Sept. 11, 1962 G. L. NELSON 3,053,391

APPARATUS FOR SCREENING

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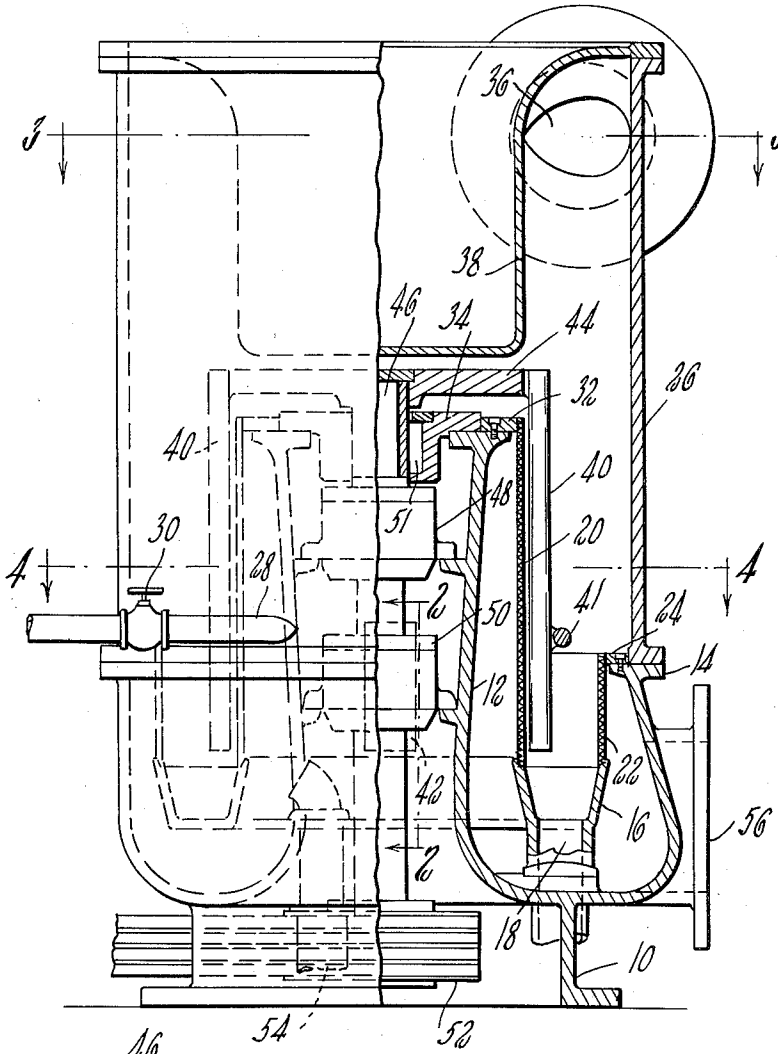


Fig. 1.

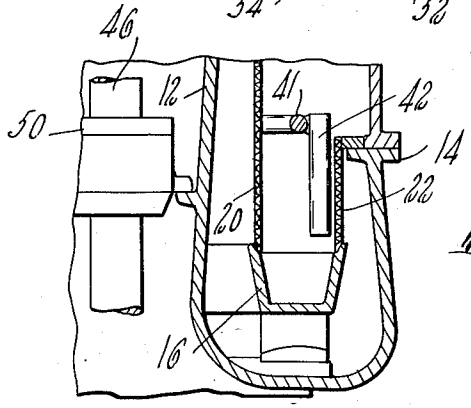


Fig. 2.

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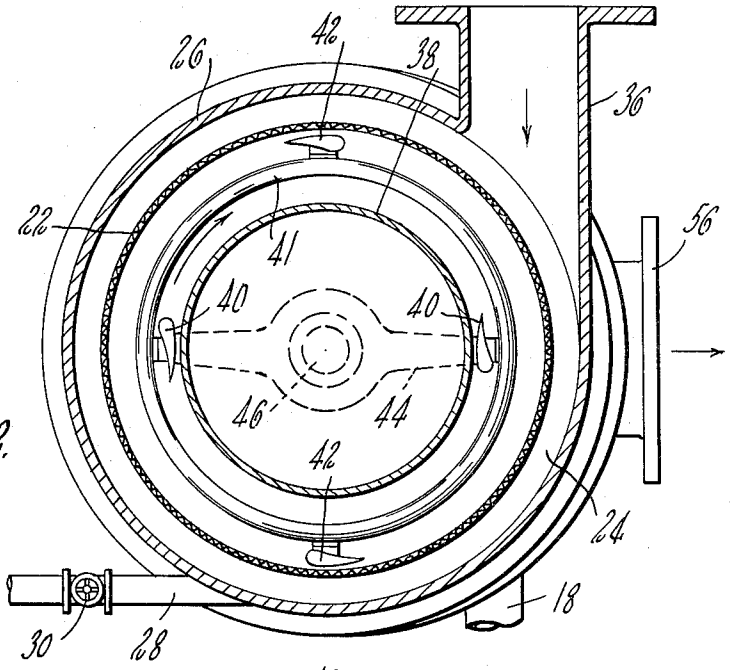


Fig. 3.

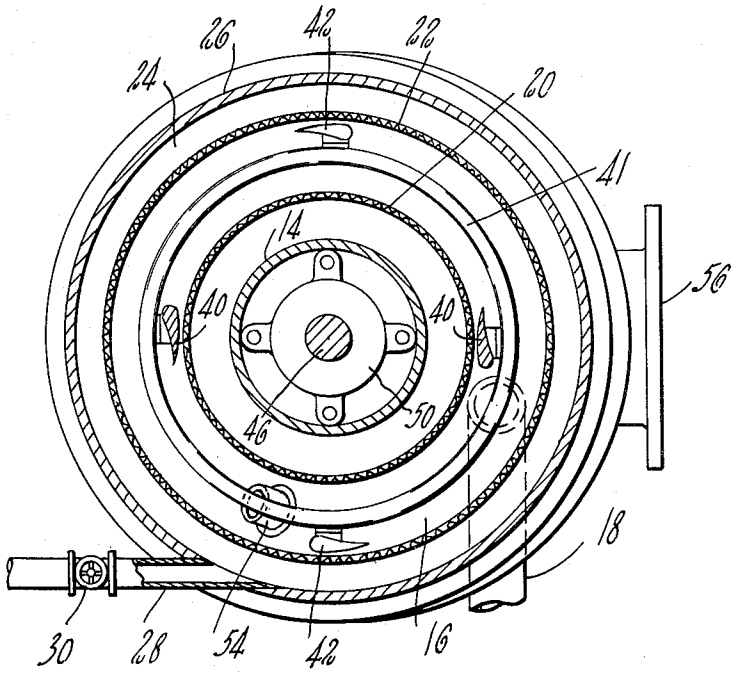


Fig. 4.

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APPARATUS FOR SCREENING

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5 Claims. (Cl. 210—304)

This invention relates to a device for screening liquid suspensions of solid particles and pertains more specifically to a device for screening aqueous paper pulp suspensions to remove fibers or other particles which are oversized or which have higher densities than the acceptable particles.

One object of the present invention is to provide a screen device which includes means for subjecting a liquid suspension to centrifugal forces of substantial magnitude of the order of several times the force of gravity and for continuously withdrawing a fractional portion of the suspension while so subjected to centrifugal forces in advance of its passage through a screen.

Another object is to provide a device of the type described which is of simplified construction and which is adapted to subject a liquid suspension both to centrifugal action and to a screening action.

Still another object of the present invention is to provide a screening device of improved construction capable of more effective separation of fibers or other particles of varying size and density.

Other and further objects will be apparent from the drawing and from the description which follows.

In the drawing:

FIG. 1 is a view in side elevation partly broken away and in section showing one embodiment of the present invention;

FIG. 2 is a view in vertical section taken along the line 2—2 of FIG. 1;

FIG. 3 is a view in cross section taken along line 3—3 of FIG. 1; and

FIG. 4 is a view in cross section taken along line 4—4 of FIG. 1.

In the embodiment shown in the drawing, the device comprises a main frame 10 on which is mounted an annular U-shaped vessel having fixed inner and outer walls 12, 14. Outer wall 14 is preferably bulged outwardly at the right hand side as seen in FIG. 1 for reasons which will be explained below. Mounted within the annular vesses is a circular trough 16 from which leads an outlet 18 for rejected particles. Extending upwardly from the inner and outer margins of trough 16 are concentric generally cylindrical wall members 20, 22. Wall member 22 consists of a screen adapted to pass through its perforations the desired particles of paper fiber or the like. The upper end of screen 22 is secured to a sealing ring 24 which in turn is secured to a flange at the upper end of outer wall 14. Extension 26 may be secured to wall member 14 by any suitable means, as by bolting through mating flanges. Because the diameter of screen 22 is less than the diameter of extension 26, ring 24 forms a radially inwardly projecting baffle or shoulder which is inwardly offset from the inner face of extension 26. Immediately above ring 24 there is provided means for continuously withdrawing a fractional portion of the contents of the device tangentially which takes the form of a pipe 28 provided with throttle valve 30.

Inner wall 20 preferably is in the form of a screen, as shown in the embodiment illustrated in FIG. 1, although part of all of it may be a smooth imperforate wall if desired. The upper end of screen 20 is secured to a sealing ring 32 which together with a fixed housing 34 is secured to a flange at the upper end of inner wall 12. Adjacent the upper end of extension 26 there is provided main inlet 36 which is disposed tangentially of extension 26 and arranged to introduce a stream of liquid suspension to flow in a spiral path about the inner face of extension 26 downwardly toward outlet 18. Supplemental housing 38 is provided to close the upper end of extension 26 and to confine the stream of suspension introduced through inlet 36 to an annular path of restricted width. Supplemental housing 38, inner wall 20, extension 26, and screen 22 together form an annular chamber through which the stream of liquid suspension flows in spiral fashion.

Means is provided for clearing the inlet face of screens 20 and 22 in the form of pairs of hydrofoils 40, 42 secured to ring 41 and to supporting arms or spider 44 which in turn is secured to the upper end of drive shaft 46 mounted in bearings 48, 50 to extend through water-purged seal assembly 51 and driven from any suitable source of power (not shown) by means of a multiple V-belt drive 52. Hydrofoils 40, 42 are mounted to be driven in a circular path which is slightly spaced from the inlet faces of the respective screens 20, 22, the spacing being of the order of 1/16 to 1/2 in. It will be understood that three or more hydrofoils may be mounted to act on each screen if desired, although two only are shown in the embodiment illustrated in the drawing. Means for introducing a supplemental supply of liquids such as water into the suspension as it passes across the face of the screens is provided in the form of an inlet 54 which opens into the space between screens 20, 22 to deliver the lisuid into a zone which is beyond the withdrawal means 28, 30 in the direction of the outlet 18. A main outlet 56 for the accepted stock opens from the space between inner wall 12 and screen 20 on the one hand and between outer wall 14 and screen 22 on the other hand. These spaces serve to receive the accepted screened stock which passes through screens 20, 22 and are enlarged as they approach outlet 56 to accommodate the increase in volume of accepted stock as it flows past the screens toward outlet 56.

In operation of the device a supply of the liquid suspension such as paper pulp which is to be cleaned by the removal of oversized or high-density particles such as shives, dirt, iron rust and the like is introduced at a high velocity through inlet 36, being thus delivered into a spiral path winding its way downwardly within the annular chamber formed between extension 26, screen 22, and inner wall 38, 20. By proper control of the velocity of the suspension during its spiral passage, the material is subjected to a centrifugal force of the order of several times the force of gravity, so that the heavier oversized particles are thrown outwardly toward the inner face of extension 26. When inner wall 20 is itself a screen, as in the preferred embodiment, the desired fraction of the suspension passes readily through this screen with a minimum of blocking or clogging of the screen apertures with dirt particles. Inasmuch as the fibrous particles present in paper pulp suspensions frequently have lengths several times the diameter of the screen apertures, it is essential that some means be provided to clear the inlet face of the screen at frequent intervals and to prevent the building up of a mat of fibres which would prevent flow of the suspension through the screen. This clearing is accomplished by the rapid and repeated passage of foils 40 across the inlet face of the screen, the passage of these foils serving to provide a pressure pulse at the screen face to create a momentary reversal of flow through the screen, thus removing any fibrous particles which have tended to mat over the apertures.

As the liquid suspension continues its downwardly spiraling flow, it reaches the shoulder or baffle formed by sealing ring 24 which serves to restrain further down-

ward passage of the heavy oversized particles which have been thrown outwardly by centrifugal force. These particles are thus constrained to pass outwardly with the fractional portion of the suspension which is continuously withdrawn through pipe **28**. These particles are thus prevented from ever reaching screen **22**, making the operation of this screen more effective. As the suspension continues to pass downwardly in the device across the face of screen **22**, the desired particles pass through the screen, the inlet face of the screen being maintained clear by the repeated passage of foils **42**, **42** in the same manner that the passage of foils **40**, **40** maintains the face of screen **20** clear. Because the liquid suspension increases in consistency while it is being subjected to centrifugation and screening, separation of the undesired particles from the suspension becomes slower and more difficult as the suspension approaches the bottom of screen **22**. Accordingly, a stream of liquid, which may be water in the case of an aqueous pulp suspension, is introduced through supplimental inlet **54** to dilute the suspension and facilitate the final stages of the screening operation.

The accepted stock which passes through screens **20** and **22** is collected in the receiving chambers formed behind these screens by walls **12**, **14** and then is passed outwardly through main outlet **56**. The bulge of outer wall **14** as it approaches outlet **56** provides the necessary increasing space required to accommodate the increasing volume of stock received from the screen as the accepted stock flows through the receiving chambers to the outlet. The portion of the suspension which is rejected by screens **20**, **22** passes downwardly into the gutter or channel **16**, whence it is removed through outlet **18**.

The device combines in a single apparatus the operations and functions of a centrifuge as well as a screen. Inasmuch as the centrifugal operation occurs in advance of the outer screen **22**, it renders the operation of this screen much more efficient than would otherwise be the case, reducing the load of oversized particles which normally would have to be rejected by screen **22**. The device also makes it possible to introduce liquid such as water through supplemental inlet **54** in order to reduce the consistency of the suspension adjacent the lower ends of screens **20**, **22** without risk of washing through the screens the undesired, heavy dirt particles.

Although a specific embodiment of the invention has been described herein, it is not intended to limit the application solely thereto, but to include all of the obvious variations and modifications within the spirit and scope of the appended claims.

What is claimed is:

1. A device for treating aqueous suspensions containing particles of solid material which comprises a fixed cylindrical screen forming a portion of the outer wall of a chamber having an inner wall concentric with said outer wall to form an annular chamber, an inlet for introducing a stream of liquid suspension at one end of said chamber to flow in a spiral path therethrough, an outlet for rejected suspension at the other end of said chamber, means disposed radially outwardly of said screen for receiving accepted suspension after its passage through the screen, means for continuously withdrawing a fractional portion of said suspension through said outer wall between said inlet and said screen, a baffle fixed to and extending radially inwardly from said outer wall, said baffle being disposed immediately beyond said withdrawal means in the direction of said outlet, and means extending into said chamber for clearing the inlet face of said screen.

2. A device as defined in claim 1 in which said withdrawal means is spaced from said inlet in a direction along the axis of said walls by a distance sufficient to permit all said suspension to complete at least one turn of its spiral path before reaching said withdrawal means.

3. A device as defined in claim 1 in which at least a portion of said inner wall comprises a generally cylindrical screen and means disposed radially inwardly of the last said screen is provided for receiving accepted suspension after its passage therethrough.

4. A device as defined in claim 1 in which the diameter of said screen is less than the diameter of the preceding portion of said outer wall between said inlet and said screen, and said baffle comprises an imperforate continuous shoulder joining said screen and said preceding outer wall portion.

5. A device as defined in claim 1 in which means is provided for introducing a supplemental supply of liquid into said chamber in a zone beyond said withdrawal means in the direction of said outlet.

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