United States Patent

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[54] **PULP SCREEN OR THE LIKE**
1 Claim, 4 Drawing Figs.

[52] **U.S. Cl.** **210/415,** 210/497.498
[51] **Int. Cl.** **B01d 29/04**
[50] **Field of Search** 210/405, 415, 484, 497, 498

[56] **References Cited**

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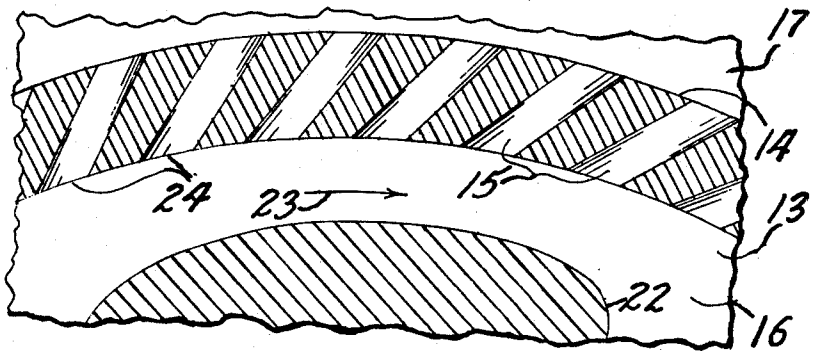
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ABSTRACT: A pulp screen plate is provided with screening holes of circular cross section extending obliquely therethrough so that elliptical hole openings are presented to the fluid material being screened. This construction encourages individual fibers longer than the diameters of the screening holes to enter and pass through those holes without increasing significantly the passage of unwanted lumps or flakelike particles therethrough. In applications employing hydrofoil impellers or the like, the holes are disposed in relatively tangential relation to the direction of movement of the adjacent strata of the fluid material being processed, thereby minimizing velocity losses to increase the capacity and efficiency of the screening machine.



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FIG. 1.

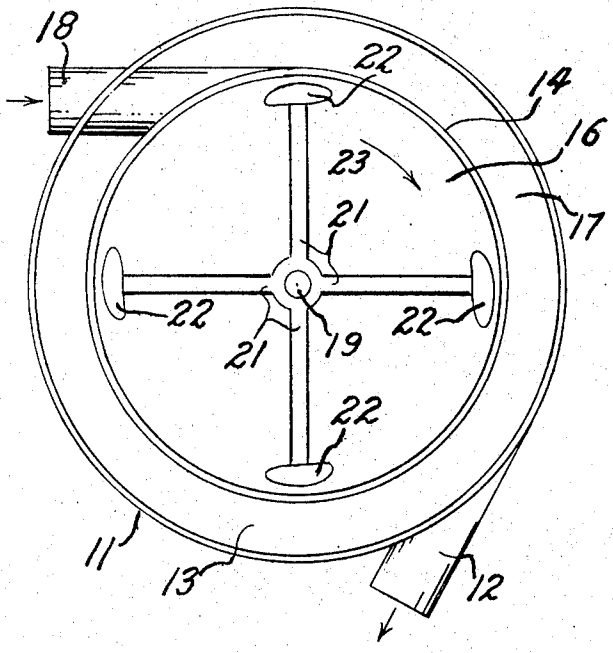


FIG. 3.

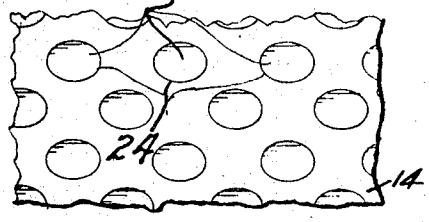
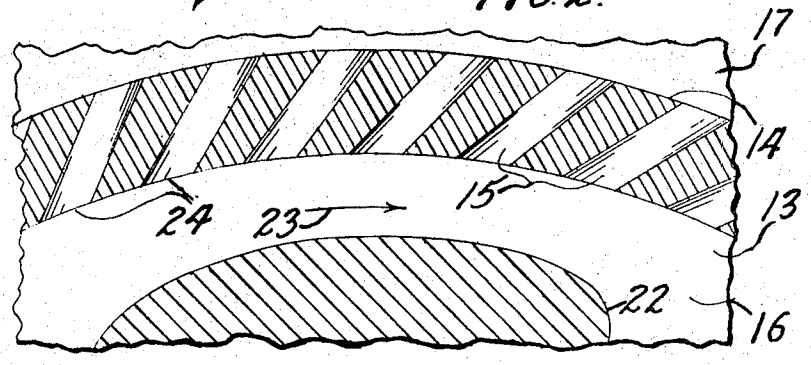


FIG. 2.



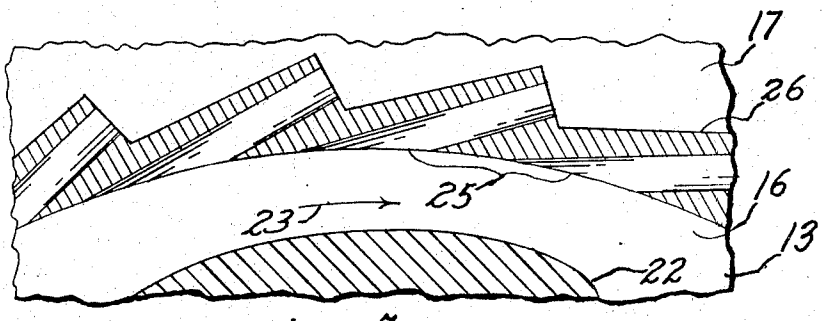


FIG. 4.

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PULP SCREEN OR THE LIKE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to screen plates and more particularly to screen plates for use in screening machines of the type employed in processing aqueous fiber suspensions of wood pump or the like used in papermaking.

2. Description of the Prior Art

In previously known screening machines used for processing wood pump or other fibrous fluid suspensions, a screen plate customarily is provided with a pattern of drilled or punched uniform circular holes normal to the face surfaces of the plate, whereby particles too large to be accommodated by the holes are separated from the material that passes through the plate. A fiber longer than the diameters of the holes can of course pass through a hole in an endwise direction, but also can span a hole and thereby refuse to pass through it. Although the agitation and circulation of the fibrous material will result in any given fiber finding its way eventually through a hole in the screen plate, it is apparent that the screening efficiency of the screen is nevertheless reduced by this phenomenon. If the holes are simply increased in size, the desired fibers will pass through the screen more readily but the maximum size of the unwanted lumps or flakelike particles capable of passing through the screen is also increased correspondingly.

In many screening machines, a hydrofoil or other moving impeller is employed to cause the strata of the fluid suspension adjacent the screen plate to flow along that plate so that the suspended material continuously washes along and through the screen holes. Typically, the screen plate in such a machine is of cylindrical tubular form, with the impeller member supported within the screen plate for rotation about the axis thereof. If the holes in such a screen plate are normal to the surface thereof, i.e., radial with respect to the axis of the plate, it is demonstrable that considerable velocity is lost in the fluid as it enters and passes through the holes of the plate, particularly if the ratio of the thickness of the plate to the hole diameter is more than 2 to 1. Obviously, such a velocity loss implies a corresponding loss in the efficiency of the machine with regard both to its overall screening capacity and also to the amount of power required to process a given amount of material.

SUMMARY OF THE INVENTION

The present invention contemplates providing screen plates of the type described above with circular holes formed at oblique angles to the internal face surface of the plate so that the ends of the holes define elliptical openings in the plane of that plate surface. Accordingly, the larger dimensions of the major axes of the holes decreases the likelihood of individual fibers spanning the holes and effects a proportional increase in the screening capacity without effecting significantly the effectiveness of the plate in screening out unwanted lumps or flakelike particles too large to pass through the circular cross sections of the holes. Since the ratio of the major and minor axes of each hole opening is a function of the angle at which the hole is disposed relative to the corresponding face surface of the plate, different fiber selectivity criteria can be realized by means of screen plates having holes drilled at corresponding different angles.

In machines provided with impellers which move the fluid material along the screen plate in a predetermined direction, the oblique holes are sloped in a direction which minimizes the change in flow direction of the fluid material entering and passing through the screening holes; thereby improving the efficiency of the machine by reducing the loss of flow velocity occasioned by the change in flow direction imposed by the screen holes. Accordingly, a cylindrical tubular screen surrounding a rotating impeller which imparts a circular flow to the fluid material introduced into the machine is provided with holes sloped in the direction of rotation of the liquid within the screen plate; or, in other words, in relatively tangential relation to the flow of material adjacent to the inner elliptical hole openings.

Various means for practicing the invention and other advantages and features thereof will be apparent from the following detailed description of the illustrative preferred embodiments thereof, reference being made to the accompanying drawings in which like reference characters refer to like elements.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawing

FIG. 1 is a schematic plan view of a pulp screening machine employing a rotary hydrofoil impeller within a tubular cylindrical screen plate provided with obliquely disposed screening holes with accordance with the present invention;

FIG. 2 is a cross-sectional plan view corresponding to a greatly enlarged portion of the screen plate shown in FIG. 1;

FIG. 3 is an elevational view of the internal face surface of a portion of the screen plate depicted in FIG. 1; and

FIG. 4 corresponds generally with FIG. 2 and illustrates a similar screen plate with its oblique screening holes disposed more nearly in tangential relation to the cylindrical internal face surface of the plate.

DESCRIPTION OF THE ILLUSTRATIVE PREFERRED EMBODIMENTS

The illustrative screening machine depicted somewhat schematically in FIG. 1 of the accompanying drawings comprises a generally cylindrical vertical tank **11** provided with an outlet conduit **12** adjacent floor plate **13** which closes the lower end of the tank. A tubular screen plate **14**, provided with uniformly distributed oblique screen holes **15** according to the present invention is attached to and extends upwardly from floor plate **13** in concentric relation to tank **11**, thereby defining a cylindrical inner tank chamber **16** within the screen surrounded by an annular outer chamber **17** between the screen and the adjacent internal tank wall. During the operation of the machine, the fluid material to be processed is delivered into chamber **16** through inlet conduit **18** and is maintained at a predetermined level within that chamber by appropriate inlet control means, not shown.

A vertical shaft **19** is appropriately journaled in coaxial relation to screen plate **14** and is provided with support arms **21** by which a plurality of hydrofoil impellers **22** are supported by closely adjacent the inner face of the screen plate. Shaft **19**, in turn, is connected to a drive mechanism, not shown, whereby the impellers move along the internal surface of the screen plate in the direction shown by arrow **23**. Accordingly, as is well known in the screening art, the impellers produce a corresponding circular flow of the peripheral fluid material within chamber **16** and also create localized successive outward and inward pressure pulsations as each impeller approaches and passes any given screening hole; thereby tending to force the adjacent material outwardly through that hole and then to clean the internal hole opening of lumps or particles which were too large to pass therethrough.

Referring now to FIGS. 2 and 3 of the drawings, it will be seen that the obliqued disposition of screening holes **15**, at an angle of 45° to the internal face of the screen plate, provides elliptical internal hole openings **24** approximately 1.4 times as long as they are wide. Therefore, as previously discussed, a fiber or other elongate particle longer than the minimum dimension of such hole openings but shorter than the longer dimension thereof is much more apt to enter and travel along the hole than in the case of a conventional screen having holes of the same size disposed in normal relation to the screen plate. However, a lump or flake which is larger in several directions than the minimum dimension of the elliptical openings is nevertheless blocked from passing through the screen. Obviously, the ellipticity of the internal openings of the screen holes is a function of the angle at which such holes

are disposed relative to the internal face of the screen plate, whereby different selectivity characteristics can be provided by different screens in which the uniform screening holes are of correspondingly different diameters and disposed at correspondingly different angles to the internal plate surface. For example, the more steeply sloped screening holes **25** depicted in FIG. 4 in screen plate **26** define more elongated hole openings than do those shown in FIGS. **2** and **3**, even though the holes are of substantially the same size in cross section as holes **15**. It will be noted also that the external surface of screen plate **26** is provided with vertically disposed steps or ridges defining relatively flat surfaces **27** through which each vertical row of screening holes communicates with the exterior of the screen plate; thus simplifying the fabrication of the screen by allowing the drills employed to produce the screening holes to enter external screen surfaces at approximately right angles thereto.

It will be apparent also by reference to FIGS. **2** and **4** that the holes in the depicted screen plates would be more than twice as long as they are wide even if they were disposed radially of the plates, as has been the case heretofore. Therefore, as mentioned above, the abrupt directional transition of fluids entering the holes from a circular flow path to a substantially radial path would produce considerable loss of flow velocity and an attendant reduction in the capacity and power consumption efficiency of the machine. By providing the screening holes in more nearly tangential relation to the direction of flow of the fluid material adjacent the internal surface of the screen, however, a reduction in this directional transition is

achieved which increases the capacity and efficiency of the machine even though the holes are actually longer than corresponding radial ones. Since such holes in absolutely tangential relation to the internal screen surface would be very difficult to produce and would be very long relative to the diameters thereof, the holes preferably are only relatively tangential, defining an angle between 10° and 60° measured from the internal plate surface at the intersection of the holes therewith.

The invention has been described in detail with particular reference to the preferred embodiments thereof, but it will be understood that variation and modifications can be effected within the spirit and scope of the invention as described heretofore and as defined in the appended claims.

I claim:

1. In a screening machine adapted to screen fibrous and particulate fluid suspensions, having a undirectionally rotatable impeller member, an inner cylindrical portion for receiving said suspension, an outer cylindrical portion for discharging said suspension, the improvement comprising: a plate screen member adapted to surround said impeller in coaxial relation to the rotational axis thereof with said impeller adjacent the inner cylindrical surface of said screen member, said screen member having a plurality of similar screening holes of substantially circular cross section extending through said screen member, said holes being disposed relative to the inner surface of said screen member at an angle of from 10 to 60°, said screen member having a thickness equal to at least twice the cross-sectional diameter of said holes.