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J. H. MARTINDALE

3,009,656

PAPER MACHINERY

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FIG-1

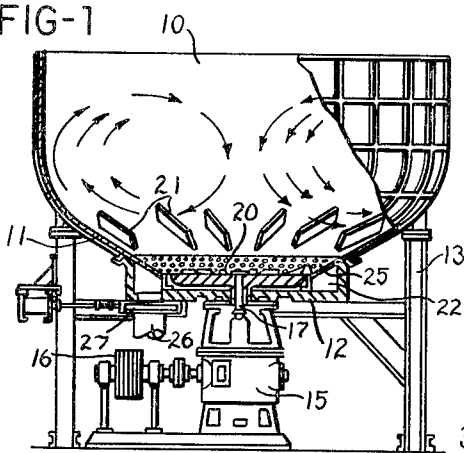


FIG-2

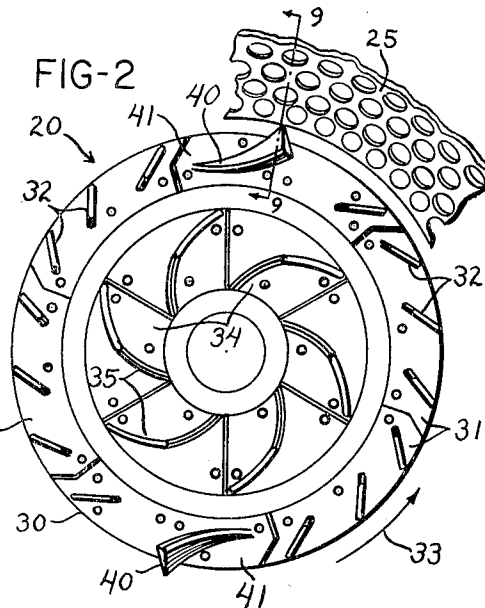


FIG-3

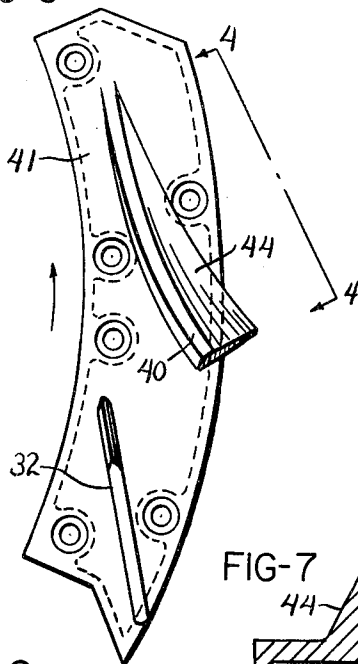


FIG-4

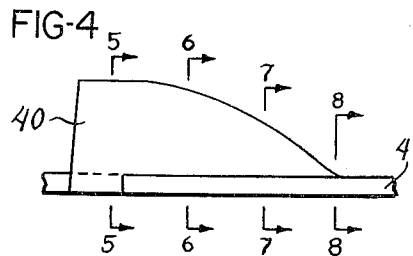


FIG-5

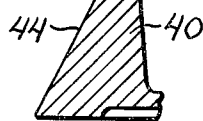


FIG-6

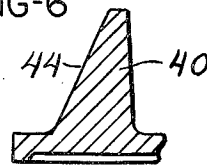


FIG-7



FIG-8

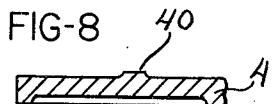
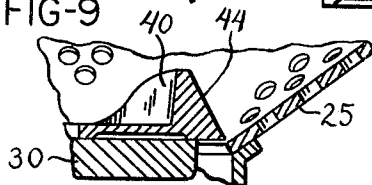


FIG-9



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PAPER MACHINERY

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4 Claims. (Cl. 241—46)

This application relates to pulping apparatus for liquid slurry stocks such as paper making stock.

The invention has special relation to pulping apparatus of the type wherein the stock to be pulped is contained in a tub which is provided with a rotor or impeller mounted in the bottom thereof for rotation on a vertical axis causing outward circulatory movement of the stock in a generally vortical pattern and which is also provided with an upwardly and outwardly inclined screen located generally in the path of the stock discharged by the impeller and controlling the passage of the pulped particles to the outlet of the tube. Pulping apparatus of this general type is employed in both batch and continuous operations, and the invention is equally applicable to both types of operation.

It is a primary object of this invention to provide pulping apparatus of the above general type wherein the impeller is of novel and improved structural characteristics which not only give increased assurance against clogging of the screen but also make it possible to obtain increased efficiency of operation with screens having substantially smaller perforations therein than have customarily been used.

A further object of the invention is to provide pulping apparatus as outlined above wherein the improved operational characteristics are obtained by a novel construction and mode of operation of the impeller which effect continuous cleaning of the screen perforations by creating a periodic pulsing action effective on the upper surface of the screen.

It is a specific object of this invention to accomplish the purposes outlined above by the provision of a pulping impeller which incorporates one or more special blades of such structure and operative relation thereto that as the impeller rotates, each blade causes a wave of stock to sweep outwardly along the upper surface of the screen and substantially parallel therewith at a high velocity creating a back pressure through the perforations of the screen effective to dislodge any particles tending to dwell on or in these perforations.

Additional objects and advantages of the invention will be apparent from the following description, the accompanying drawing and the appended claims.

In the drawing—

FIG. 1 is a view partly in side elevation and partly broken away in vertical section showing pulping apparatus embodying an impeller constructed in accordance with the invention;

FIG. 2 is a plan view of the impeller in FIG. 1 and a fragment of the associated screen or extractor plate;

FIG. 3 is an enlarged detail view in plan through one of the component parts of the impeller of FIG. 2 including one of the special blades thereon;

FIG. 4 is a fragmentary elevational view taken as indicated by the line 4—4 of FIG. 3;

FIGS. 5—8 are fragmentary sections taken as indicated by the section lines 5—5, 6—6, 7—7 and 8—8 respectively of FIG. 4; and

FIG. 9 is a fragmentary section taken as indicated by the line 9—9 of FIG. 2.

Referring to the drawing, which illustrates a preferred embodiment of the invention, FIG. 1 shows pulping apparatus which is generally of the construction disclosed

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in Martindale Patent No. 2,371,837, issued March 20, 1945, to the assignee of this application. This pulper includes a tub or vat having a cylindrically extending upper wall portion 10, an inwardly tapered lower wall portion 11 and a bottom wall 12, and it is carried by supports 13 of any suitable character. Arranged below the tub is a gear drive 15 shown as driven by a pulley 16 from a suitably located motor (not shown), and the gear drive 15 drives a vertical shaft 17 which supports an impeller 20 for rotation centrally of the bottom portion of the tub.

In operation, the impeller 20 provides an effective circulation outwardly and then upwardly along the outer portions of the tub in a generally vortical pattern providing a return flow towards the impeller, as indicated by the arrows in FIG. 1, and stationary guide plates 21 are mounted on the wall portion 11 to guide the upward flow of the partially pulped stock. Adjacent the bottom of the tub is an annular chamber or compartment 22 partitioned from the space above the impeller by a perforate screen or extractor plate 25 of frustoconical form which permits the passage to the compartment 22 of pulped particles which have been sufficiently reduced in size to pass through the perforations of this screen 25. This pulped stock may be withdrawn from the compartment 22 continuously or batch-wise, by way of the conduit 26 and control valve 27.

The present invention is concerned with the fact that it is possible for incompletely pulped particles to dwell on or partially in the perforations in the screen 25 and thereby to cause partial or complete clogging of the screen. This result is particularly undesirable in batch pulping operations, since it has a definite tendency to delay, or even to stop, dumping of the contents of the tub in view of the fact that when dumping begins, there is a maintained drainage force through the screen wall tending to hold clogging particles in place. It is accordingly the purpose of this invention to provide an impeller 20 of special characteristics providing positive assurance against dwelling of oversized particles on the screen in such manner as to cause clogging thereof.

The impeller 20 includes a main supporting plate 30 having a plurality of segments 31 bolted on the upper surface thereof around its outer periphery, and these segments 31 each include one or more upstanding impeller vanes 32 arranged tangentially of the axis of the impeller in such manner that as the impeller rotates in the direction of the arrow 33, the stock is discharged outwardly of the impeller toward the screen 25 in the general pattern already described in connection with FIG. 1. In addition, the impeller 20 is provided inwardly of the segments 31 with a plurality of segments 34 carrying pumping vanes 35 of somewhat greater height than the vanes 32 for urging the pulp radially outwardly across the surface of the plate toward the pulping vanes 32.

In addition to the vanes 32, the impeller 20 is provided with one or more special blades 40, preferably two for maximum balance, each of which is carried by a segment 41 similar to the segments 31 and each also including one pulping vane 32. The blades 40 are so constructed and arranged with respect to the balance of the impeller and the screen 25 that as the impeller rotates, each blade 40 causes a wave of stock to be directed upwardly along the surface of the screen 25 in a direction closely approaching parallelism with the screen and at a substantially higher velocity than the discharge from the vanes 32. The result of these conditions is that as this high velocity wave crosses the screen 25, it creates an upward or back pressure through the perforations in the screen tending to dislodge any clogging particles for further upward travel into the interior of the tub. In addition, since this wave is of short effective width, it rotates around the tub and is followed by pres-

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sure in the opposite direction as the stock returns behind it in opposition to the back pressure. Thus as each of these high velocity waves rotates around the tub, it creates an effective pulsating action with respect to the perforations in the screen 25, which comprises essentially a temporary upward suction through the screen followed by the downward pressure resulting from the static head of stock in the tub.

For preferred results in the practice of the invention, it is important that the proper relationship be maintained between the configurations of the blade 40 and the perforate screen 25 such that the wave of stock created by each blade 40 will be directed upwardly in very nearly parallel relation with the upper surface of the screen 25, as distinguished from impinging thereon at materially lesser angles of incidence as does the discharge from the blades 32, while at the same time the angle between the direction of this wave and the surface of the screen 25 should be less than 180°. It is therefore desirable to maintain the radially outer edge of each blade 40 in the same horizontal plane as and very close to the bottom edge of the screen 25, as shown in FIG. 9. In addition, the angle defined by the working surface 44 of the blade 40 and the screen 25 in any vertical section should approach but be less than 90°, as also shown in FIG. 9.

In addition to the angular relationships noted above, each blade 40 should include substantially greater working area than each of the vanes 32, in order to assure the desired higher velocity for the wave of stock which it creates. For example, satisfactory results in this connection have been obtained with an impeller whereon the blade 40 reaches a maximum height of 4.625 inches and an overall length of approximately 13 inches, in comparison with an overall length of approximately 6 inches and a maximum height of 1.375 inches for each vane 32. In addition, the blade face 44 is slightly curved in a horizontal plane as shown in FIGS. 2-3, to a definite concave configuration which further increases its effectiveness in the operation of the invention as described above.

Results which have been obtained with pulping apparatus constructed in accordance with the invention have been outstanding in efficiency in a variety of aspects. Thus operating with pulpers having screens provided with conventional perforations, clogging has been consistently prevented, and therefore the pulping time has been reduced as well as the dumping time in cases of batch operation. In addition, it has been found that these same advantages are obtainable with screens provided with perforations which are substantially smaller than those customarily used, for example as small as from 1/4 to 3/8 inch in comparison with holes of 1-inch diameters. A further advantage which results from these characteristics is both that better defibering is obtained within the pulper, since large undefibred particles will not permit it to escape through the screen, and also that there is substantially higher retention of undesired trash within the pulper, which in turn decreases the amount of screening necessary at subsequent stations in the stock preparation system.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In pulping apparatus of the character described including a generally cylindrical tub, an outlet for pulped stock in the lower portion of said tub, and an upwardly and outwardly inclined annular screen covering said outlet, the combination of an impeller mounted for rotation on a vertical axis centrally of said screen and including a circular plate forming the body thereof, a plurality of upstanding impeller vanes on the upper surface of said

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plate, means for rotating said impeller in the direction to cause said vanes to produce discharge of the stock outwardly of said plate toward said screen, a blade on said plate extending in the direction opposite to the direction of rotation of said plate from a position located inwardly of the periphery of said plate to a position radially beyond the periphery of said plate and closely adjacent the inner periphery of said screen, said blade being of substantially greater height than said vanes, and the radially outer surface of said blade being inclined upwardly and inwardly with respect to said plate at an angle causing a wave of stock to be directed toward said screen at an angle approaching 180° and at a velocity substantially greater than the stock discharged by said vanes to effect upward sweeping of the upper surface of said screen of particles tending to dwell thereon accompanied by a pulsating action with respect to the perforations in said screen as said wave moves circumferentially of said tub.

2. An impeller construction for pulping apparatus of the character described including a generally cylindrical tub adapted to have an impeller mounted in the bottom thereof for rotation on a vertical axis and having an upwardly and outwardly inclined screen surrounding said bottom in the path of stock discharged from the periphery of such impeller, comprising a circular plate forming the body of said impeller, a plurality of upstanding impeller vanes on the upper surface of said plate for producing discharge of the stock outwardly of said plate toward said screen, a blade on said plate for causing a wave of stock to be discharged toward said screen as said impeller rotates, said blade extending in the direction opposite to the direction of rotation of said impeller from a position located inwardly of the periphery of said plate to a position radially beyond the periphery of said plate, said blade being of substantially greater height and length than said vanes, and the radially outer surface of said blade being inclined upwardly and inwardly with respect to said plate at an angle causing said wave of stock to be directed toward said screen at an angle approaching 180° and at a velocity substantially greater than the stock discharged by said vanes to effect upward sweeping of the upper surface of said screen of particles tending to dwell thereon accompanied by a pulsating action with respect to the perforations in said screen as said wave moves circumferentially of said tub.

3. An impeller construction for pulping apparatus of the character described including a generally cylindrical tub adapted to have an impeller mounted in the bottom thereof for rotation on a vertical axis and having an upwardly and outwardly inclined screen surrounding said bottom in the path of stock discharged from the periphery of such impeller, comprising a circular plate forming the body of said impeller, a plurality of upstanding impeller vanes on the upper surface of said plate for producing discharge of the stock outwardly of said plate toward said screen, a blade on said plate for causing a wave of stock to be discharged toward said screen as said impeller rotates, said blade extending in the direction opposite to the direction of rotation of said plate from a position located inwardly of the periphery of said plate to a position radially beyond the periphery of said plate, said blade being of increasing height from the inner to the outer end thereof with the major portion thereof being of substantially greater height and length than said vanes, and the radially outer surface of said blade being substantially flat in section and inclined upwardly and inwardly with respect to said plate at an angle with respect to the angle of inclination of said screen which approaches 90° to cause said wave of stock to be directed toward said screen at an angle approaching 180° and at a velocity substantially greater than the stock discharged by said vanes to effect upward sweeping of the upper surface of said screen of particles tending to dwell thereon accompanied by a pulsating action with respect to the perforations in said screen as said wave moves circumferentially of said tub.

4. An impeller construction for pulping apparatus of the character described including a generally cylindrical tub adapted to have an impeller mounted in the bottom thereof for rotation on a vertical axis and having an upwardly and outwardly inclined annular screen surrounding said bottom in the path of stock discharged from the periphery of such impeller, comprising a circular plate forming the body of said impeller, a plurality of upstanding impeller vanes on the upper surface of said plate for producing discharge of the stock outwardly of said plate toward said screen, a blade on said plate for causing a wave of stock to be discharged toward said screen as said impeller rotates, said blade extending in the direction opposite to the direction of rotation of said plate from a position located inwardly of the periphery of said plate to a position radially beyond the periphery of said plate, said blade being of increasing height from the inner to the outer end thereof with the major portion thereof being of substantially greater height than said vanes, the radially outer surface of said blade being substantially flat in section and inclined upwardly and inwardly with respect to said plate at an angle with respect to the angle of incli-

nation of said screen which approaches 90° to cause said wave of stock to be directed toward said screen at an angle approaching 180° and at a velocity substantially greater than the stock discharged by said vanes to effect upward sweeping of the upper surface of said screen of particles tending to dwell thereon accompanied by a pulsating action with respect to the perforations in said screen as said wave moves circumferentially of said tub, and said outer face of said blade having a concavely curved configuration in plan to increase the velocity of said wave of stock.

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