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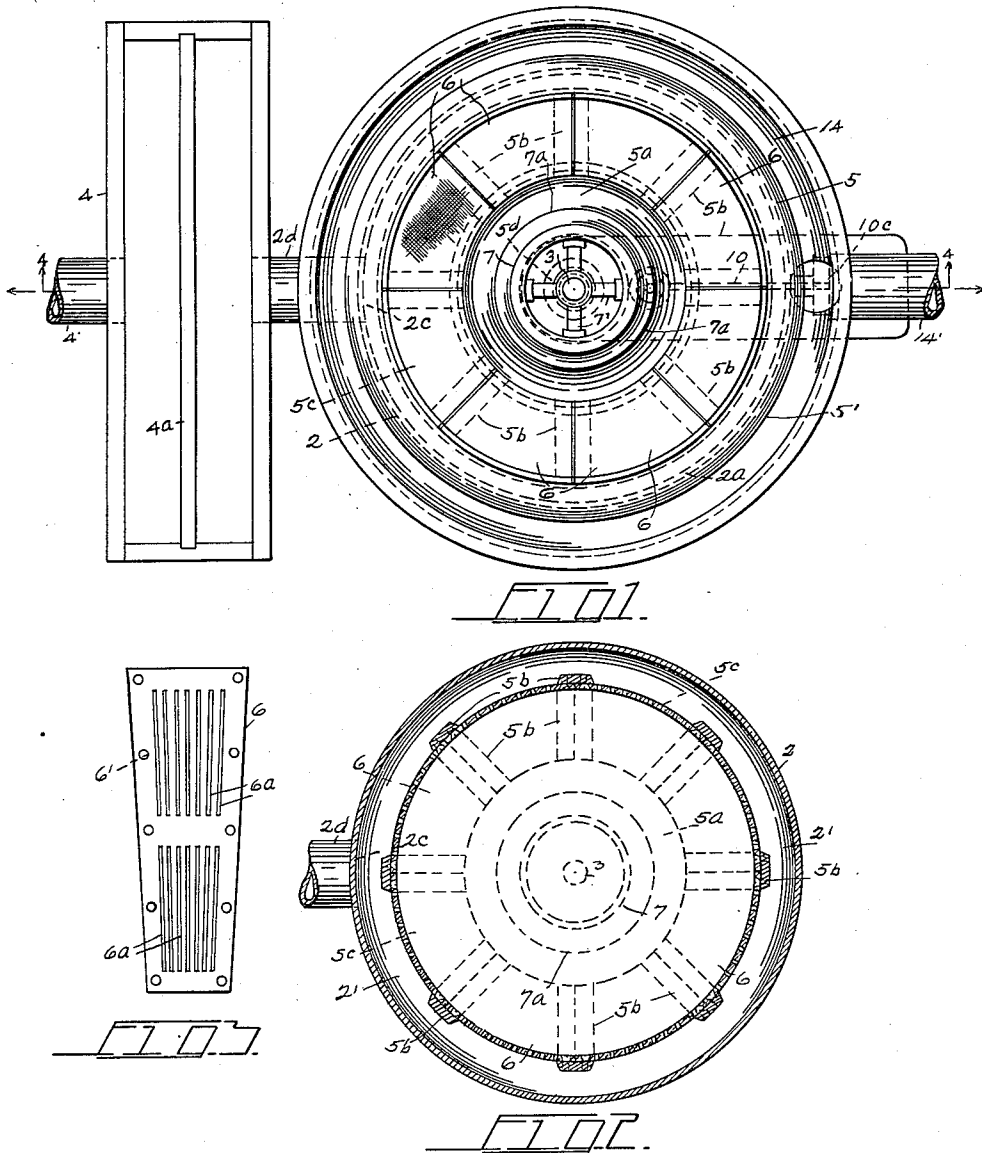
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ROTARY PULP SCREEN

Filed Jan. 6. 1931

2 Sheets-Sheet 1



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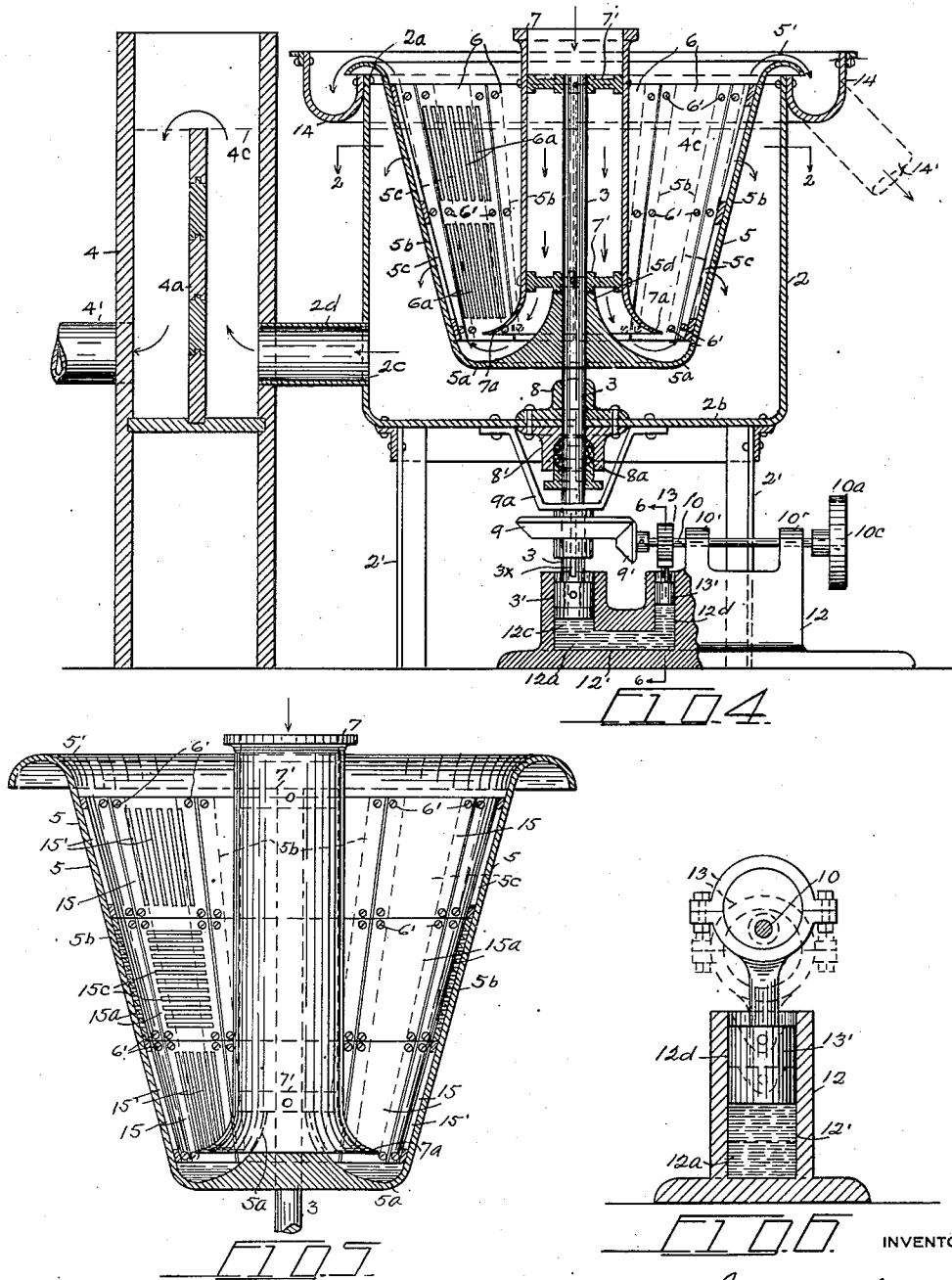
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UNITED STATES PATENT OFFICE

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ROTARY PULP SCREEN

Application filed January 6, 1931. Serial No. 506,909.

This invention relates to a screening mechanism, designed for conditioning ground wood or other pulp for paper-making, wall-board, and the like, and has for its object to provide a pulp screen of the upright rotary type, which comprises an open top vat or tank, in which is rotatably disposed an inverted frusto-conical screen also having a normally open top and an imperforate concavo-convex bottom, the unscreened pulp or stock comprising, for example, ground wood suspended in water being delivered to the top of the screen and conducted thence toward the contracted bottom by means of a concentric spout, the latter having a flared bottom by which the stock is spread or deflected horizontally towards the inclined walls of the cone, and thereafter wells upwardly to a predetermined level, which is usually maintained throughout the screening operations. A particular object is to provide a basket-like frame having a flared annular open top-portion, the latter being connected with the bottom portion by a series of ribs spaced to provide openings that are closed by the screen plates, the said plates being detachably secured to said ribs and forming a continuous relatively smooth inner surface which obviates the usual tendency of the pulp to felt said surface and clog the relatively fine slots or openings of said plates. The basket is mounted rigidly upon a vertical shaft by which it may be rotated at any suitable speed. In practice, the speed at which the basket is rotated is such as to create a certain degree of centrifugal action by which the liquid mass is forced radially against the plates to effect the screening. This centrifugal action also tends to force the unscreened stock delivered by the feeding-spout upwardly over the inner surface of the cone, thereby to separate all coarse particles, such as splinters, knots, grit, and the like, which are unfit for papermaking, from the acceptable stock that passes through the screen plates and is collected by the vat, from which said stock may freely flow into a box or other receptacle ready to be delivered to the paper-making machine. The top of the hopper-like screening member is shaped like the mouth of a bell to provide an easy means of escape for the coarse refuse, which according to the present mechanism, gravitates into an annular trough that surrounds the mouth of the hopper, to be carried away by suitable means. The closed bottom of the screening member is kept free and clear of the coarse waste material by the continuous flooding and washing effected by the strong downward pressure exerted by the relatively long column of unscreened stock that flows through the feed-spout. This freeing and cleansing, as well as the centrifugal action is facilitated by the peculiar shape of the inner surface of said bottom portion and the inclination of the screen plates. These several actions tend to keep the stock to be screened moving continuously upwardly and effects the complete separation and disposal of the refuse without loss of any of the acceptable or serviceable pulp, and besides prevents the coarse material from collecting either at the bottom or at the sides of the hopper, as explained. And a further object is to provide novel and simple mechanism for producing short and quick vibrations of the shaft and hopper, which agitate the pulp and tend to prevent clogging of the slotted portions of the screens.

I attain these objects by the means set forth in the detailed description which follows, and as illustrated by the accompanying drawings, in which—

Figure 1 is a top plan view of the complete machine. Fig. 2 is a horizontal section, taken on line 2—2 of Fig. 4. Fig. 3 is a plan view of one of the slotted screen plates. Fig. 4 is a transverse vertical section, taken on line 4—4 of Fig. 1, showing the detail construction of the inverted cone-shaped screen, the driving, and also the vibrating mechanism. Fig. 5 is an enlarged transverse section of the hopper and an elevation of the feed-pipe, the section being taken on line 4—4 of Fig. 1, showing a modification of the screen plates. And Fig. 6 is an enlarged transverse vertical section, taken on line 6—6 of Fig. 4, showing the eccentric mechanism that effects the vibration of the shaft and screen.

In the drawings, 2 represents the pulp-col-

lecting vat, which may be supporting by legs 2', and having a normally open top 2a and a closed bottom 2b, the latter being perforated centrally to receive shaft 3, which is preferably slidable relatively to said bottom. One side of the vat is formed with an outlet opening 2c for the discharge of the acceptable pulp as through a pipe 2d, into a box or other receptacle 4, from which the pulp may be again discharged via a pipe 4'. The box 4 is preferably divided vertically and longitudinally by a sectional partition 4a, by means of which different levels of the pulp in the vat and screen may be regulated, as indicated by dotted line 4c in Fig. 4.

The screen, preferably an inverted frustum cone 5, comprises a basket-like frame having an annular flared top or mouth 5' and an imperforate concavo-convex bottom 5a, the latter being bored axially to receive the shaft 3 with which the basket is rigid and therefore rotatable. The top 5' and the bottom 5a are preferably connected and spaced by ribs 5b, to provide tapered openings 5c, which are closed by correspondingly shaped slotted or woven screen plates 6, the latter preferably overlapping the ribs, and their lateral edges abutting, as shown in Figs. 1, 2, 4 and 5. The plates 6 are usually secured to the ribs 5b by screws, as 6', and in the preferred arrangement, the plates are formed with several series of relatively fine vertical screening slots, as 6a. By this construction and arrangement, the whole inner surface of the hopper 5 is substantially smooth and free from humps or crevices that might cause felting or clogging when the hopper is filled with unscreened stock. The unscreened stock, which for paper-making comprises ground wood suspended in water, is delivered to the bottom of the hopper 5 by means of a concentric pipe or spout 7, which loosely telescopes the shaft 3 and is supported by spaced spiders 7', through which the shaft passes. The top of spout 7 preferably extends slightly above the plane of the bell top of the hopper, and its bottom is preferably flared outwardly, as at 7a, in order to spread and deflect the gravitating stock in all directions horizontally over the concave inner surface of the bottom 5a. The flare of the spout 7 is preferably arranged substantially parallel to a conical central portion, as 5d, of the bottom, to accelerate the free flow of the stock. This insures the constant washing of said bottom portion and prevents accumulation of the coarse waste material, as explained. The bottom of the vat 2 is fitted inside and outside with guides, as 8—8', for the shaft, the lowermost guide comprising an ordinary stuffing-box, as 8a. Below the stuffing-box, shaft 3 is fitted with a bevel gear 9, which is driven by a pinion 9', the latter being mounted upon and driven by a horizontal shaft 10, which operates in bearings 10', that rise from a block 12. The

gear 9 has driving connection with shaft 3 by means of a spline 3a, which enables the shaft to slide axially in the gear, and the gear is held in mesh with the pinion 9' during the reciprocation of the shaft, by a U-shaped brace, as 9a, which depends from the vat 2. The shaft 10 may be driven by belt and pulley, as 10a—10c, shown in Fig. 4. The block 12 is formed with a U-shaped cavity 12' comprising a reservoir which is partially filled with oil or other suitable fluid, as 12a, whose displacement by an eccentric pump 13, effects the axial vibration of the shaft 3 and screen 5. For this purpose, the lower end of shaft 3 is enlarged to form a plunger, as 3', which is reciprocable in the larger caliber arm, as 12c of the reservoir, while in the smaller caliber arm 12d, of the reservoir, is reciprocably disposed a plunger 13'. The concentric mechanism that operates the plunger 13' is mounted upon and actuated by shaft 10, as shown in Figs. 4 and 6. By this arrangement, the downward movement of plunger 12d displaces the oil 12a and lifts the shaft and hopper, while the downward movement of said parts is effected by gravity alone, following each upward movement of the plunger 12d. The strokes of the pump 13 are preferably relatively slight, and when shaft 10 is rotated at a speed of one hundred or more R. P. M., the vibratory movements of the hopper 5 are relatively short and quick and tend to so agitate the body of the pulp within the hopper 5, as to prevent the solid particles suspended in the liquid from clinging to the inner wall of the hopper. The agitation induced by the axial vibrations of the screen also tends to supplement the normal centrifugal force caused by the rotation of the hopper for continuously working the coarse refuse upwardly towards the mouth 5' to be spilled into an annular trough 14, which surrounds the mouths of the vat and hopper, and from which the refuse may be carried away, as by a pipe 14'. In the present device, the weight of the shaft 3 and the hopper 5 is virtually supported by the fluid 12a.

It will be understood from the present novel construction of the hopper 5, having imperforate bottom 5a, which is continuously washed and kept clear of waste by the strong gravitative flow of the fresh unscreened stock, that the latter, owing to the flare of the spout 7 and the concave of the inner surface of the bottom, creates more or less ebullition in the vicinity of the bottom ends of the screen plates and this boiling action tends to start the upward motion of the buoyant splinters, knots, and the like, which are thereafter kept moving in the said direction by the centrifugal force and the vibrations of the hopper, so that by the time the coarse particles reach the tops of the slots 6a, complete separation of the acceptable pulp from the said refuse is effected, and

when the waste is finally ejected from the screen, there can be no loss of acceptable pulp, and hence the usual rescreening of the tailings is entirely obviated. By the herein described method and means of screening, there is little danger of the screen becoming clogged and requiring frequent shutting-down of the machine for cleaning the plates 6', and there being practically no loss of serviceable pulp, nor interruptions of the operation of the machine, the present improvement insures higher efficiency than any other rotary pulp screen known to me.

In Fig. 5, is shown a modification which consists of providing, for example, a number of relatively short slotted plates, as 15, which are preferably slotted longitudinally, as at 15', and plates 15a which are slotted transversely, as at 15c. These short plates are preferably disposed in alternate order, as shown at the left in Fig. 5, and said plates may be fastened to the common ribs 5a by screws 6', as shown. In other respects, the hopper may be constructed the same as shown in Figs. 1, 2 and 4. This arrangement of sectional screen plates has for its object to interrupt and change the flow of the screenable pulp towards and through the slots of the plates for the purpose of agitating the same to lessen the danger of felting and clogging of the screen plates.

Having thus described my invention, what I claim, is—

1. A rotary pulp screen, having in combination with an open top vat and an upright shaft journaled in the bottom of the vat, an inverted hollow frustum cone rotated by the shaft comprising a flared open top portion and an imperforate concave bottom portion separated by screen plates, a gravity feed-spout loosely telescoping the shaft and having a flared bottom end adapted to deflect the unscreened stock radially to wash the concave surface of the bottom and supplement the centrifugal force caused by the rotation of the cone to effect the upward movement of the coarse refuse whereby to separate said refuse from the acceptable stock that passes through said plates and to spill said refuse over the top of the cone, and means to drive said shaft.

2. A rotary pulp screen including a vat and an upright shaft extending above and below the bottom of the vat, a hollow conical basket supported and rotated by the shaft, comprising an annular top portion and a concave bottom portion connected and spaced by inclined screen plates, a spout to conduct the unscreened stock towards the bottom of the basket, the bottom end of the spout being flared to correspond to the concave of the bottom of the basket to effect continuous washing of the bottom and to so agitate the stock after it leaves the spout as to prevent accumulation in the lower portion

of the basket of any of the refuse or sediment, the discharge from the spout being of such nature as to start a strong upward flow of the stock over the screen plates whereby to enable the centrifugal force created by the revolving basket to carry the refuse upwardly above the screening zone and to cause said refuse to spill over the top of the basket.

3. A pulp screen having in combination with an open top vat, a hollow upright body rotatable in said vat, an upright shaft passing concentrically through the vat and body to rotate the latter, said body having an open top and an imperforate concave bottom connected and spaced by inclined screen plates, a gravity feed-spout for the unscreened stock disposed concentrically in the body and supported by the shaft, the bottom of the spout being expanded and adapted to deflect the unscreened stock radially to wash the concave surface of the bottom and to start the flow of the unscreened stock upwardly over said plates, means to drive said shaft to create centrifugal force to continue the upward movement of the stock to effect the separation of the coarse refuse from the acceptable pulp that passes through the screen plates and to cause said refuse finally to spill over the top of the body, and means to vibrate the hopper to prevent felting and clogging of the screen plates.

4. An upright rotary pulp screen, having in combination with an open top vat, an inverted cone-shaped screen disposed in the vat, having a circular arrangement of inclined screen plates, a shaft passing through the bottom of the vat and centrally through the screen, a gravity feed-spout loosely telescoping said shaft adapted to carry the unscreened stock towards the bottom of the screen, the top of said screen being open, the bottom of the screen being imperforate and concave, the bottom end of said spout being flared and arranged parallel to the concave of the bottom adapted to deflect the stock radially with sufficient force to keep said bottom clear and free of splinters and other coarse refuse and also to start the upward flow of the stock over the screen plates, means to rotate said screen to create sufficient centrifugal force to cause said refuse to rise above the screen plates and spill over the top of the screen.

5. An upright rotary pulp screen comprising a vat, an inverted hollow frustum cone, having flared open top and imperforate concave-convex bottom connected and spaced by ribs and forming with said ribs openings, inclined screen plates secured to the ribs and closing said openings, the lateral edges of said plates abutting, a shaft extending upwardly concentrically through the vat and cone adapted to rotate said cone, a gravity feed-spout loosely telescoping said shaft to carry unscreened stock to the bottom of the

cone, the bottom end of said spout being flared outwardly adapted to deflect the stock radially over said bottom with sufficient force to start the upward flow of the stock over the screen plates, means to rotate said shaft
5 and cone to create centrifugal action to continue the upward flow of the stock towards the tops of the screen plates, means to effect the axial vibration of the cone, and adjustable means to maintain the stock at various
10 predetermined levels within the cone.

6. An upright rotary pulp screen, including a vat, a hopper-like screen disposed concentrically in the vat, a shaft passing upwardly through the bottom of the vat and
15 supporting and rotating the hopper, means to drive said shaft, a pump actuated by the shaft driving means to reciprocate said shaft and vibrate said hopper, said hopper having
20 an annular open top and concave bottom, said top and bottom being spaced to provide openings which are closed by inclined screen plates, a gravity feed-spout disposed concentrically in said hopper, the lower end of
25 said pipe being expanded adapted to deflect the unscreened stock radially toward the bottom ends of the screen plates with sufficient force to start the upward flow of the stock over said plates, and an annular trough
30 surrounding the top of the hopper adapted to collect the slivers and other coarse refuse separated from the acceptable pulp and ejected from the hopper by the centrifugal force created by the rotation of the hopper.
35 In testimony whereof, I affix my signature.

JOHN A. WIENER.

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