P. P. WESTBYE.

PULP SCREENING MACHINE.

APPLICATION FILED AUG. 9, 1911.

1,155,116. Patented Sept. 28, 1915.

5 SHEETS—SHEET 1.

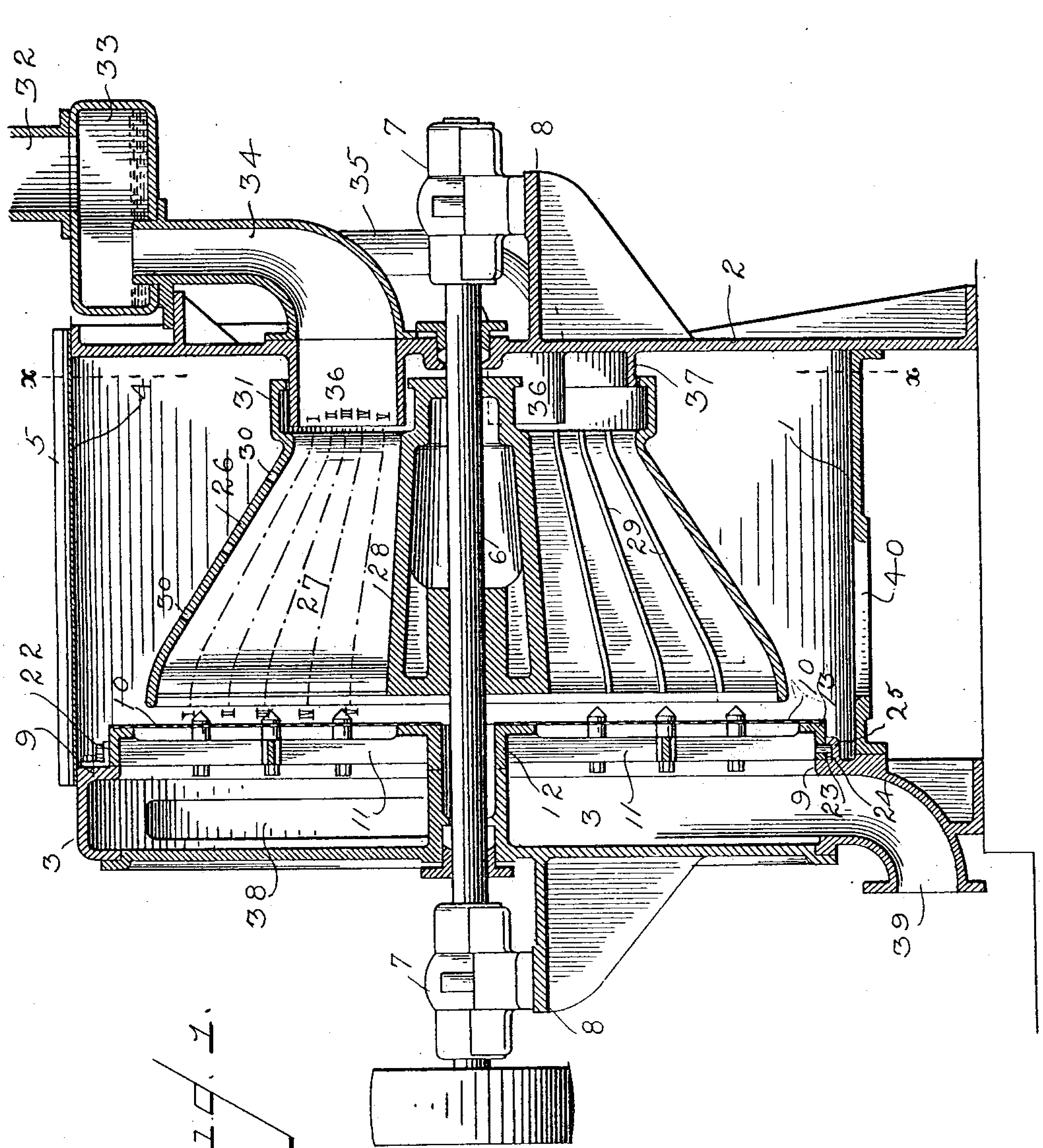

Fig. 1.

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Fig. 4

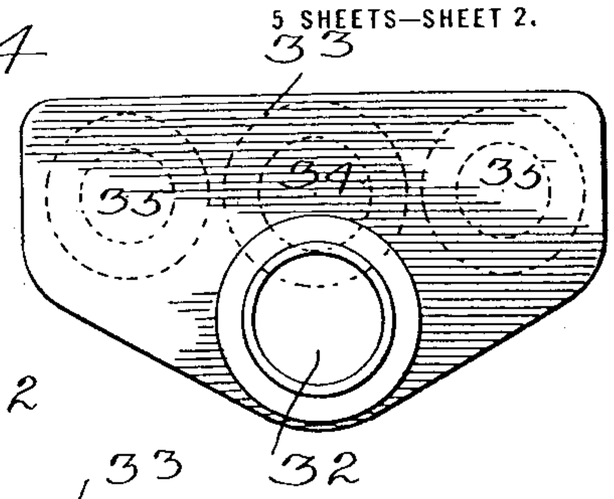

Fig. 2

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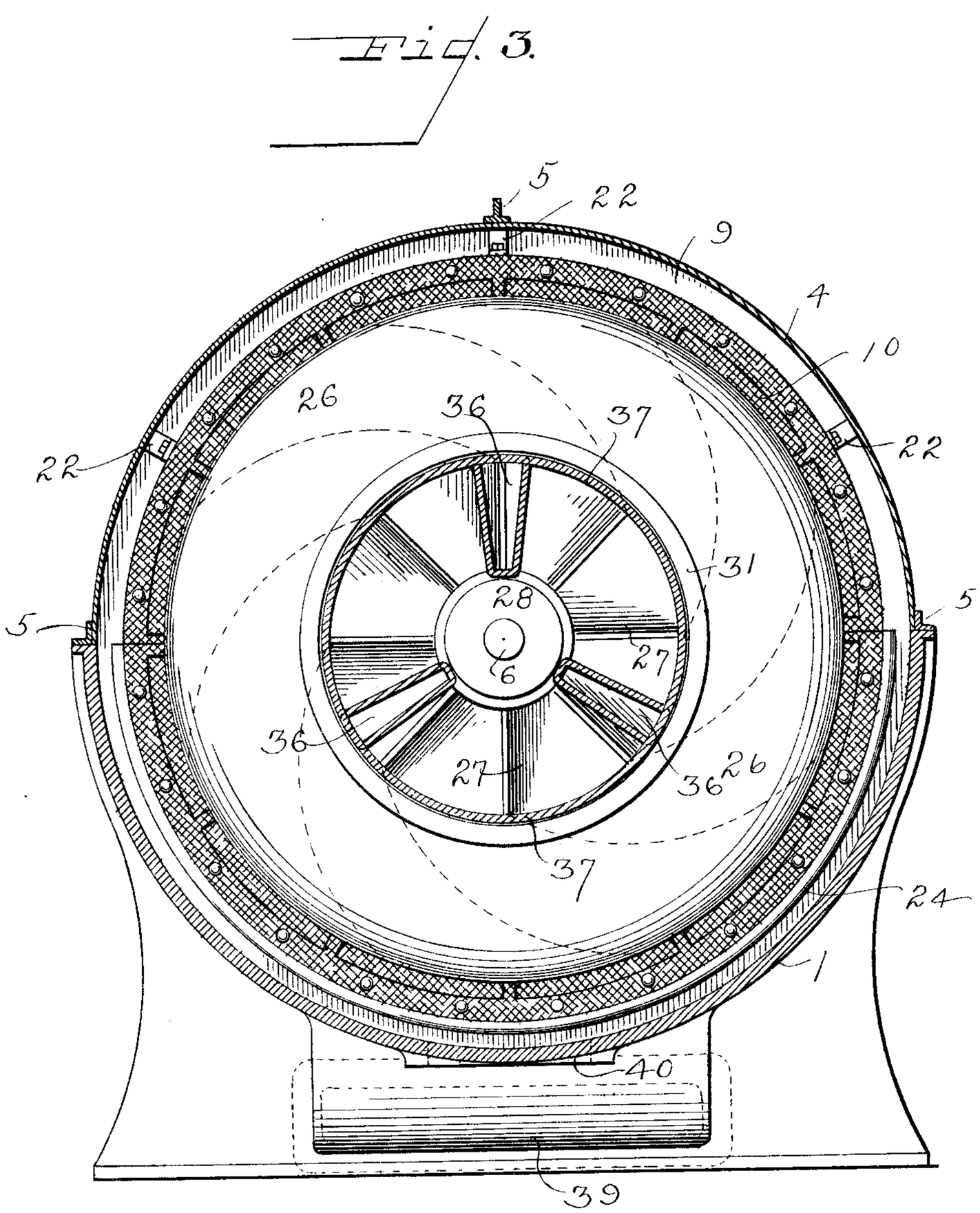
5 SHEETS—SHEET 3.

Fig. 3.



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5 SHEETS—SHEET 4.

Fig. 5

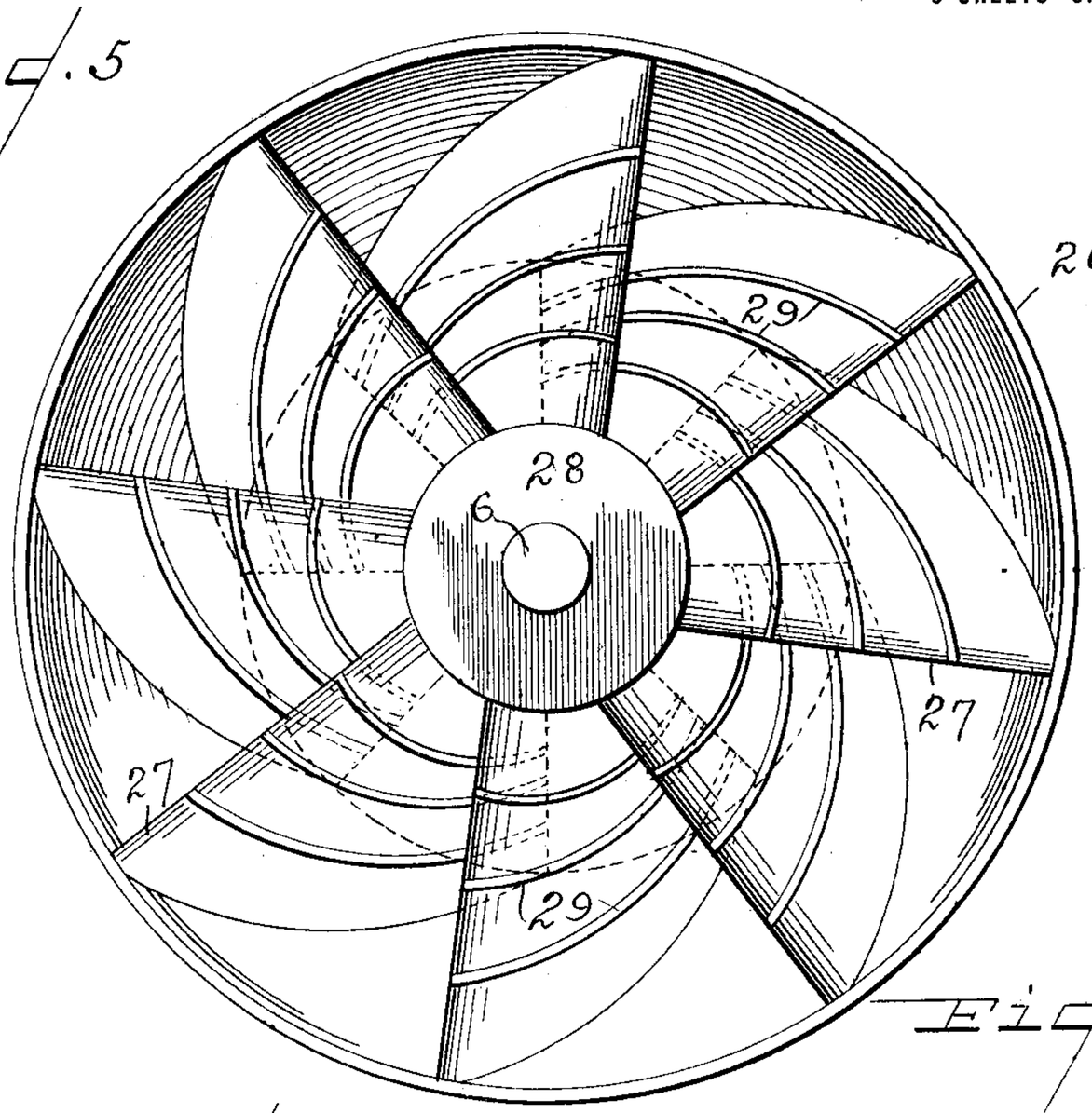


Fig. 6.

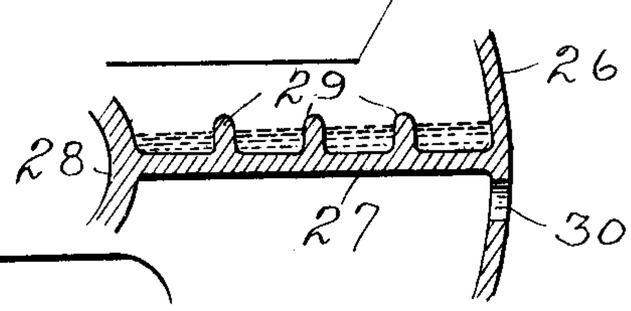
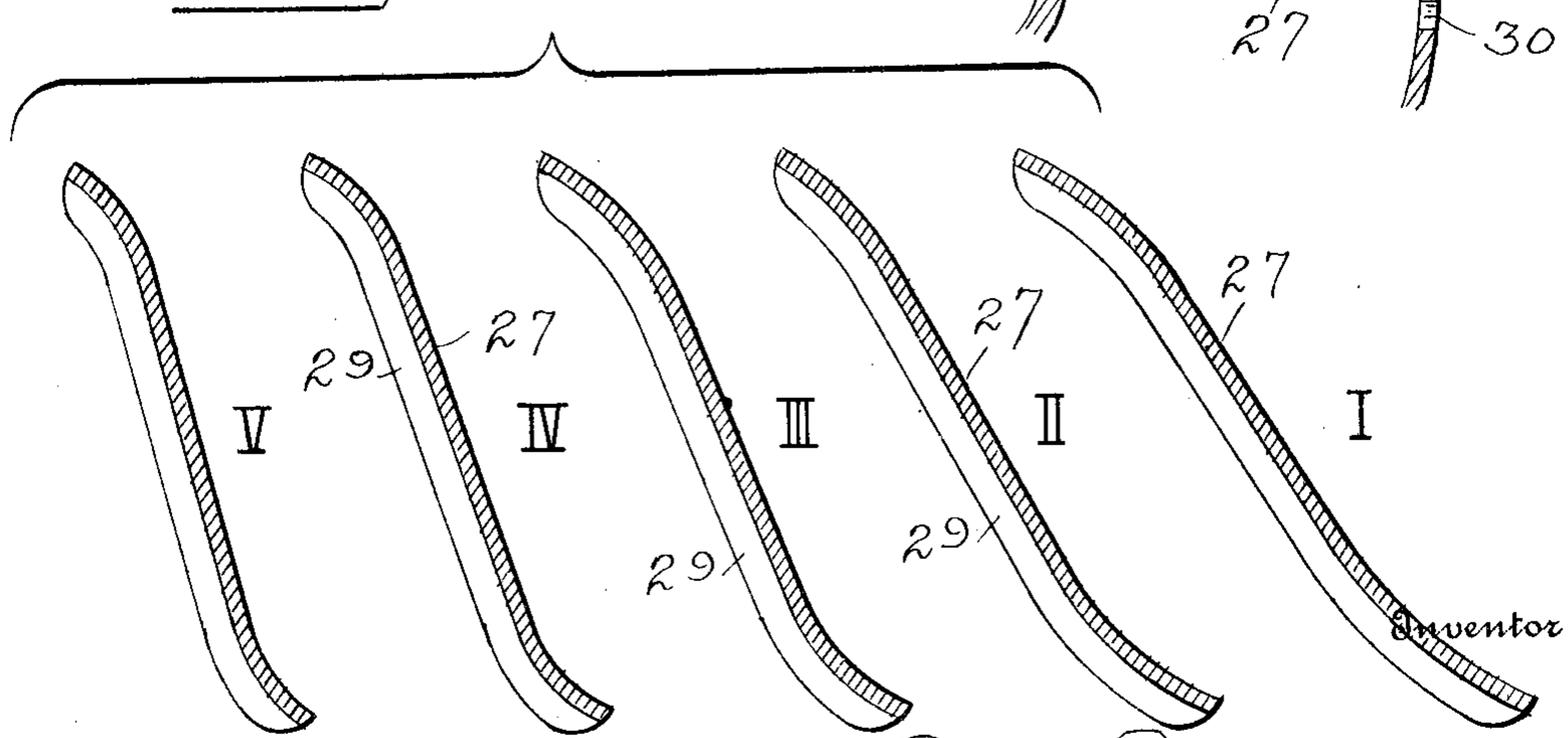


Fig. 7.



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5 SHEETS—SHEET 5.

Fig. 8.

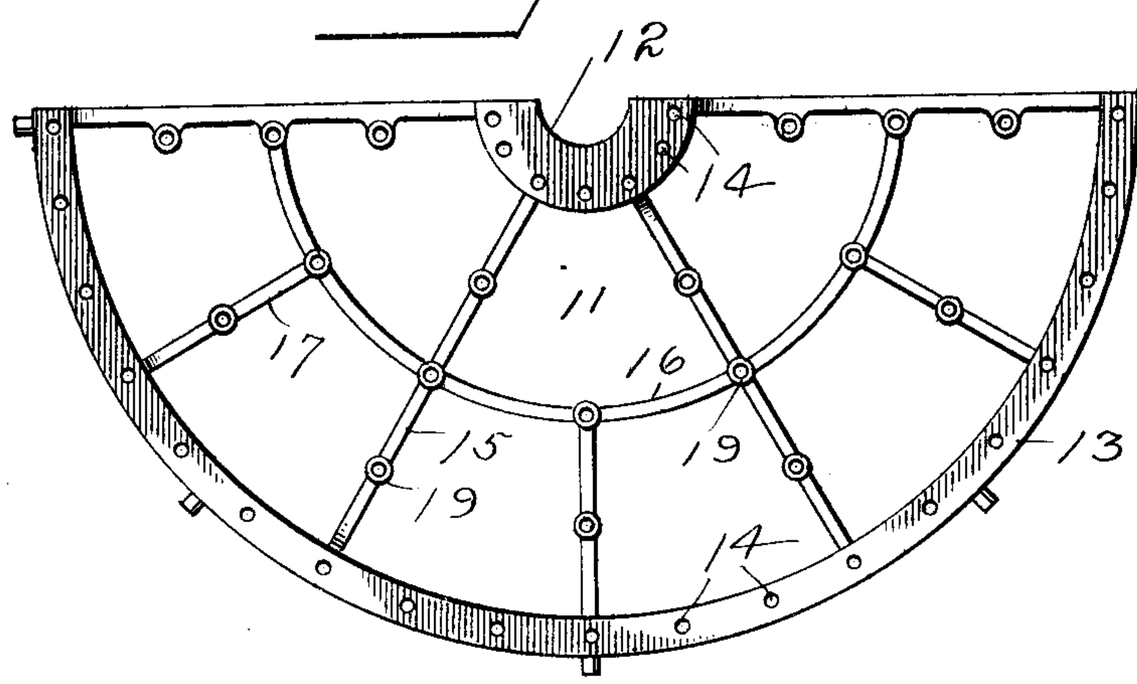


Fig. 9

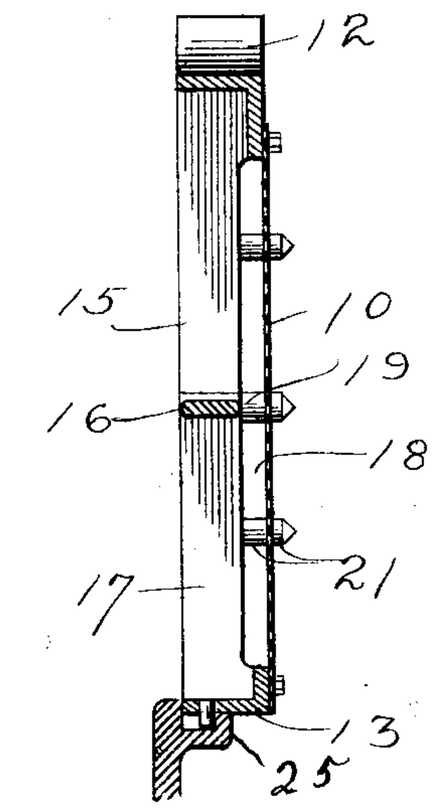
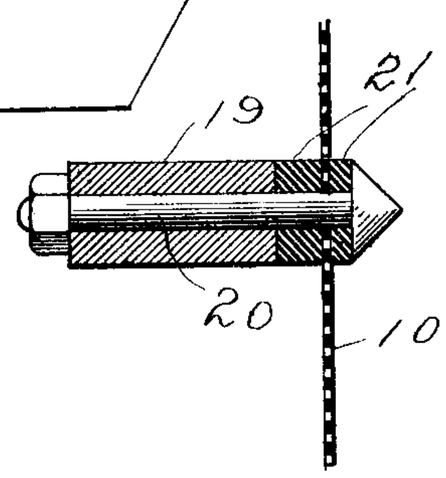


Fig. 10



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PEDER P. WESTBYE, OF PETERBOROUGH, ONTARIO, CANADA.

PULP-SCREENING MACHINE.

1,155,116. Specification of Letters Patent. Patented Sept. 28, 1915.

Application filed August 9, 1911. Serial No. 643,232.

To all whom it may concern:

Be it known that I, PEDER P. WESTBYE, a subject of the King of Norway, residing at Peterborough, in the county of Peterborough, Province of Ontario, Canada, have invented certain new and useful Improvements in Pulp-Screening Machines, of which the following is a specification.

My invention relates to paper making machinery, and particularly to pulp screens adapted to separate the finer and usable portions of the pulp from the coarse or unusable portions of the material.

The object of the invention is to simplify the structure, as well as the means and mode of operation of such machines, whereby they will not only be cheapened in construction, but will be more efficient in use, economical in operation, positive in action easily operated and unlikely to get out of repair.

A further object is to provide an improved screening method with improved means for supporting the screen and for forcibly discharging the pulp against the stationary screen, and furthermore improved means for securing an equal distribution of the pulp over a screen surface of comparatively large area.

A further object is to provide improved feeding devices for supplying the pulp whereby the distributing mechanism will be supplied substantially equally throughout.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention consists of the features of construction, the parts and combinations thereof and the mode of operation, or their equivalents, as hereinafter described and set forth in the claims.

Referring to the drawings, Figure 1 is a vertical longitudinal sectional view of the assembled machine. Fig. 2 is an end elevation of the assembled machine showing the pulp supply conduits. Fig. 3 is a transverse vertical sectional view on line *xx* of Fig. 1, showing the intake end of the rotary distributer, and the discharge orifices of the supply conduits. Fig. 4 is a plan view of the pressure equalizing chamber for the pulp supply. Fig. 5 is an end elevation of the revoluble rotor or distributer, viewed from the discharge end. Fig. 6 is a detail transverse sectional view of one of the rotor or distributer vanes. Fig. 7 embodies five different longitudinal sectional views of the rotor or distributer vanes, on lines I—I, II—II, III—III, IV—IV and V—V respectively, of Fig. 1 showing the variations in the curvature of the vanes or blades. Fig. 8 is an elevation of one of the semi-annular screen supporting frames. Fig. 9 is a vertical sectional view through the lower half screen and its supporting frame showing the engagement of the screen support with the frame of the machine. Fig. 10 is a detail sectional view of the screen attachment means.

Like parts are indicated by similar characters of reference throughout the several views.

In constructing the machine there is employed a semi-annular or trough shaped body 1, having at one end thereof an annular head 2 and at the opposite end an annular housing 3, which forms an outlet chamber for the screened pulp as here after described. The semi-annular body 1 forms the lower half of a horizontal cylindrical casing, the upper half of which comprises a removable semi-annular cover 4 supported upon the annular head 2 and housing 3 and on the upper edges of the semi-annular body 1, and preferably secured in place by means of longiturinally disposed angle irons 5—5.

Extending centrally through the casing is a revoluble shaft 6 journaled in bearings 7—7 mounted in suitable brackets 8—8 projecting from the annular head 2 and the housing 3.

At its inner side the annular housing 3 is provided with an interior peripheral flange 9 upon which is supported the vertical stationary pulp screen which forms a perforated diaphragm between the annular head 3 and the main casing. The screen plates are preferably two in number, each semi-annular in shape and secured upon semiannular supporting frames or spiders 11, shown in detail in Figs. 8 and 9. It is obvious that the screen plates and supporting frame therefor might be single continuous annular members or the screen plate and supporting frame might be divided into a plurality of segmental sections of any proportion.

Referring particularly to Figs. 8 and 9, the supporting frame for the screen comprises a central half hub portion 12, and a semi-annular rim portion 13 the faces of which lie in a common plane and to which the screen plate is directly attached by bolts

or rivets through the holes 14 in the hub and rim portions. The hub portion 12 and rim portion 13 are connected by radial arms 15 which are further united by a concentric tie 16 which is further connected to the rim 13 by additional radial arms 17. It is to be understood that the particular arrangement of arms and ties is not essential, but that such arms and ties may be increased or diminished, or rearranged to meet different conditions of service.

As will be seen in Fig. 9 the radial arms 15 and tie 16 do not extend flush with the faces of the hub and rim portions, and the screen plate 10 does not rest directly upon the radial arms and tie, but that the arms and tie are located somewhat below the plane of the faces of the hub and rim portions, whereby a clearance space 18 is provided intermediate the screen plate and arms.

Located at intervals on the arms 15 and tie 16 are bosses 19 which project into proximity to the screen plate 10. Each of the bosses 19 are perforated for the reception of retaining bolts 20 by which the screen plate 10 is secured in place. The retaining bolts 20 are supplemental to the bolts of rivets by which the margins of the screen plate is secured to the hub and rim portions.

In order to reduce to minimum the resistance afforded by the heads of the retaining bolts 20 to the passage of the pulp, the heads of said bolts are formed conical whereby any pulp striking the bolt heads will be deflected laterally onto the screen plate.

In order to reduce the liability to breakage of the screen plate due to the great pressure and strain to which the screen plate is subjected, the central portions of the screen plate are yieldingly or resiliently supported upon the bosses 19 by means of rubber or other resilient collars 21 located upon the retaining bolts 20 on opposite sides of the screen plate 10. It is obvious that helical springs might be substituted for the resilient collars 21. The screen plate frames are removably secured upon the interior flange 9 of the annular head 3. The upper semiannular screen plate frame is attached to the flange 9 by means of angle irons or brackets 22 bolted to the rim 13 of the screen plate frame and to the flange 9. The lower half frame is provided about its periphery with a plurality of radially disposed studs 23 which engage within the groove 24 of a grooved flange 25 projecting inward from the lower half of the interior flange 9. The lower half frame may be removed after the removal of the upper half frame by a partial rotation of the lower half frame within the flange 25 and about the shaft 6 whereby the radial studs 23 will be caused to pass out of the groove 24.

Carried upon the shaft 6 is a revoluble rotor or runner which operates by centrifugal tendency to distribute the pulp equally over the extended surface of the screen plate. The rotor comprises a conical or bell shaped shell 26, the larger end of which is directed toward the vertical screen plate 10, having therein a plurality of radial vanes or blades 27. The shell 26 is continuous or imperforate throughout, except for certain air vents hereafter mentioned. While the vanes or blades 27 are radially disposed when viewed from the end, these vanes are somewhat helical or winding in their longitudinal relation. The shell 26, the vanes 27, and the hub or sleeve 28 are preferably formed integral, but it is obvious that such parts might be formed separate and subsequently assembled. At the intake and discharge ends of the vanes the vanes are curved rather abruptly in opposite directions, as shown in Fig. 7, the degree of curvature varying in proportion to the distance from the axis or shaft, as does also the inclination or pitch of the vanes. The inclination or pitch of the vanes as well as the curvature of the vanes at the intake and discharge ends is mathematically calculated in accordance with the lineal velocity of the pulp in comparison with the circumferential velocity of the rotor at the given point. The necessary curvature may be ascertained with accuracy by well known engineering formulas and diagrams, the curvature varying in accordance with the speed at which it is desired to revolve the rotor and the head or pressure of the pulp supply. The sections of vanes shown in Fig. 7 are designed for a rotor speed of two hundred and seventy five to three hundred revolutions per minute, with a pulp discharge velocity of twenty feet per second.

The pulp supply enters the smaller end of the rotor and after traveling along the vanes 27 is discharged from the large end thereof against the screen plate 10. It is to be noted that the screen plate 10 is perpendicular to the axis of rotation of the rotor or distributer. To maintain the pulp at substantially even depth throughout the width of the vanes, and to prevent an excess of pulp passing to the outer edge of the vanes under the influence of centrifugal tendency, there are provided on the advance or pulp engaging faces of the vanes 27, a plurality of ribs 29 projecting from the vanes and providing several gradually widening channels through which the pulp flows. Inasmuch as the rapid rotation of the rotor might cause a suction or partial vacuum at the rear or under side of each of the vanes, which might disturb the even distribution of the pulp over the next succeeding vane, there are provided in the exterior shell 26 of the rotor at points to the rear of each of the vanes 27, air vents 30 by which the air pressure within and outside the shell may be maintained in equilibrium. It will also be seen that at

its discharge end the conical shell 26 is slightly curved forward, which serves to overcome the outward movement of the pulp due to centrifugal tendency as it leaves the rotor, and to confine the pulp discharge to the area of the screen plate. At is intake end the rotor is provided with a flange 31 which overhangs the discharge nozzles of the pulp supply conduit thereby preventing waste or leakage.

Pulp is supplied to the machine through the conduit 32. The supply of pulp through the conduit 32 is frequently irregular, and the length of the conduit 32 varies under different condition and in different mills, thereby supplying the pulp under different head or various pressures. In order that the pulp may be supplied to the rotor or distributer at a constant pressure whereby the discharge velocity of the pulp may be maintained at the given ratio for which the machine is designed, pressure equalizing means is provided. This equalizing means comprises a chamber 33 into which the conduit 32 discharges, from which lead a plurality of supply conduits 34 and 35. These conduits 34 and 35 project within the chamber 33 above the bottom thereof whereby the pulp discharged by the supply conduit 32 collects in the bottom of the chamber 33 and overflows the upper ends of the supply conduits 34 and 35. Thus the current of pulp carried by the conduit 32 is interrupted, and the rotor is supplied with pulp under a constant head equal to the height of the upper ends of the conduits 34 and 35 above the discharge nozzles to be described. It is obvious that the chamber 33 may be located at any desired height above the rotor, thereby supplying the pulp to the rotor under different heads or pressures. The supply conduit 32 is off set in its relation with the conduits 34 and 35 as shown in Fig. 4, whereby the pulp cannot directly enter the conduits 34 and 35 under pressure as it is discharged from the conduit 32, but must enter the chamber 33 from which it overflows the conduits 34 and 35 thereby maintaining the constant head or pressure.

Projecting inward from the annular head 2 and extending within the annular flange 31 of the rotor are a plurality of radially disposed discharge nozzles with which the conduits 34 and 35 communicate. The object of the plurality of nozzles is to supply the pulp equally throughout the entire intake of the rotor. In the drawings three of the nozzles 36 have been shown. It is obvious however that any desired number of nozzles 26 and corresponding supply conduits 34 and 35 may be employed. In as much as the conduits 35 supplying the nozzles directing pulp to the lower portion of the rotor are longer than the conduit 34 supplying the upper portion of the rotor, the head of pulp or pressure will be greater in the conduits 35 than in the conduit 34, therefore the conduits 35 are made of slightly less diameter than the shorter conduit 34, thereby equalizing the pulp discharge, the nozzles 36 of the conduits 35 having correspondingly smaller orifices as clearly shown in Fig. 3. Further the imaginary circular path upon the screen plate supplied with pulp from any given point of the rotor or any given channel formed between the ribs 29 of the vanes 27, being proportionately greater as such point or channel is removed from the axis of the rotor, a gradually increasing supply of pulp is required in a radial direction. In view of this the nozzles 36 are somewhat sector shaped, the sides of the nozzles being divergent, and more widely separated at the outer than at the inner portions. This variation in width of the nozzle insures the outer portions of the screen plate of greater circumferential length being fully supplied with pulp equally with the central portions of the screen plate of less circumferential length. Thus the shape of the nozzles further insures the even distribution of pulp over the whole surface of the screen plate.

The rapid rotation of the rotor is inclined to create a suction at the intake end, which not only facilitates the feeding of the pulp through the conduits 34 and 35 and the nozzles 36, but it also tends to draw into the rotor a current of air which might interfere with or disturb the distribution of the pulp upon the rotor vanes. To obviate this there is provided upon the inner side of the annular head 2 a flange 37 projecting within the terminal flange 31 of the rotor. This flange prevents the entrance of an excessive amount of air and also the loss of pulp through leakage.

As before stated the top 4 of the main casing is removable whereby the rotor or screen plate may be inspected or repaired. There are also provided manholes 38 in the annular walls of the housing 3 and likewise covered manholes, (not shown) in the head of said housing.

The pulp is supplied to the equalizing chamber 33 through the conduit 32, from which chamber it is conducted to the rotor by the conduits 34 and 35, being discharged into the rapidly revolving rotor through the nozzles 36. The centrifugal tendency due to the rapid rotation of the rotor tends to spread the pulp over the vanes or blades of the rotor from which the pulp is forcibly discharged against the stationary vertical screen plate 10. The finer or usable portions of the pulp pass through the perforations of the screen plate into the outlet chamber formed by the annular housing 3, from which the screened pulp is conducted through the outlet conduit 39. The coarser

portions of the pulp or unusable portions comprising splinters, chunks or lumps of pulp, and foreign matter known as tailings failing to pass through the screen plate fall to the bottom of the semi-annular body 1 and escape through the outlet 40 in the bottom of said member. In working certain classes of material it may be found desirable to provide a water spray directed upon the screen plate 10 to keep the perforations of the plate clear and prevent the clinging of tailings thereto. Such spray devices being well known are not shown in the drawings.

While the parts above described are preferably employed as shown in the drawings, that is with the rotor revolving on a horizontal axis and the screen plate in a vertical position, it is obvious that the mechanism might be employed in a vertical position, with the screen plate horizontal.

From the above description it will be apparent that there is thus produced a machine of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction, and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

Having thus described my invention I claim;

1. In a pulp screening machine, a casing, a screen member in said casing, a supporting frame for the screen member, a plurality of bosses on the supporting frame upon which the screen member rests, whereby the screen member will be spaced away from the supporting frame, a distributer adapted to distribute the pulp over the screen surface, and a pulp supply leading to the distributer.

2. In a pulp screening machine, a casing, a screen member within the casing, a supporting frame for the screen member, resilient abutments for the screen member adapted to yieldingly support the screen against the impact of the pulp discharged thereon, a distributer for the pulp and a pulp supply conduit leading to the distributer.

3. In a pulp screening machine, a casing, a screen member within the casing, a supporting frame for the screen member, a plurality of attachment bolts securing the screen member to the supporting frame, resilient collars about said bolts on opposite sides of the screen, a distributer for the pulp, and a pulp supply conduit leading to the distributer.

4. In a pulp screening machine, a casing, a screen member within the casing, a supporting frame for the screen member, a plurality of bolts attaching the screen to the supporting frame, conical heads upon the attachment bolts whereby portions of pulp discharged against the bolt heads will be deflected onto the screen, a distributer for the pulp, and a pulp supply conduit leading to the distributer.

5. In a pulp screening machine, a casing, a screen member within the casing, a supporting frame for the screen member, a grooved flange within the casing, projections carried by the screen supporting frame extending within the groove of the flange whereby the screen and frame will be detachably engaged therewith.

6. In a pulp screening machine, a casing, a vertically disposed screen member within the casing, resilient supporting means for the screen member, a distributer for the pulp and a pulp supply conduit.

7. In a pulp screening machine, a casing, a screen member, a rotary distributer comprising an annular shell, a plurality of vanes spirally arranged within the shell adapted to discharge the pulp in a direction substantially parallel with the axis of rotation, a plurality of ribs located on the advance side of the vanes and extending from the intake to the discharge ends thereof, a pulp supply leading to the distributer, and means to rotate the distributer.

8. In a pulp screening machine, a casing, a screen member, a rotary distributer comprising an annular shell and a plurality of vanes within the shell, the shell having therein a plurality of air vents adjacent to the rear sides of the vanes, a pulp supply conduit leading to the distributer, and means for rotating the distributer.

9. In a pulp screening machine, a casing, a screen member, a rotary distributer, a pulp supply conduit leading to the distributer, a discharge nozzle for the supply conduit sector shaped in cross section and radially disposed in relation to the axis of the distributer.

10. In a pulp screening machine, a casing, a screen member, a rotary distributer, a pulp supply conduit discharging into the distributer at a point eccentric therewith, a nozzle for the supply conduit having its greatest dimension in a direction radial to the axis of the distributer.

11. In a pulp screening machine, a casing, a screen member, a rotary distributer, a pulp supply conduit leading to the distributer, a nozzle for said conduit having a substantially V shaped discharge orifice eccentrically located in relation with the axis of rotation.

12. In a pulp screening machine, a casing a substantially vertically disposed screen member, a rotary distributer, a pulp supply conduit, a plurality of nozzles with which the supply conduit communicates, said nozzles being eccentrically arranged in radial

relation about the axis of the distributer and discharging thereinto.

13. In a pulp screening machine, a casing, a screen member, a distributer, a pulp supply conduit, a plurality of radially disposed slotted nozzles discharging into the distributer at different heights, said nozzles being of different cross area according to the relative height of the several nozzles whereby the varying height of the head will produce an equal discharge through the several nozzles.

14. In a pulp screening machine, a casing, a substantially vertically disposed screen member, a distributer rotating upon a horizontal axis, and a bifurcated pulp supply conduit, the branches of which discharge into the distributer at different heights and are of different relative cross area in accordance with their relative height of discharge.

15. In a pulp screening machine, a casing, a substantially vertically disposed screen member, a distributer rotating upon a horizontal axis, and a plurality of pulp supply conduits of different cross area discharging into the distributer at points eccentric to the axis of rotation.

16. In a pulp screening machine, a casing, a screen member, a distributer, a pulp supply conduit, a reservior into which the pulp supply conduit having outlets of different areas discharges, a plurality of auxiliary conduits leading from the reservoir to the distributer, said reservoir being adapted to interrupt the head of pulp within the conduit whereby the pulp will be supplied to the distributer under a constant head equivalent to the height of the reservoir above the discharge orifices of the auxiliary conduits.

17. In a pulp screening machine, a casing, a screen member, a distributer, a pulp supply conduit, a reservoir into which the pulp supply conduit discharges, a plurality of auxiliary conduits leading from the reservoir to the distributer, the intake orifices of said auxiliary conduits being located above the bottom of the reservoir, substantially as specified.

18. In a pulp screening machine, a screen member, a rotary distributer, a pulp supply conduit leading thereto, having a divergent discharge orifice, radially disposed in relation with the distributer said orifice being of greater width at its outer end than at the end adjacent to the axis of the rotor.

19. In a pulp screening machine, a screen member, a rotary distributer, a pulp supply conduit leading to the distributer, and a plurality of slotted discharge orifices radially disposed in relation with the distributer through which the pulp is supplied thereto.

In testimony whereof, I have hereunto set my hand this 31st day of July, 1911.

PEDER P. WESTBYE.

Witnesses:
LOTTIE DAVIS,
J. E. L. GOODWILL.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."