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695,027, Jan. 2, 1968, now abandoned.

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[54] **SCREENING APPARATUS**
8 Claims, 5 Drawing Figs.

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 209/283, 209/306, 210/412, 210/415
 [51] Int. Cl. B01d 29/38
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 411, 415, 433, 209, 213, 219, 412; 209/282, 283,
 273, 280, 281, 306

ABSTRACT: Screening apparatus of the type employed for screening pulp stock wherein diluent fluid is supplied adjacent the accepted stock face of the screen for diluting the accepted stock and causing it to flow in a direction counter to the flow of stock along the feed face of the screen.

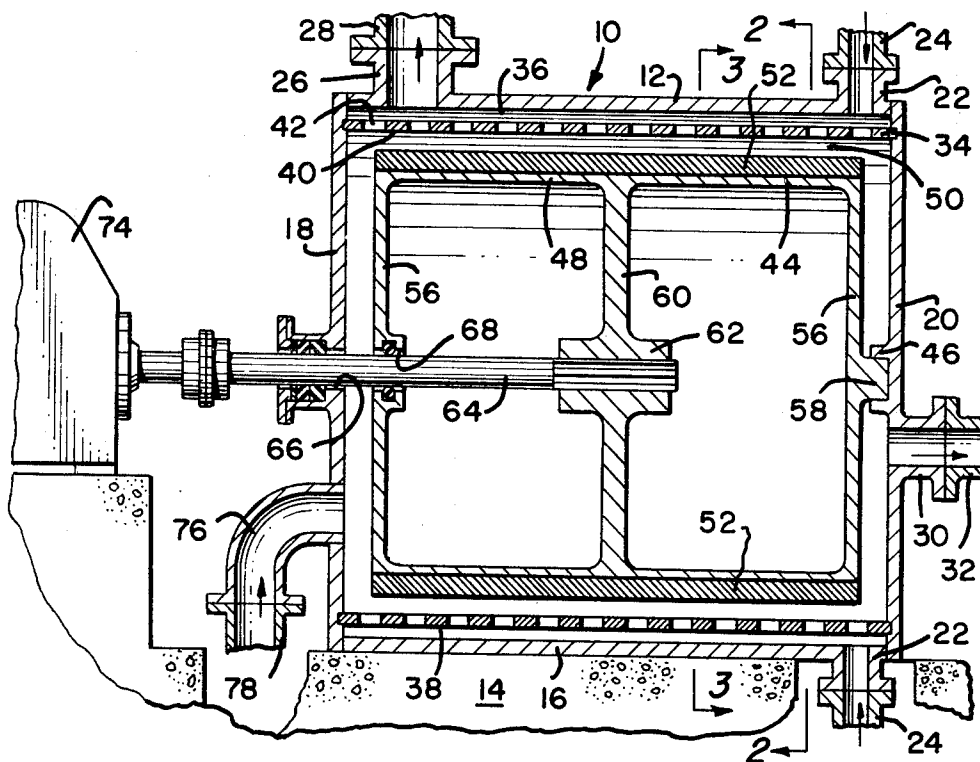


FIG. 1

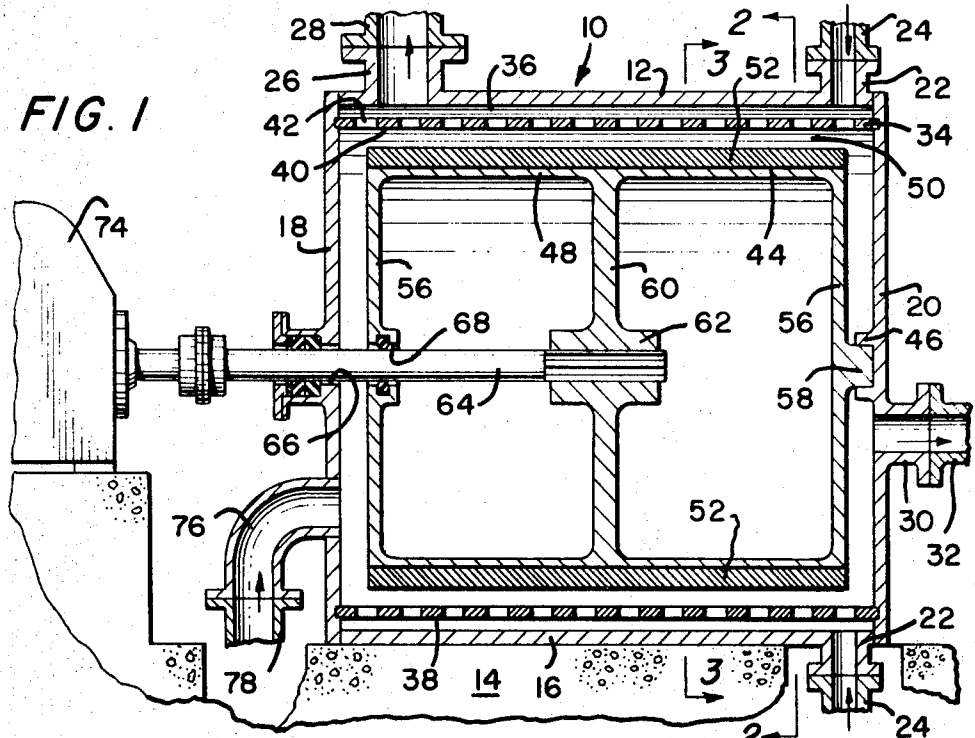


FIG. 3

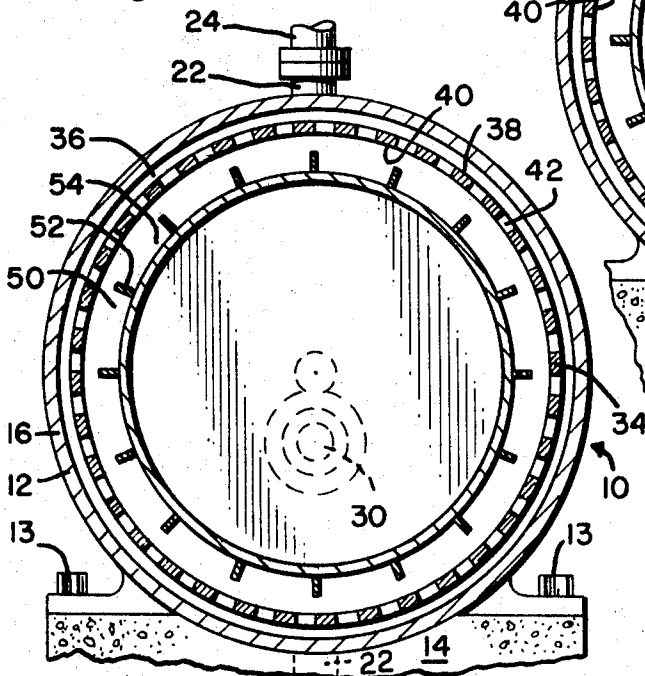
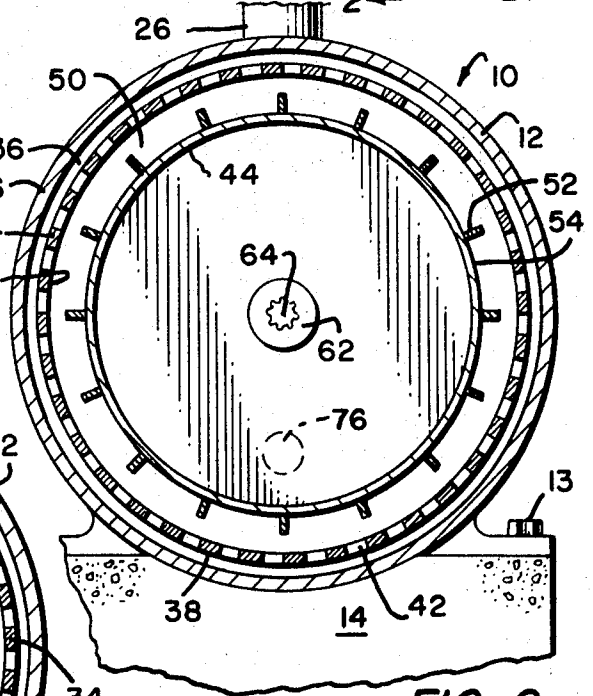
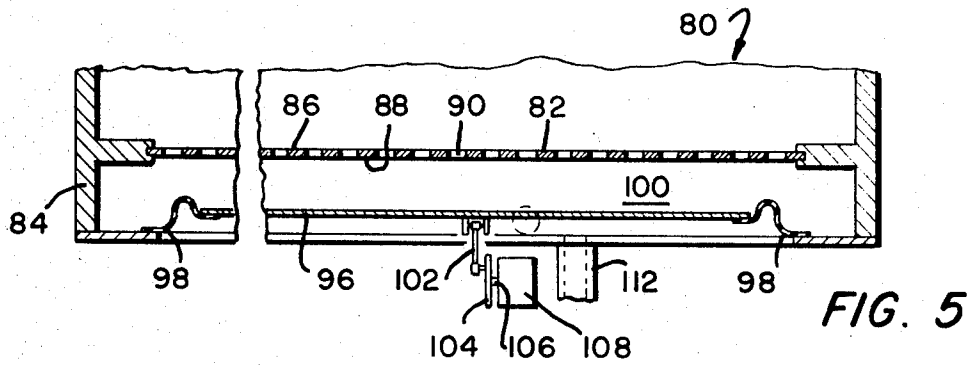
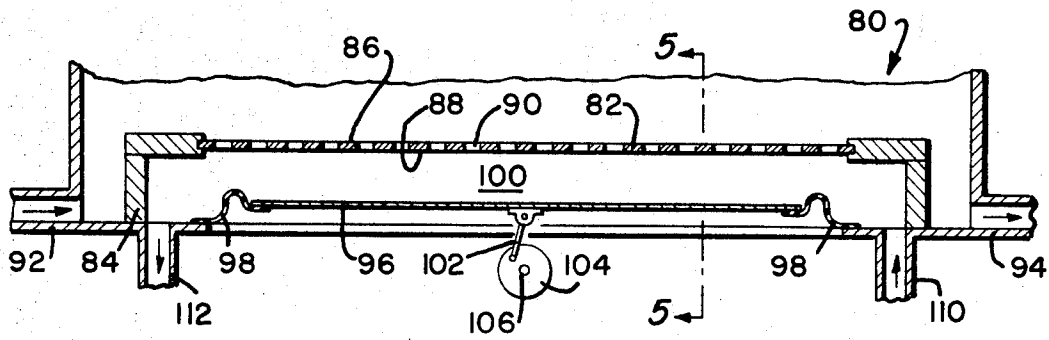


FIG. 2



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SCREENING APPARATUS

This application is a continuation of application Ser. No. 695027 filed Jan. 2, 1968, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to apparatus for screening mixtures of fibrous material and liquid and has more particular reference to screening apparatus of the type employed for screening pulp stock during the manufacture of paper.

Conventionally, screening apparatus of the aforementioned type has included a pulp screen, generally formed from a perforated or slotted metal plate, and has usually been constructed to cause relative vibration between the pulp screen and the pulp stock. This relative vibration may be induced by pulsing the screen, pulsing the accepted pulp stock, pulsing the feed pulp stock, or by rapidly moving a bar or airfoil adjacent a face of the screen to produce a pressure and/or suction wave adjacent the surface of the screen. The relative vibration has, of course, proven to be particularly beneficial to prevent the feed stock from dewatering and forming a mat such as could cause blinding of the screen.

However, in conventional screening apparatus of the aforementioned type, the relative vibration has been found to create additional problems. More specifically, in such conventional screening apparatus, the relative vibration has frequently returned through the screen an undesirably large quantity of accepted stock. This return of the accepted stock, when it occurs adjacent the inlet end of the screen (i.e. the end of the screen initially receiving the feed stock), is objectionable due to its adverse effects on the net throughput of the screening apparatus. This return of the accepted stock, when it occurs adjacent the discharge or rejects end of the screen (i.e. the end of the screen discharging the rejected material), is, of course, undesirable in that it reintroduces a quantity of accepted stock into the rejected material and thereby necessitates that the latter be rescreened to recover this accepted stock.

An object of the present invention is to provide a screening apparatus which includes new and improved means for substantially minimizing the quantity of accepted stock which is returned through the screen during the aforescribed relative vibration.

Another object of the invention is to provide a screening apparatus including new and improved means of the type set forth which is particularly constructed and arranged for substantially minimizing the quantity of accepted stock returned through the screen adjacent the ends of the latter.

SUMMARY OF THE INVENTION

The foregoing objects, and those other objects and advantages of the invention which will be apparent from the following description taken in connection with the accompanying drawings, may be attained by the provision of a screening apparatus which, generally considered, comprises a screen having feed and accepts faces and screening apertures extending therebetween, stock supply means operatively associated with the screen for supplying pulp stock to the screen feed face at one end of the screen, first discharge means operatively associated with the screen and communicating with the stock supply means for discharging stock rejected by the screening apertures from the screen feed face at the other end of the screen, wall means extending along the screen bounding a passage which extends along the accepts face of the screen to receive the stock accepted by the screening apertures, dilution liquid supply means connected to the passage for supplying dilution liquid to the passage at said other end of the screen whereby the dilution liquid intermixes with the accepted stock and causes the latter to flow along the screen accepts face towards said one end of the screen, and second discharge means connected to the passage for discharging a mixture of dilution liquid and accepted stock from the passage at said one end of the screen.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary, elevational sectional view of a rotary screening apparatus including an embodiment of the present invention;

FIG. 2 is a sectional view taken on line 2-2 of FIG. 1, looking in the direction of the arrows;

FIG. 3 is a sectional view taken on line 3-3 of FIG. 1, looking in the direction of the arrows;

FIG. 4 is a fragmentary, elevational sectional view of a screening apparatus including a planar screen in combination with an embodiment of the present invention; and

FIG. 5 is a sectional view taken on line 5-5 of FIG. 4, looking in the direction of the arrows.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout the several views, FIGS. 1 through 3 illustrate a rotary screening apparatus designated generally as 10 which comprises a housing or casing 12 mounted by bolts 13 upon a foundation or support 14. The casing 12 is formed to include a horizontally disposed, annular sidewall 16 and a pair of end walls 18, 20 rigidly connected to the opposing ends of the sidewall 16. The end of the sidewall 16 adjacent the end wall 20 includes a plurality of arcuately spaced, integrally formed, inlet conduits 22 which are each connected through suitable conventional piping, shown fragmentarily as 24, to a source (not shown) of the pulp stock to be screened by the screening apparatus 10. The end of the sidewall 16 adjacent the end wall 18 includes an integrally formed, outlet conduit 26 which is connected through suitable conventional piping, shown fragmentarily as 28, to discharge rejected material from the screening apparatus 10. The end wall 20 includes an integrally formed, outlet conduit 30, connected through suitable conventional piping 32, for discharging the screened pulp stock produced during the operation of the screening apparatus 10.

The casing 12 contains a horizontally disposed, annular screen plate 34 which is rigidly supported at its opposing ends by the end walls 18, 20 and concentrically arranged with the sidewall 16 to provide an annular feed space or fluid passage 36 between the screen plate 34 and the sidewall 16. The screen plate 34 includes a circumferential, outer or feed side face 38, a circumferential, inner accepts or accepted stock side face 40, and a plurality of screening openings or apertures 42 extending between the side faces 38, 40.

A rotor 44 is located within the casing 12 internally of the screen plate 34 and rotatably supported by a hub 46 formed on the end wall 20. The rotor 44 is constructed to include an annular sidewall 48, concentric with the sidewall 16 of the casing 12, which is spaced from the accepted stock face 40 of the screen plate 34 to provide an annular accepts space or fluid passage 50 between the sidewall 48 and the accepted stock face 40. The outer circumference of the sidewall 48 is constructed to include a plurality of protrusions 52 which are spaced by pockets 54. The protrusions 52 and pockets 54, as will be understood, cooperate in a conventional manner to pulse stock in the annular space 50 during the rotation of the rotor 44. The opposing ends of the sidewall 48 of the rotor 44, as illustrated in FIG. 1, are closed by end walls 56, one of which includes an integral stub shaft 58 rotatably supported by the aforementioned hub 46.

The rotor 44 includes an internal, annular mounting flange 60 which carries a hub 62 at its inner end. The rotor 44 is supported by a driving shaft 64 which extends through aligned openings 66, 68 in the end wall 18 of the casing 12 and one of the end walls 56 of the rotor 44, respectively, and is splined to the hub 62. The driving shaft 64 is connected through suitable conventional reduction gearing (not shown) to a driving motor 74 to be rotatably driven by the latter.

The present invention, as applied to the screening apparatus 10, comprises the provision of new and improved means for substantially reducing the quantity of screened pulp stock driven back through the screening apertures 42 during the

rotation of the rotor 44. More specifically, as illustrated in FIG. 1, the end wall 18 of the casing 12 is provided with an integrally formed, inlet conduit 76. The inlet conduit 76 is connected through suitable conventional piping, shown fragmentarily as 78, to a source (not shown) of a diluent fluid, such as clean water, to continuously receive diluent fluid from such source. The diluent fluid supplied through the inlet conduit 76 flows into the annular space 50 and therethrough towards the outlet conduit 30. This flow of the diluent fluid causes it to dilute the accepted stock adjacent the accepted stock face 40 and to cause the resultant diluted accepted stock to flow along the accepted stock face 40 in a direction counter to the flow of feed stock along the feed face 38 of the screen plate 34. This dilution of the accepted stock, as will be understood, substantially reduces the quantity of accepted stock driven back through the screening apertures 42 during the backward flow portions of the cyclic pulses produced by the rotation of the rotor 44. Moreover, as the flow of the diluted accepted stock is counter to the flow of feed stock along the feed face 38 of the screen plate 34, the accepted stock flowing into the annular space 50 through the screening apertures 42 at the opposing ends of the screen plate 34 is substantially immediately removed from adjacent the ends of the screen plate 34. Thus, the large quantity of stock accepted by the screening apertures 42 at the inlet end (i.e. the end adjacent the inlet conduits 22) of the screen plate 34 is prevented from returning through the screening apertures 42; and the stock accepted by the screening apertures 42 adjacent the discharge end (i.e. the end adjacent the outlet conduit 30) of the screen plate 34 is prevented from intermixing with the rejected material at such end of the screen plate 34.

In the operation of the screening apparatus 10, the rotor 44 is continuously rotated to pulse the accepted stock in the annular space 50 whereby, during the forward flow portion of each pulse, stock flows through the screening apertures 42 into the annular space 50 and, during the backward flow portion of each pulse, stock from the annular space 50 is returned through the screening apertures 42 to dilute the feed stock in the annular space 36. The feed stock is introduced into the annular space 36 adjacent the end wall 20 through the inlet conduits 22 and flows along the feed face 38 towards the end wall 18. During this flow of the feed stock, a portion of the latter is accepted by the screening apertures 42 and flows into the annular space 50. The portion of the feed stock rejected by all of the screening apertures 42 is, however, discharged from adjacent the end wall 18 through the outlet conduit 26.

The diluent fluid which is introduced into the casing 12 through the inlet conduit 76 flows through the annular space 50 towards the end wall 20. This flow of the diluent fluid causes it to become intermixed with the accepted stock in the annular space 50 and dilutes the accepted stock. Thus, the stock which is driven back through the screening apertures 42 by the rotation of the rotor 44 is of much lower consistency, relative to the consistency of the feed stock, than in conventional screening apparatus wherein the accepted stock is undiluted. In addition, the diluent fluid flowing through the annular space 50 causes the aforementioned mixture of diluent fluid and screened pulp stock to flow towards the end wall 20 of the casing 12. As a result, this flow of the diluent fluid substantially immediately removes the portions of the accepted stock discharged by the screening apertures 42 nearest the opposing ends of the screen plate 34 to greatly minimize the quantity of the accepted stock driven back through the screening apertures 42 at these locations. The mixture of diluent fluid and accepted stock which is discharged from the annular space 50 flows from the screening apparatus 10 through the outlet conduit 30 and the piping 32 which is connected thereto.

FIGS. 4 and 5 illustrate an embodiment of the present invention as applied to a screening apparatus, designated generally as 80, which includes a flat or planar screen plate 82. As illustrated in FIGS. 4 and 5, the screen plate 82 is peripherally supported by a rigid, imperforate, boxlike sup-

porting structure 84. The screen plate 82, similarly to the aforescribed screen plate 34, includes a feed side face 86, an accepts or accepted stock side face 88, and a plurality of screening openings or apertures 90 extending between the side faces 86, 88.

The screening apparatus 80 includes an inlet conduit 92, communicating with a source (not shown) of the pulp stock to be screened, for supplying stock to the inlet end of the feed face 86 of the screen plate 82, and an outlet conduit 94 for discharging stock rejected by the screening apertures 90 from the opposing or discharge end of the feed face 86. The screening apparatus 80, moreover, includes a rigid, imperforate plate 96, located adjacent the accepted stock face 88, which is peripherally sealed by a diaphragm 98 formed of resilient material. The plate 96 and the diaphragm 98, as illustrated in FIGS. 4 and 5, cooperate with the screen plate 82 to define an accepts or fluid passage 100 which extends along the accepted stock face 88 throughout the length and width of the screen plate 82. The plate 96 is pivotably connected to one end of a link or connecting member 102, the opposing end of which is pivotably connected to a crank 104. The crank 104 is mounted upon a shaft 106 which is connected through suitable conventional reduction gearing (not shown) to a driving motor 108 to be rotatably driven by the latter.

An inlet conduit 110, connected to a source (not shown) of a diluent fluid such as clean water to continuously receive diluent fluid from such source, communicates with the end of the fluid passage 100 adjacent the outlet conduit 94. An outlet conduit 112 communicates with the end of the fluid passage 100 adjacent the inlet conduit 92 for discharging fluid from the fluid passage 100.

In the operation of the aforescribed screening apparatus 80, the motor 108 is operated to cause the plate 96 to be continuously oscillated and thereby pulse the pulp stock in the fluid passage 100 to provide the aforementioned relative vibration. The pulp stock to be screened flows from the inlet conduit 92 and along the feed face 86 through the feed passage bounded by the face 86 and the walls adjacent the sides of the screen 82 towards the outlet conduit 94. During this flow of the pulp stock, a portion of the stock is accepted by the screening apertures 90 during the forward flow portion of each pulse cycle of the plate 96 and flows into the fluid passage 100. The portion of the pulp stock rejected by all of the screening apertures 90 is, however, discharged from the feed face 86 through the outlet conduit 94. The diluent fluid introduced into the fluid passage 100 through the inlet conduit 110 flows through the fluid passage 100 towards the outlet conduit 112. During this counterflow of the diluent fluid, it intermixes with the accepted stock in the fluid passage 100 and dilutes such accepted stock. Thus, during the reverse flow portion of each pulse cycle of the plate 96, a portion of this diluted stock flows back through the screening apertures 90 to dilute the feed stock. The diluted pulp stock is discharged from the fluid passage 100 through the outlet conduit 112.

From the foregoing, it will be seen that I have provided a screening apparatus which includes new and improved means for substantially minimizing the quantity of screened pulp stock returned through the screen during the aforescribed relative vibration of the latter. It will also be seen that this new and improved means is particularly effective in preventing the return through the screen of accepted stock adjacent the opposing ends of the screen. It will be understood, however, that, although I have hereinbefore illustrated and specifically described only two embodiments of my invention, my invention is not limited merely to these illustrated and described embodiments but rather contemplates other embodiments and variations employing the concepts and teachings of my invention.

Having thus described my invention, I claim:

1. An apparatus for screening pulp stock, comprising a screen having feed and accepts faces and screening apertures extending from said feed face to said accepts face, stock supply means at one end of said screen communicating with a

source of pulp stock and operatively associated with said screen for supplying pulp stock to said feed face at said one end of said screen, rejected stock discharge means at the other end of said screen communicating with said stock supply means for discharging stock rejected by said screening apertures from said feed face at the other end of said screen, wall means extending along said accepts face cooperating therewith to bound a passage which extends continuously along said accepts face in communication with said screening apertures to receive accepted stock therefrom, dilution liquid supply means communicating with a source of dilution liquid and connected to said passage at said other end of said screen independently of said screening apertures for supplying dilution liquid to said passage at said other end of the screen, said wall means directing such dilution liquid through said passage along said accepts face towards said one end of said screen whereby the dilution liquid intermixes with accepted stock in said passage to cause such accepted stock to flow along said accepts face towards said one end of said screen, and accepted stock discharge means connected to said passage at said one end of said screen for discharging the mixture of dilution liquid and accepted stock from said passage at said one end of said screen.

2. A screening apparatus according to claim 1, wherein said screen is a flat screen and said wall means includes means operable for pulsing the mixture in said passage.

3. A screening apparatus according to claim 1, wherein said screen is annular, and said wall means is also annular whereby said passage is annular.

4. A screening apparatus according to claim 1, wherein said screen is annular with said feed and accepts faces being the outer and inner faces of said screen, respectively, said wall means is annular and disposed within said screen whereby said passage is annular, and means are provided for pulsing the mixture in said passage.

5. A screening apparatus according to claim 4, wherein said pulsing means is carried by said wall means and said wall means and screen are relatively rotatable.

6. An apparatus for screening pulp stock, comprising a screen having feed and accepts faces and screening apertures extending therebetween, stock supply means communicating with a source of pulp stock and operatively associated with said screen for supplying pulp stock to said feed face at one end of said screen, first discharge means operatively associated with said screen and communicating with said stock supply means for discharging stock rejected by said screening apertures from said feed face at the other end of said screen, second discharge means operatively associated with said screen for discharging accepted stock from adjacent said accepts face at said one end of said screen, dilution liquid supply means communicating with a source of dilution liquid and on the accepts side of said screen for supplying dilution liquid to said accepts face at said other end of said screen independently of said screening apertures, and means extending along said screen bounding a space which extends continuously along said accepts face from said one end of said screen to said other end thereof, said space communicating with said screening apertures to receive stock accepted thereby and said space connecting said dilution liquid supply means with said second discharge means whereby dilution liquid supplied to said dilution liquid supply means flows along said accepts face towards said one end of said screen and intermixes with accepted stock in said space to cause such accepted stock to flow along said accepts face to said second discharge means.

7. A screening apparatus according to claim 6, wherein said screen is a flat screen, and said feed and accepts faces are the upper and lower faces, respectively, of said screen.

8. A screening apparatus according to claim 6, wherein said screen and space are annular.

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