Aug. 29, 1961 L. N. LANG 2,998,064

STRAINER CONSTRUCTION

Filed Dec. 11, 1957

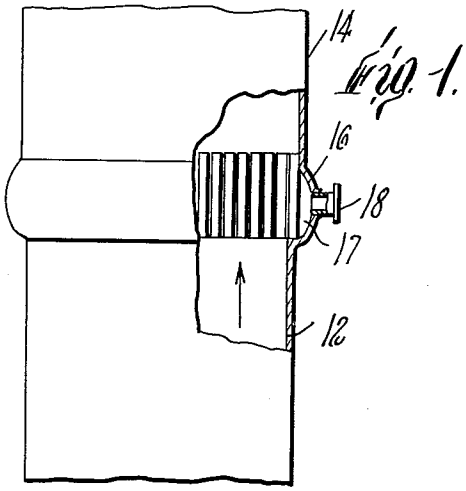


Fig. 1.

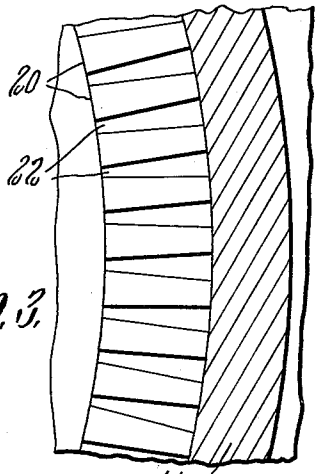


Fig. 3.

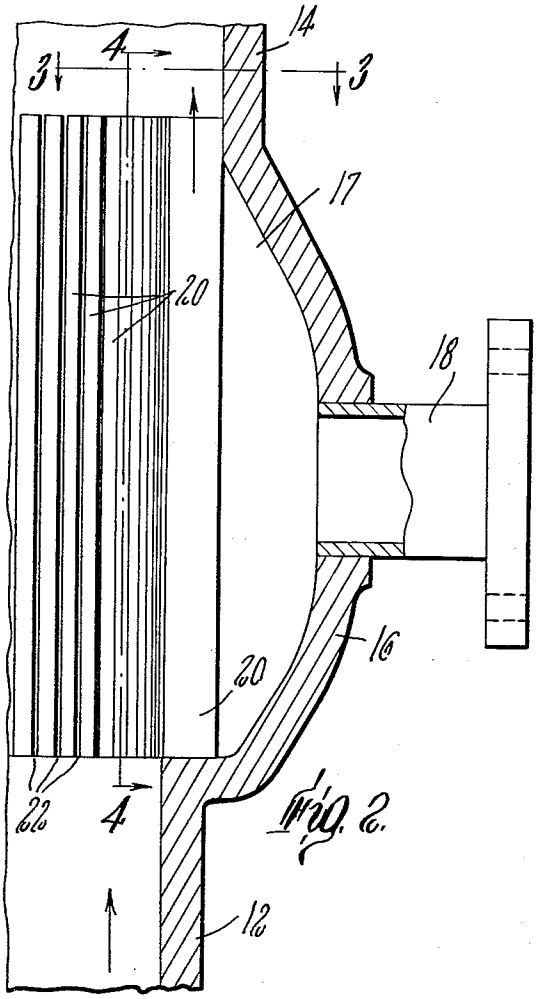


Fig. 2.

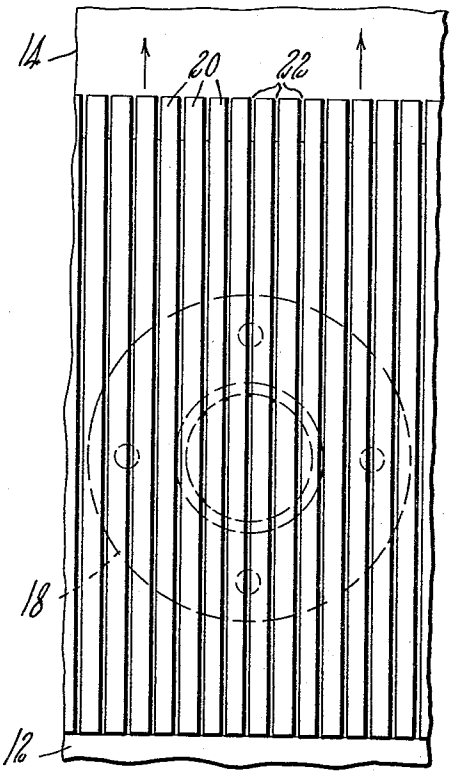


Fig. 4.

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STRAINER CONSTRUCTION

Lloyd N. Lang, De Pere, Wis., assignor to Improved Machinery Inc., Nashua, N.H., a corporation of Maine

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This invention relates to the separation of the components of a solid particle-liquid mixture and more particularly to a novel strainer construction therefor especially useful in apparatus for the continuous pulping of wood chips in the manufacture of pulp for the papermaking industry.

Continuous pulping of wood or other fibrous material is carried out, for example, by digesting particles of fibrous materials such as wood chips in a highly heated liquid chemical solution, preferably under pressure, by feeding the wood chips into one end of a reaction vessel and advancing them toward the other end while treating them so that they will be substantially reduced to pulp by the time they reach the end of the reaction vessel for discharge. This operation, particularly in the case of multiple zone treatment, requires that the liquid be continuously separated from the wood chips both for heating it and in order to replace spent liquid as required. For doing this, the reaction vessel is commonly provided with a peripheral strainer usually consisting of a plurality of slots or holes in the wall of the cylindrical reaction vessel forming a band therearound, the said slots or holes communicating with an annular chamber suitably connected to heaters, fresh liquid chemical supply, etc. However, this type of structure tended to clog because of the tendency of a wood chip partially within and passing along a slot or hole to become lodged therein against the downstream end wall of the slot or hole. When this occurred, successive wood chips tended to pile up behind such a chip and so clog the slot or hole. If this occurred in enough slots or holes to prevent the required flow of liquid therethrough, the apparatus had to be shut down for cleaning. In an attempt to solve this difficulty, various means have been employed, for example, mechanical fingers arranged periodically to enter the slots or holes to force out chips lodged therein or valves to reverse the liquid flow to flush out the lodged chips. These means, however, have proved to be cumbersome, expensive and difficult to maintain, and hence do not offer an entirely satisfactory solution to the problem.

Accordingly, it is an object of the present invention to provide a non-clogging strainer structure of simple and rugged design and construction in order to obviate the above-mentioned problems so that continuous pulping apparatus can be operated continuously without the necessity of expensive and time-consuming shutdowns or cumbersome ancillary apparatus for the purpose of unclogging strainers.

This object has been accomplished according to the present invention by providing a strainer structure wherein slots are oriented longitudinally in the reaction vessel and are open at their downstream end in the direction of movement of the wood chips for a depth at least as great as that to which a wood chip may be received in the slot. Thus, if a wood chip enters a slot either entirely or partially, it will either pass through or be moved along the slot by the advancing mass of chips until it passes freely from the end thereof. The reaction vessel wall is preferably displaced to provide the open downstream end of each of said slots.

Various other objects and features of the invention will become apparent from the following description of a preferred embodiment thereof, taken with the accompanying drawings, wherein:

FIG. 1 is an elevation partially broken away and in section showing a portion of a reaction vessel incorporating the invention;

FIG. 2 is an enlarged elevation of a portion of FIG. 1;

FIG. 3 is a cross-sectional plan taken on the line 3—3 of FIG. 2; and

FIG. 4 is a cross-sectional elevation taken on the line 4—4 of FIG. 2.

Referring to the drawings, the continuous pulping reaction vessel, partially shown in FIG. 1, is shown for a specific example generally upright and of cylindrical shape and includes means for feeding wood chips into the bottom thereof and removing pulp from the top as is well known in the art, being shown for example in copending application Ser. No. 561,405, filed January 26, 1956, now Patent No. 2,878,116, and hence not shown herein. One or more strainers, such as the one shown in FIG. 1 may be employed at various vertical levels in the vessel as may be required in view of the chemical or other processes to be carried out in the vessel, and such strainers may be connected through their surrounding annular chambers, to suitable heaters or sources of fresh liquid chemical or the like as needed, all as is well known in the art.

According to the present invention, however, the reaction vessel has a lower imperforate wall portion **12** below the perforate strainer portion and an upper imperforate wall portion **14** above said strainer portion, the vessel walls being bulged outwardly between said imperforate wall portions to form the outer wall **16** of an annular chamber **17** which includes a pipe **18** which may be connected to a heater or source of liquid chemical supply etc. as required. The upper imperforate wall portion **14** is spaced radially outwardly from the lower imperforate wall portion **12** by a distance at least as great as the size of the wood chips or other solid particles to be separated. The perforate wall portion between said imperforate wall portions defines the inner wall of annular chamber **17** and comprises a plurality of bars **20** extending between said upper and lower wall portions in a direction preferably parallel to the axis of the vessel but at least not converging in a direction of chip movement. The bars **20** are spaced from one another as a band extending entirely around the periphery of the vessel to form a plurality of slots **22** of a width less than that of the size of a wood chip or other solid particle to be separated from the liquid which will pass freely through the slots. Preferably, the bars **20** are of generally truncated shape so that the space between them defining slot width increases in a radial direction outwardly, as best shown in FIG. 3, so that jamming of chips between the bars is decreased.

It is essential in accordance with the principles of this invention that the inner faces of bars **20** forming the inner face of the perforate wall portion, that is the faces toward the axis of the reaction vessel, are positioned with respect to the inner face of lower wall portion **12** at least not inwardly thereof and preferably flush therewith, and that said faces of bars **20** are positioned inwardly with respect to the inner face of upper wall portion **14** by a distance at least as great as the size of the wood chip or other particles. Thus, the bars **20** being generally rectangular in side elevation, are welded to the upper end of lower wall portion **12**, preferably with their innermost faces flush therewith and are welded to the lower end of the upper wall portion **14** preferably with their outermost faces in contact therewith, as shown, with their upper ends adjacent the upper wall portion extending inwardly therefrom in a direction perpendicular thereto. By so doing, the upper wall portion **14** is thereby spaced radially outwardly from the lower wall portion by a distance equal to the thickness of said bars, with the innermost faces of said bars parallel to said axis or diverging somewhat upwardly to avoid jamming.

Typical dimensions of the slots **22** between the bars is 1/16 to 3/16 inch, preferably 1/8 inch, with the thickness of the bars defining the radial displacement of the upper and lower wall portions being about 3/4 to 2 inch, preferably 1½ inch. If this be compared with a typical wood chip size of 1/16–3/8 x 5/8–1½ inch in its smallest and largest dimension, it will be seen that such wood chips will be prevented from passing between the bars **20** into chamber **17**, and yet even if they were to extend into the slot for their maximum dimension, such dimension is still less than the radial displacement of the wall portions. Hence, there is no obstruction to the passage beyond the upper downstream end of the slot of a wood chip in the slot so that, during operation, with wood chips passing upwardly along the slots and the inside faces of the bars, the recessed position of the inner surface of the upper wall portion relatively to the inner faces of the bars **20** will prevent contact of a wood chip with any surface or wall which might tend to obstruct it.

While I have chosen to illustrate my invention in a generally upright reaction vessel in which the wood chips move upward, it is equally suited for use in a vessel in which the wood chips move downward, in which case the entire structure will be inverted, with the inner faces of the bars flush with the upper wall. Likewise, the invention may be used in a generally horizontal reaction vessel, or any other, so long as the displacement of the vessel walls before and after the strainer occurs in the correct relationship to the direction of flow, that is, with the downstream end of the slots open.

Thus it will be seen that the structure of the invention provides a novel strainer structure for separation of solid particles, such as wood chips, from a liquid. Various modifications of the invention such as to dimension of the slots and radial displacement in conformance with the size of the solid particles to be separated, within the spirit of the invention and the scope of the appended claims will be apparent to those skilled in this art.

What is claimed is:

1. In apparatus for the continuous separation of the components of a solid particle-liquid mixture, an elongated vessel having a first imperforate wall portion with an inner face, a second imperforate wall portion spaced axially and outwardly from said first imperforate wall portion, and a perforate wall portion with an inner face extending axially between said imperforate wall portions, said perforate wall portion having a plurality of spaced elements providing a plurality of slots extending longitudinally of said vessel and having the inner face of said perforate wall portion positioned with respect to said first wall portion at least not inwardly with respect to the inner face of said first wall portion and positioned inwardly from said second wall portion with the ends of said members adjacent said second wall porttion extending inwardly therefrom to said face of said perforate wall portion, whereby solid particles advancing through said vessel along and at least partially within said slots from said first to said second wall portions pass freely from the ends of said slots and liquid passes through said slots.

2. In apparatus for the continuous separation of the components of a solid particle-liquid mixture, an elongated vessel having a first imperforate wall portion with an inner face, a second imporforate wall portion spaced axially and outwardly from said first imperforate wall portion, and a perforate wall portion extending axially between said imperforate wall portions, said perforate wall portion comprising a plurality of bars extending between said first and second wall portions and spaced from one another around the periphery of said vessel to provide a plurality of slots extending longitudinally of said vessel around the periphery thereof, said bars having their inner faces positioned with respect to said first wall portion at least not inwardly with respect to the inner face of said first wall portion and positioned inwardly from said second wall portion with the ends of said bars adjacent said second wall portion extending inwardly therefrom to said faces, whereby solid particles advancing through said vessel along and at least partially within said slots from said first to said second wall portions pass freely from the upper ends of said slots and said liquid passes through said slots.

3. In apparatus for the continuous treatment of the wood chip component of a wood chip-liquid mixture, an elongated generally upright pressurized reaction vessel of generally cylindrical shape having a lower imperforate cylindrical wall portion, an upper imperforate cylindrical wall portion spaced radially outwardly from and concentric with said lower imperforate wall portion and a perforate wall portion therebetween defining the inner wall of an annular chamber, said perforate wall portion comprising a plurality of bars extending between said upper and lower wall portions and spaced from one another around the periphery of said vessel to provide a plurality of slots extending longitudinally of said vessel around the periphery thereof continuously between said wall portions, said bars having their inner faces positioned flush with respect to said lower wall portion providing a slotted cylindrical surface forming a continuation of said lower wall portion and positioned inwardly from said upper wall portion with the ends of said bars adjacent said upper wall portion extending inwardly therefrom to said faces, whereby wood chips advancing upwardly through said vessel along and at least partially within said slots pass freely from the upper ends of said slots and liquid passes through said slots into said annular chamber.

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