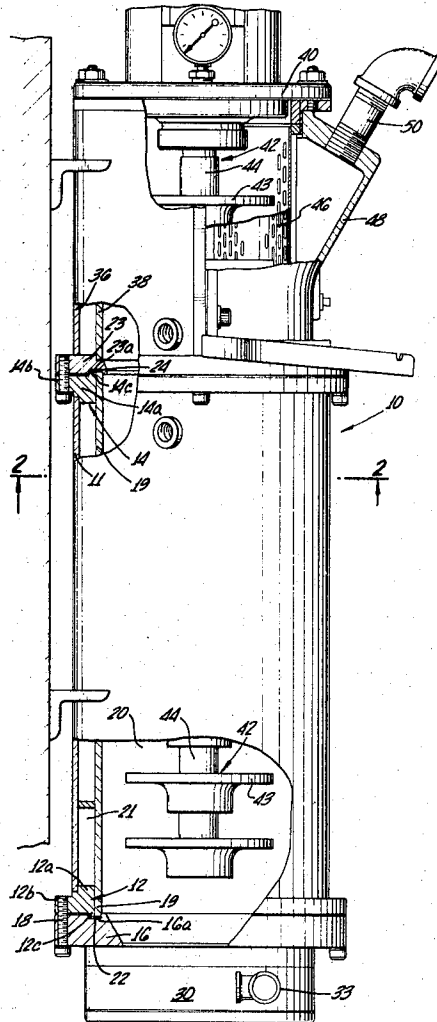
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[57]

ABSTRACT

A vessel having an outer cylindrical jacket with flanges formed on its ends that position an inner liner which defines a processing chamber. The flanges are bolted to connecting rings which cooperate with the ends of the liner to support it and seal the processing chamber from the space between the jacket and the liner, while permitting easy replacement of the liner.

4 Claims, 2 Drawing Figures



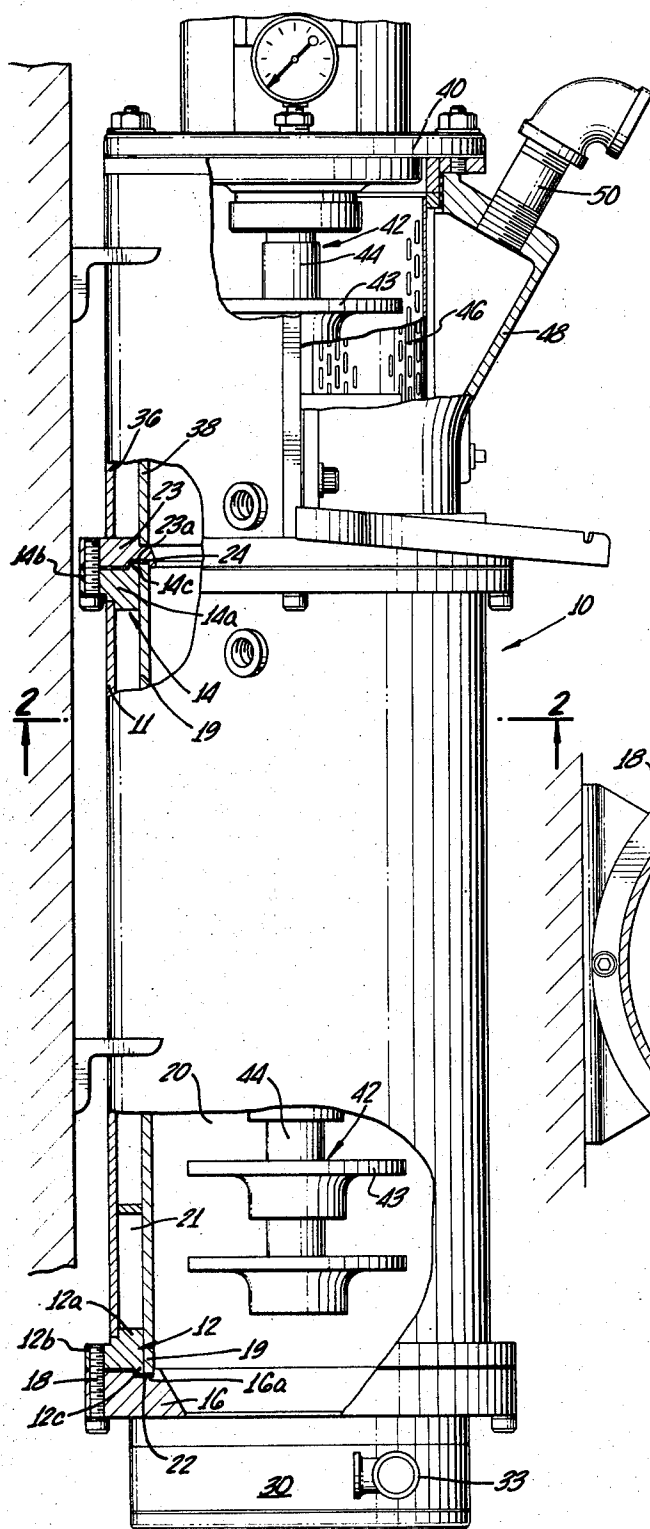


FIG. 1

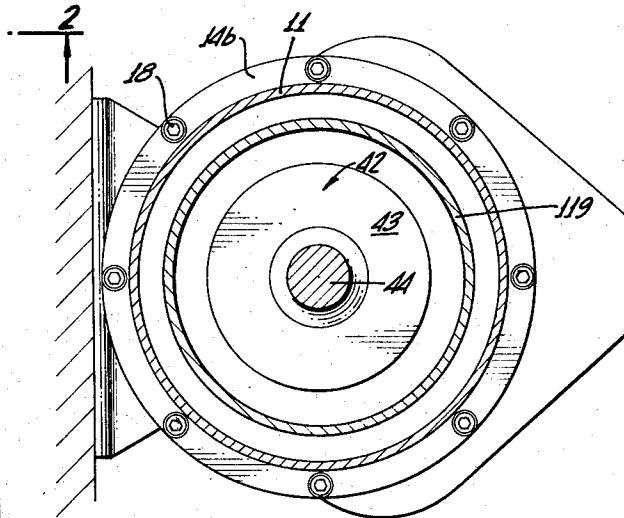


FIG. 2

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SANDMILL VESSEL

This invention relates to apparatus for processing liquids and more particularly to an improved construction for the vessel forming the processing chamber in apparatus known as a "sandmill." Sandmilling is a continuous high production method of dispersing agglomerates such as pigments in film forming materials to produce smooth, uniform, finely dispersed products. The process is used in the manufacture of many types of critical-specification finishes including paints, inks, dye stuffs, coatings, insecticides and similar products where a high degree of fineness is required. Such a process utilizes a mill having a processing chamber containing sand or other grinding media and a rotor for agitating the sand. The liquid to be processed is pumped through the chamber as the sand is agitated.

The equipment employed in performing such process is subjected to the constant abrasion of the moving sand with the result that the metal walls defining the processing chamber eventually become worn and must be replaced. Since apparatus of this type is typically run continuously, replacement or repair of the worn portions can be required at relatively frequent intervals. The various types of liquid to which the chamber walls are subjected can also contribute to eroding of the wall material.

A sandmill vessel typically has a double wall construction with a heat transfer medium being circulated in the space between the two walls, and it is the inner wall or liner which forms the processing chamber containing the sand that is subjected to the wearing action. Since the outer wall or jacket and other components of the overall apparatus are not subjected to such wear, it is impractical to simply discard the entire machine when only the liner is worn. In known arrangements the liner is formed integral with the outer jacket, and it is necessary to cut the liner from the remainder of the apparatus with a torch or other cutting equipment, and it is then necessary to weld the new liner in its proper position. These operations take considerable amount of time and hence are quite costly. Also, it is sometimes difficult to properly position the replacement liner in this fashion.

In accordance with the present invention, the sandmill vessel is formed of an improved construction wherein the inner liner is readily separable from the remainder of the vessel so that it can be easily replaced when worn. More specifically, flanges are welded to the ends of the vessel outer jacket, the flanges extending radially inwardly and outwardly from the jacket wall. A cylindrical liner is positioned within the jacket to define the processing chamber. The liner is spaced from the surrounding jacket by the inner portion of the flanges. A connecting ring attached to the structure closing the ends of the chamber is bolted to each flange, and each ring is formed with an annular groove for receiving the ends of the liner. In this manner the liner is removably clamped in position and is sealed from the space surrounding the processing chamber. As the liner becomes worn, the vessel can be easily disassembled by unbolting the connecting rings with the result that it is much less expensive to replace a liner than with an all-welded construction.

For a more detailed description of the invention, reference may be had to the following specification and drawings in which:

FIG. 1 is a side elevational, partially sectionalized view of the sandmill of the invention illustrating the construction of the vessel; and

FIG. 2 is a cross-sectional view on line 2—2 of FIG. 1.

The sandmill of the invention may be seen to include a vessel 10 having an outer cylindrical jacket 11 with thickened annular flanges 12 and 14 welded to the opposite ends of the jacket. The lower flange 12 includes a main axially thickened portion 12a having a notch in its outer upper corner which is welded to the end and the adjacent inner surface of the outer jacket 11. The lower flange 12 includes an outer portion 12b having a series of circumferentially spaced axially extending threaded holes. The flange 12 further includes an axially extending rib 12c formed on the inner lower corner of the main portion 12a. The upper flange 14 is constructed and numbered similar to that of the flange 12 except that it is inverted with respect to the lower flange.

A connecting ring 16 is bolted to the lower flange 12 by a plurality of bolts 18 extending into the threaded holes of the flange portion 12b. The connecting ring 16 extends inwardly beyond the jacket 11 and includes an annular groove 16a formed in its upper surface. A cylindrical liner 19 defining a processing chamber 20 is positioned within the jacket 11, spaced from the jacket by the flanges 12 and 14 to form a space 21 for receiving a heat transfer medium such as cooling water. As can be seen, the lower end of the liner 19 is positioned within the groove 16a together with the rib 12c on the flange 12, and a flat annular gasket 22.

A similar ring 23 is bolted to the upper flange 14 and is provided with a downwardly facing annular groove 23a. The upper end of the liner 19, the upstanding rib 14c and a flat annular gasket 24 are positioned within the groove 23a. From this construction, it can be seen that the liner 19 and the outer jacket 11, through its flanges, are compressed between the connecting rings 16 and 23 with the gaskets, so that the processing chamber 20 and the water jacket space 21 are properly sealed from each other and the surroundings. If a liner becomes worn, it is only necessary to remove the bolts 18 joining the rings 16 and 23 to the flanges 12 and 14 on the outer jacket 11 to separate the liner 19 from the remainder of the vessel 10.

Completing the description of the other components of the sandmill, it can be seen that the lower end of the mill is closed by a cover assembly 30 which is suitably attached to the connecting ring 16. The liquid to be processed within the processing chamber 20 is fed into the processing chamber through an inlet 33 in the lower cover assembly 30 by means of a pump (not shown).

The upper portion of the sandmill includes an upper outer wall or jacket 36 and a inner liner 38 attached to the ring 14 and spaced from the jacket 36 by the ring 14. Both may be welded to the connecting ring 14, however, in that the liner 38 of the upper portion does not become worn nearly as readily as the lower liner 19, and hence need not be replaced often. The upper jacket 36 and the liner 38 are further connected to and closed by a top cover assembly 40. If desired, a construction similar to that described for the lower liner and jacket can be employed for the upper liner and gasket as well.

A rotor assembly 42 including a plurality of individual rotors 43 mounted on a shaft 44 is supported at the upper end of the vessel 10 by the cover assembly 40, with the rotor assembly 42 being driven by motor and pulley arrangement (not shown). A section of the upper jacket 36 and the liner 38 are cut away and replaced by a curved screen 46 defining an outlet from the processing chamber 20. The screen 46 permits the processed liquid from leaving the vessel while preventing the escape of the grinding media within the processing chamber. An outlet enclosure 48 encloses the screen 46, and the processed liquid finally leaves the mill through an outlet pipe 50.

In operation it will be apparent from the foregoing that liquid to be processed is pumped into the processing chamber 20 through the inlet 33 and then upwardly through the grinding media in the chamber and out the outlet pipe 50. The rotor assembly 42 is continually agitating the sand to provide thorough dispersing of the solid particles within the liquid. When the liner 19 becomes worn by the abrasive action of the grinding media, the unit can be simply and easily dismantled in the manner described to replace the liner.

What is claimed is:

1. A mill for processing liquid including a vessel forming a processing chamber for containing sand or other grinding media, a rotatable impeller in said chamber for agitating the sand, and an inlet and an outlet to the chamber for pumping the liquid through the sand, the means defining said vessel comprising:

an outer cylindrical jacket;

a cylindrical liner positioned within the jacket and forming the actual processing chamber;

means spacing said liner from the jacket to define a space for circulating a heat exchange medium; and means removably attached to said jacket for closing the ends of the jacket and the liner and sealing the processing chamber from the space between the liner and the jacket, the construction of the closing means being such that upon removal of the connection between the jacket and the closing means the liner is free to be easily withdrawn from the vessel for repair or replacement.

2. The mill of claim 1 wherein said closing means includes a ring which is bolted to the end of the vessel, the ring having an annular groove in which is positioned a gasket and the end of the liner.

3. The mill of claim 1 including:

an annular flange permanently attached to the ends of the jacket, said flanges extending inwardly to space the liner from the vessel; and

said closing means includes on each end a member which is attached to the flanges on the ends of the vessel, said members being formed to cooperate with the ends of the vessel and said flanges to seal the ends of the liner and the jacket.

4. A mill for precessing liquid having a vessel with a processing chamber for containing sand or other grinding media, a rotatable impeller in said chamber for agitating the media, and an inlet and outlet to the chamber to permit the pumping of liquid through the media in the chamber, means defining said vessel comprising:

an outer cylindrical jacket having an annular flange welded to its lower end and an annular flange welded to its upper end, each of said flanges having an outer portion which extends outwardly beyond the cylindrical outer surface of the jacket, each of said flanges further including a portion extending inwardly beyond the inner cylindrical surface of the jacket;

a lower connecting ring bolted to the bottom of the vessel, the bolts extending into the outer portion of the lower flange, the ring including an annular groove in its upper surface;

a depending annular rib formed on the inner portion of said lower flange and extending into said groove;

a cylindrical liner positioned within said vessel and forming the processing chamber for confining the grinding media, the lower end of the liner being positioned within said groove adjacent said rib;

an upper connecting ring bolted to the upper flange with the bolts extending into the outer portion of said upper flange, the upper ring having an annular groove formed in its lower surface;

an upstanding annular rib formed on the inner portion of said upper flange and extending into the groove in said upper ring, the upper end of said liner extending into said annular groove in said upper ring adjacent said upstanding rib; and

gasket means positioned within each of said grooves adjacent the ends of said liner and said ribs to seal the joint formed by the liner, the rings and the flanges.

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