

July 5, 1955

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2,712,488

METHOD AND APPARATUS FOR WASHING PULP

Filed Nov. 12, 1949

3 Sheets-Sheet 1

Fig. 1.

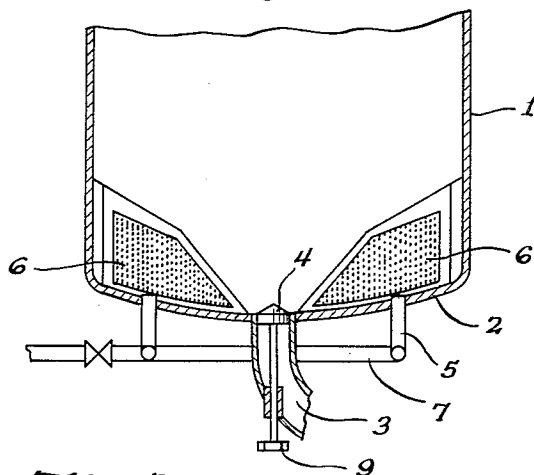


Fig. 2.

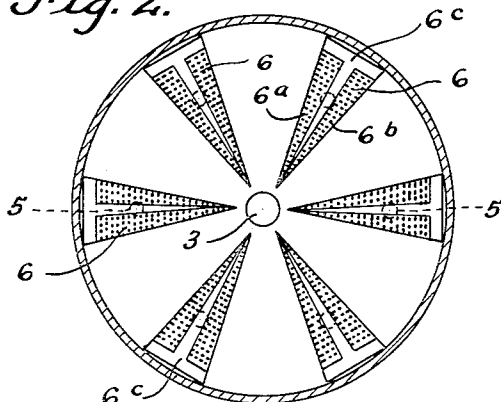
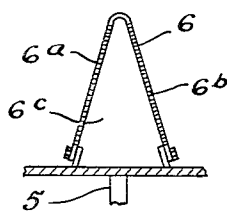


Fig. 3.



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Fig. 4.

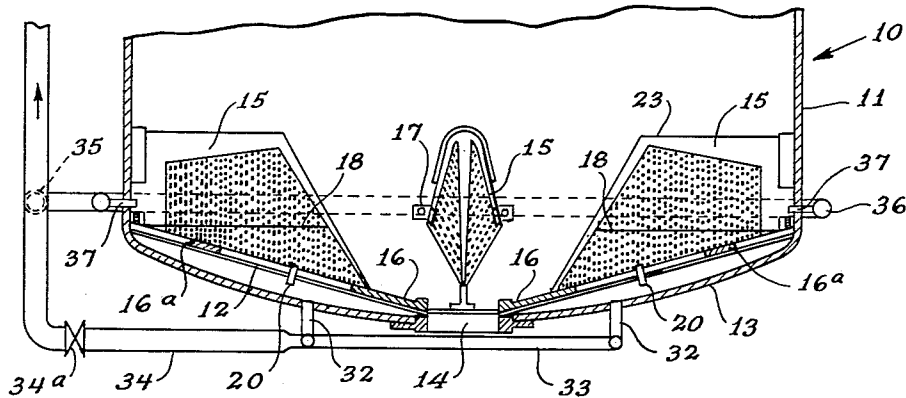
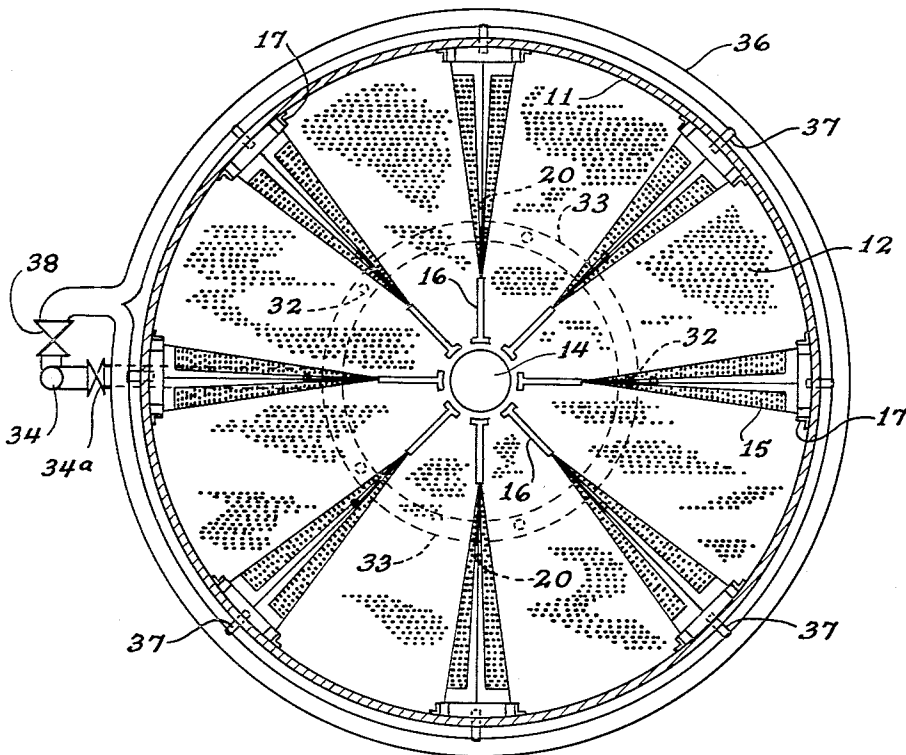


Fig. 5.



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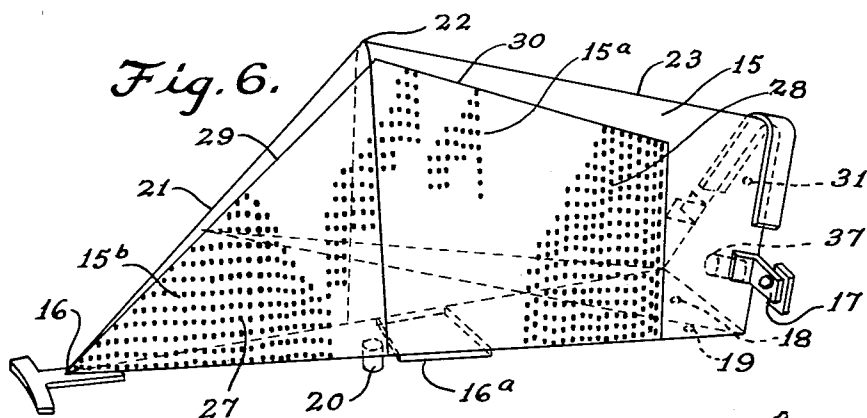
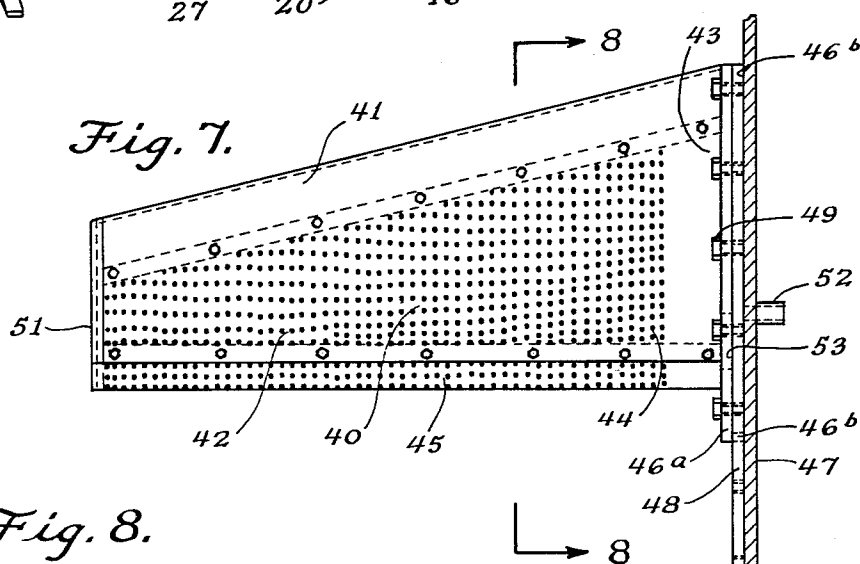
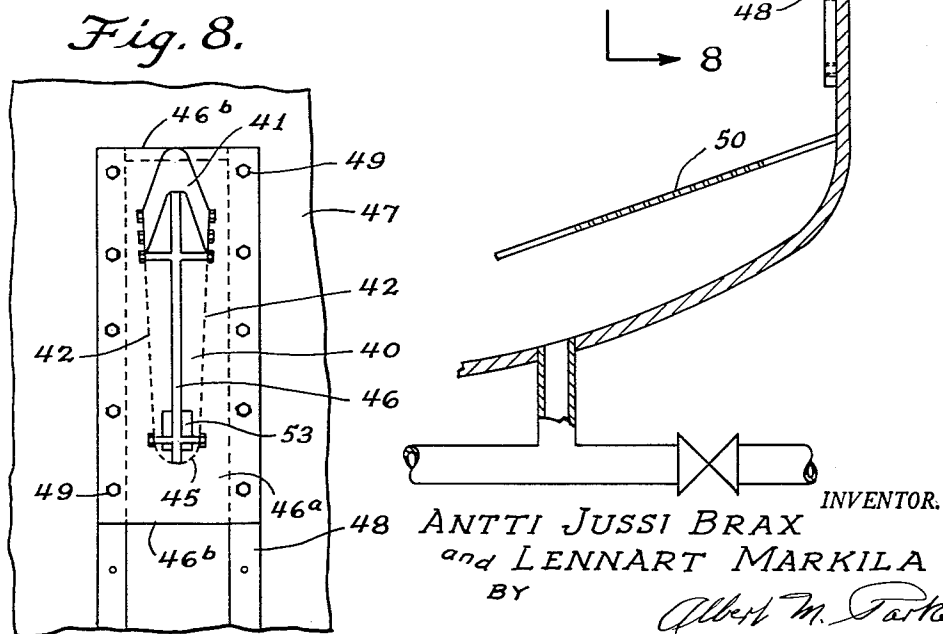
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3 Sheets-Sheet 3



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METHOD AND APPARATUS FOR WASHING PULP

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9 Claims. (Cl. 8—156)

This invention relates to improvements in washing apparatus and methods of washing, and, in particular, to such apparatus and methods for washing fibrous materials.

In the washing of fibrous materials such as chemical pulp, it has been the practice to use tanks, either closed or open, to receive the pulp, which tanks are equipped with screens adjacent the bottom thereof. Washing liquid is introduced in the top of the tank and passes down through the fibrous stock removing therefrom the heavy cooking liquor, which latter flows off through the screen at the bottom of the tank. It is well known that the flow of liquid out of the tank is greatest in the immediate vicinity of the side walls of the washing tank. It will thus be appreciated that the greatest amount of diluted waste liquor is discharged at this part of the tank. In the washing of sulphate pulp, a blow tank diffuser is generally used, but the use of this equipment is objectionable in that it takes too much time and results in diluted waste liquor. A series of diffusers and a very considerable amount of heat must be employed for concentrating such waste liquor.

The prior art equipment above described is inefficient. The inventors have now found, that this is due largely to the fact that during the washing operation on account of flow of the washing liquid and of the weight of the fibrous material, or pulp, there is accumulated a compact layer on the strainer surface of the bottom of the tank. In a short time this accumulation serves to materially retard, and eventually substantially prevent, the outflow of waste liquor through the whole strainer bottom.

The principal object of the present invention is to provide for the washing of fibrous materials more rapidly and more economically than has heretofore been the case.

Another object is to provide for the drawing off of the waste liquor in the washing of fibrous materials without interference from the fibrous mass.

A further object is to prevent the settling of the fibrous mass to the bottom of the washing tank from interfering with the discharge of waste liquor from the tank.

Further and more detailed objects of the invention will in part be obvious and in part be pointed out hereinafter as the description of the invention, taken in conjunction with the accompanying drawing, proceeds.

In that drawing:

Figure 1 is a fragmentary vertical section through a washing tank in accordance with the invention and through two of the strainer compartments.

Figure 2 is a top plan view looking into a washing tank towards the bottom thereof, which tank is equipped with six strainer compartments.

Figure 3 is an enlarged vertical cross-section of a strainer compartment as shown in Figure 2.

Figures 4 and 5 are views respectively similar to Figures 1 and 2 of another embodiment of the invention.

Figure 6 is an enlarged perspective view of a strainer compartment adapted to be employed in a tank, as shown in Figures 4 and 5.

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Figure 7 is an elevation of another embodiment of strainer compartment shown as applied to a fragmentary vertical section of a tank, and

Figure 8 is a vertical section of a strainer compartment of Figure 7 taken on lines 8—8 of Figure 7.

Though several embodiments of the invention are shown in the various figures of the drawing, and are to be described in detail hereinafter, it is to be expressly understood that such showings are solely for illustrative purposes and that the invention is not limited thereby.

Generally speaking, the invention is concerned with the provision of a suitable number of screen, or strainer compartment or compartments, and the mounting of the same in the lower portion of washing tanks. Such compartments are so formed and mounted that, during the washing operation, portions of the compartments will extend above the pulp layer compacted adjacent the bottom of the tank, the screen surfaces thereby being so placed in such a compact layer that the one formed on the pulp supporting bottom cannot occur on said surfaces, thus providing for the relatively rapid flowing off of the removed liquor, while leaving the fibrous material behind in the tank.

In the embodiment shown in Figures 1 and 2, the side wall of the washing tank is indicated at 1, its imperforated bottom at 2, and an outlet for the washed pulp at 3. The valve 4, arranged in the outlet 3 keeps the outlet closed during the washing process and can be operated with the handle 9.

The bottom 2 is provided with a plurality of strainer compartments 6 which, as shown in Figure 2, are arranged radially and spaced apart with a substantial portion of the bottom 2 remaining between them and using a part of the bottom 2 as their bases. Each compartment 6 is provided with a discharging pipe 5. These strainer compartments are formed of strainer plate, or other suitable material, have sloping side walls 6a and 6b converging to a common top, or ridge. The compartments 6 extend from a point adjacent the outlet opening 3 to a point closely adjacent, or right up against the side wall 1, and diverge at their bases in a wedge shape, as shown in Figure 2. As the bottom 2 is unperforated throughout, all liquid will pass through the strainer plate of the compartment walls 6a and 6b into the compartment 6 and will be drained off through the pipes 5, which are connected with a ring main 7 from which the waste liquor passes through a waste discharge pipe provided with a valve. The ends 6c of the compartment 6 are preferably formed of ordinary unperforated plate. The embodiment shown in Figures 1, 2 and 3 functions as follows:

Washing liquid is introduced at the top of the tank containing pulp from which it is desired to remove the cooking liquor and the washing liquid flows downwardly, removing the heavier cooking liquor, which runs off through the strainer compartments. The strainer compartments 6 are so dimensioned as to extend above the most compact pulp layer, so the removed liquor can continue to flow relatively unhindered through the strainer surfaces of the strainer compartments 6 during the whole washing process. This liquor escapes through the outlets 5, the ring main 7 and then, through the waste discharge pipe. The steep side walls and narrow tops of the strainer compartments prevent the pulp accumulating thereon, in as compact a manner as on the pulp mass supporting bottom of a washing tank, thus, the flow of washing liquid can continue relatively unhindered.

In the embodiment shown in Figures 4 and 5, the tank, generally indicated at 10, has a side wall 11, a screen bottom 12, and a closing end 13. The center bottom opening for removing the washed pulp is shown at 14, while the strainer compartments are indicated at 15. In this instance the strainer compartments 15 are shown

as eight in number, but are mounted radially within the washing tank, as in the embodiment previously described. Likewise the strainer compartments 15 diverge towards the side wall 11. In this instance, however, the compartments 15, rather than lying directly on the bottom 12, may be mounted a slight distance above the same by means of the braces 16 and the end supports 17 (Figure 6). The braces 16, the supporting plates 16a, and mounting members 17 are respectively affixed to the bottom 12 and side wall 11.

In this instance, the strainer compartment 15, as shown in detail in Figure 6, is divided into two superposed sections 15a and 15b. These sections are separated from each other by an imperforate inclined bottom 18 which serves as the bottom for the upper section 15a, while the bottom 19, being the bottom of the whole compartment 15, is also the bottom of the lower section 15b. The bottom 19 is also imperforate and is provided with an outlet 20 for carrying away the liquid flowing into the section 15b. The inner end edges 21 of the strainer compartments 15 incline sharply upwardly from the brace 16 to a peak point 22. From there to their outer ends they continue in a substantially horizontal line 23. Thus, in effect, each side wall of the compartment 15 has a triangular tip portion 21 and a trapezoidal, or other polygonal, main portion 28. The substantial part of the portions 27 and 28 is perforated, as indicated by the outline of the perforated portion in Figure 6. These perforations are, for instance, in the form of conical holes from 1 to 3 millimeters in diameter, and spaced from 5 to 10 millimeters apart. The edge of the triangular portion 27, however, between the lines 21 and 29 and the edge of the portion 28 between the top 23 and the line 30, as well as the rear part of the portion 28 and the end plate 31, are imperforate.

The outlet 20, from the lower section 15b, discharges the liquid flowing into the lower section 15b into the end 13, from where it is carried off by pipes 32 which discharge into a ring main 33. The ring main 33 is connected with a rising pipe 34 which extends up along-side of the tank and connects at 35 with another annular pipe 36 connecting the tank at a position opposite to the end plates 31 of the strainer compartments 15. The pipe 36 is connected at 37 by suitable short pipes extending through the end walls 31 with the interior of the upper portions 15a of the compartment 15.

A valve 38 is interposed between the annular pipe 36 and the rising pipe 34, so that the annular pipe 36 and, accordingly, the upper sections 15a of the strainer compartments 15 may be disconnected. This forces the liquid within the tank to escape only through the lower sections 15b of the respective compartments 15. Thus, the liquid will pass out through the pipe 20.

The washing operation in the form of Figures 4 through 6, corresponds generally to that described in connection with Figures 1 to 3, but differs therefrom in that the draining, or straining, of liquid also can take place through the perforated screen bottom 12. The liquid can be discharged either through the screen bottom 12, the outlets 20 and the annular pipe 36 simultaneously, or only through the annular pipe keeping hereby the valve 34a in the pipe 34 closed or, as above is said, only through the bottom 12 and the outlets 20. The liquid through the upper section 15a of the compartment 15, can be cut off as soon as the boundary layer between the concentrated liquor and diluted liquid has dropped to the level of the bottom of the section 15a. This shutoff prevents the already diluted liquid from being taken along while the concentrated liquor in the lower part of the tank will be drawn off through the lower section 15b, the outlet 20, and the perforated bottom 12. When the boundary layer between concentrated liquor and diluted liquid no longer exists, and liquid flowing through the outlet 20 and the screen bottom 12 is fully diluted, the washing operation is at an

end. Instead of having the compartments 15 divided in two sections 15a and 15b, the tank according to Figures 4 and 5 can be provided with compartments shown in Figures 1-3, either placed directly on the screen bottom 12 or provided with a separate bottom plate similar to that in compartments 15. If placed directly on the screen bottom, the outlets 20 may be omitted. By operating the valves 34a and 38 in the pipes 34 and 36 the washing procedure can take place in the aforesaid manner. If wanted, the annular pipe 36 can be omitted whereby the liquor during the whole washing procedure will be drained off through the bottom 12 and the outlets 20 into the closing end 13 and herefrom into the pipe 34.

The strainer compartment 40, in the form shown in Figures 7 and 8, differs from the Figure 6 embodiment in being designed to be affixed to the tank wall at a desired level. This compartment, like that of Figure 6, has an imperforate top section 41 and has perforated side plates 42 whose perforations may, if desired, extend all the way to the inner end 43, but may otherwise be terminated at a position spaced therefrom, as shown at 44. The strainer compartment 40 is rhombic in cross section, as shown in Figure 8, and has its rounded bottom 45 also perforated almost from the outer to the inner end as indicated.

The compartment 40 is supported by a cross-shaped frame 46 which in turn through a plate 46a is mounted on the tank wall 47 by means of suitable supporting rails 48 and bolts 49. Tightening lists 46b, which stiffen the plate 46a, are fixed on the upper and the lower end of the plate 46a between the rails 48. These lists 46b close the space between the plate 46a and the wall 47, simultaneously permitting the regulation of the vertical position of the compartment 40 in relation to the perforated bottom 50 of the tank in dependence from the thickness of the compact pulp layer accumulated in the tank. Said space communicates with the inner side of the compartment 40 in a suitable manner, for instance through the opening 53 shown in Figs. 7 and 8. Instead of the opening 53 the plate 46a may also be open at the whole area innerside the fastening lines of the compartment 40, or the plate 46a may be perforated. The several compartments 40 of this type employed within the tank will point from the wall towards the center of the tank and may, if desired, slant together their center. Their inner ends 51 would normally be imperforate, but may if desired be perforated.

The operation of this embodiment is similar to that of the embodiments already described, for here, again, the strainer compartments are formed and mounted so as to prevent the hindrance to the withdrawal of waste liquor otherwise affected by the accumulation of the pulp layer on the strainer bottom of the tank. Also here the screens of the compartments are so placed that they cannot be covered by such a compact pulp layer as formed on the pulp supporting bottom. In this embodiment the liquor entering into the compartments 40 discharges out through the opening in the plate 46 and further through a pipe 52 at the wall 47 and is drawn off through an annular pipe, such as the pipe 36, shown in Figures 4 and 5. Here, again, the outlet through the pipes 52 can be closed off when the level of the concentrated liquor has fallen below the level at which it could be discharged through the strainer compartment. The concentrated waste liquor remaining is withdrawn through the strainer bottom 50.

In the embodiments shown in Figures 6 and 7, it is desirable to determine when the boundary layer between the concentrated liquor and the diluted liquid has fallen to where it is desirable to close the discharges leading away from the strainer compartments. This can be accomplished by some such means as a pipe extending from the outside of the tank and opening outward through the unperforated top part of the compartment and another pipe for withdrawing samples from beneath the compartment. When these are connected outside the tank to

means for measuring liquor concentration, the level of the boundary layer can be determined.

Tanks with strainer compartments, as disclosed in Figures 6 or 7, may also be operated in a somewhat reverse manner. In other words, instead of shutting off the withdrawal of liquor from the compartment of Figure 7, or upper section of the compartment of Figure 6 at the time that the boundary layer has dropped to the level where the compartments are no longer effective for drawing off the concentrated liquor, the valves are left open. The washing liquid introduced at the top of the tank is shut off and instead, washing liquid is introduced up through the screen bottom of the tank. This consequently raises the level of the waste liquor and allows it to be withdrawn through the strainer compartments. This washing step has the further advantage that the pulp layer does not accumulate so compactly on the screen bottom and, thus, the final emptying of the pulp out of the tank is facilitated.

Modifications and variations in the apparatus and method above set forth will be readily apparent to those skilled in the art and may, of course, be made without departing from the spirit and scope of the invention, it being intended that all matter contained in the above description, or shown in the accompanying drawing be interpreted in an illustrative and not in a limiting sense. For instance, the number, position and form of strainer compartments can be modified, so long as the total straining surface in each separate case is sufficiently great, that the compartments reach above the compacted pulp layer and are so placed that they cannot be covered by a compact pulp layer, as on the washer bottom. Thus, the surfaces 42 shown in Figs. 7 and 8 may be unperforated so that liquor only is drawn off the lowermost perforated surface 45. Hereby the side walls 42 of the compartment may be shortened. Instead of having a number of compartments, for instance six or eight according to Figs. 2 and 5, only one compartment can be used. This compartment may be placed on the bottom of the tank as a ring concentric to the center of the tank, the ring compartment having thereby in radial direction a cross-section similar to the cross-section in Fig. 3. Hereby also the steep screen plates on both sides of the ring compartment are ring-shaped. However, the outer side of the ring compartment may extend to the side wall of the tank. Hereby the ring compartment preferably may be built of a ring-shaped, almost vertical screen plate between the center and the sidewall of the tank, the top of the compartment being thereby connected with the wall of the tank by means of an unperforated plate placed either horizontally or slanting towards the center of the tank. The bottom and the wall of the tank form hereby respectively the bottom and the outer wall of the compartment which wholly extends in horizontal direction over a substantial part of the bottom of the tank. The invention also contemplates the provision of suitable spraying devices entrained upon the strainer surfaces for cleaning purposes when necessary.

Having described the invention, what we claim as new and desire to secure by Letters Patent is:

1. A strainer compartment for pulp washing apparatus which comprises, an elongated base, said base increasing in width from one end to the other thereof, an imperforate end wall extending substantially laterally upwardly from said base, and a pair of side walls extending upwardly from the longitudinal edges of said base, said side walls converging into a joining element along the tops thereof, and said side walls being engaged with said end wall, forming an enclosure defined by said base, said end wall, said joining element and said side walls, said side walls being formed with perforations throughout a substantial portion of their height for draining liquid therethrough, and said base being provided with means for draining off said liquid.

2. A structure as defined in claim 1, said imperforate

end wall being formed with a draining opening therethrough.

3. A structure as defined in claim 1, and including a separating element mounted within said drainage compartment for dividing said strainer compartment into two separate compartment portions.

4. A strainer compartment for pulp washing apparatus which comprises, an elongated base, said base increasing in width from one end to the other thereof, an imperforate end wall extending substantially laterally upwardly from said base, and a pair of side walls extending upwardly from the longitudinal edges of said base, said side walls converging into a joining element along the tops thereof, and said side walls being engaged with said end wall, forming an enclosure defined by said base, said end wall, said joining element and said side walls, said side walls being formed with perforations throughout a substantial portion of their height for draining liquid therethrough, and means for draining off said liquid from said compartment.

5. The process of washing pulp blown from a digester to remove the cooking liquor therefrom and recover such liquor in substantially undiluted state which comprises, confining a quantity of pulp carrying such liquor, washing said cooking liquor from said pulp by introducing washing liquid on top of said pulp, drawing off the substantially undiluted cooking liquor washed from said pulp through an area extending both longitudinally and vertically into said quantity of pulp and terminating said drawing action when cooking liquor diluted by said washing liquid commences to flow through said area.

6. The process of washing pulp blown from a digester to remove the cooking liquor therefrom and recover such liquor in substantially undiluted state which comprises, confining a quantity of pulp carrying such liquor, washing said cooking liquor from said pulp by introducing washing liquid on top of said pulp, straining off cooking liquor through an area extending upwardly through part of said pulp at an incline from a small angle with respect to the vertical, and terminating said straining action when cooking liquor diluted by said washing liquid commences to flow through said area.

7. The process of washing pulp blown from a digester to remove the cooking liquor therefrom and recover such liquor in substantially undiluted state which comprises, confining a quantity of pulp carrying such liquor, washing said cooking liquor from said pulp by introducing washing liquid on top of said pulp, drawing off substantially undiluted cooking liquor washed from said pulp through an area extending both longitudinally and vertically into said quantity of pulp and terminating said drawing action when cooking liquor diluted by said washing liquid commences to flow through said area, and withdrawing additional undiluted cooking liquor through a second area located below said first area.

8. The process of washing pulp blown from a digester to remove the cooking liquor therefrom and recover such liquor in substantially undiluted state which comprises, confining a quantity of pulp carrying such liquor, washing said cooking liquor from said pulp by introducing washing liquid on top of said pulp, drawing off the substantially undiluted cooking liquor washed from said pulp through an area extending both longitudinally and vertically into said quantity of pulp, terminating said drawing action when cooking liquor diluted by said washing liquid commences to flow through said area and drawing off additionally undiluted cooking liquor from the bottom of said mass of pulp.

9. The process of washing pulp blown from a digester to remove the cooking liquor therefrom and recover such liquor in substantially undiluted state which comprises, confining a quantity of pulp carrying such liquor, washing said cooking liquor from said pulp by introducing washing liquid on top of said pulp, drawing off part of the substantially undiluted cooking liquor washed from said

pulp through a zone extending horizontally with respect to the base of said quantity of pulp and extending vertically from said base up within said quantity of pulp, observing the boundary between undiluted cooking liquor and cooking liquor diluted by said washing liquid, terminating the drawing off of said undiluted cooking liquor through said zone when said boundary has moved down to said zone and thereafter drawing off additional undiluted cooking liquor from the bottom of said quantity of pulp.

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