Sept. 6, 1932. R. T. LANG 1,876,064

APPARATUS FOR DEWATERING AND WASHING PULP

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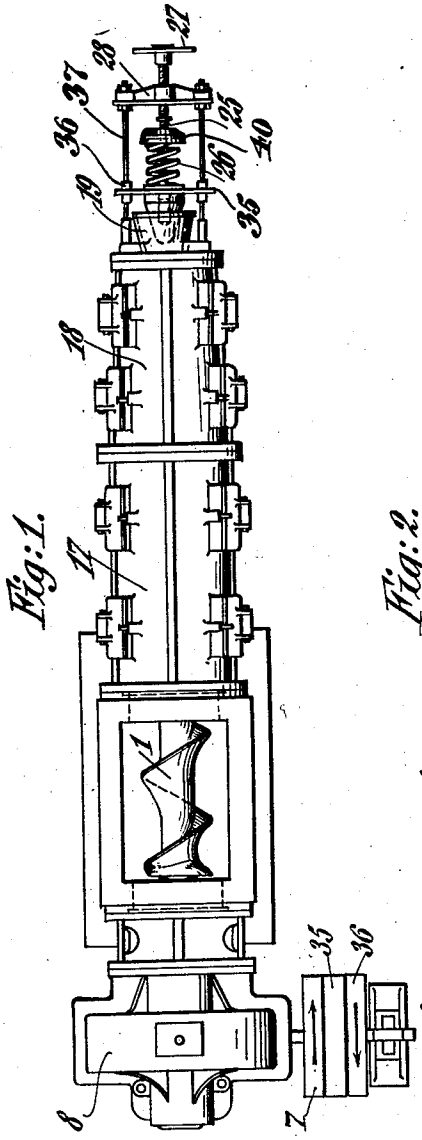


Fig. 1.

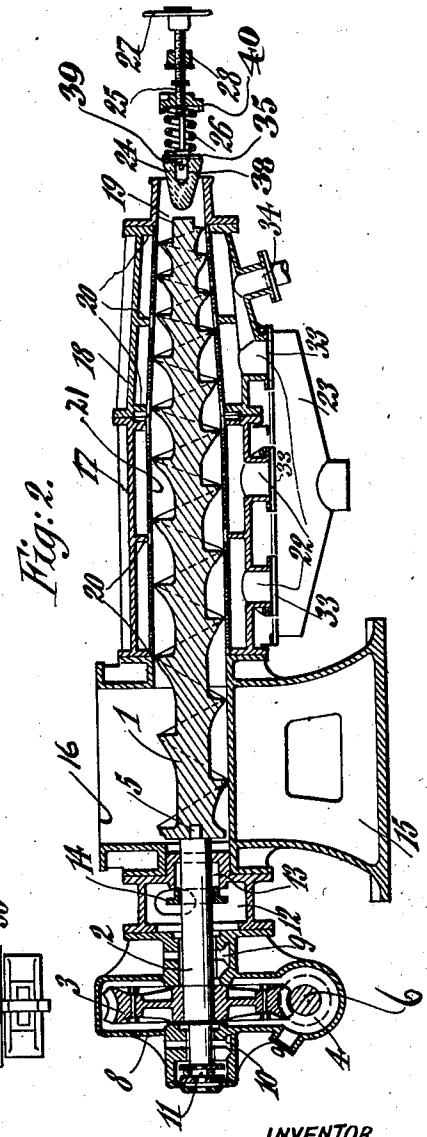


Fig. 2.

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Fig:3.

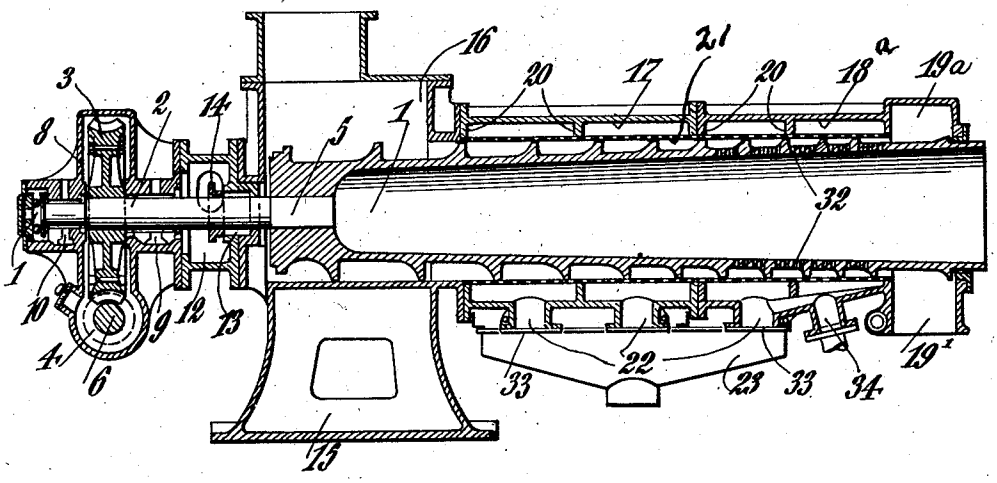


Fig:4.

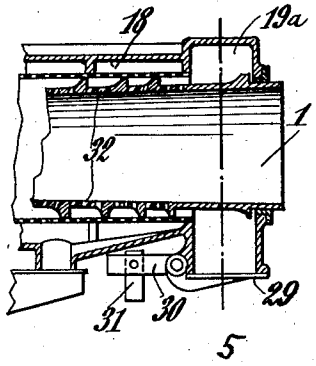
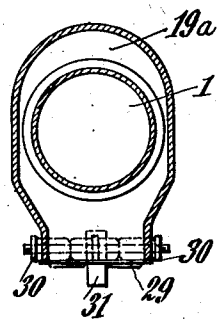


Fig:5.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR DEWATERING AND WASHING PULP

Application filed May 8, 1926. Serial No. 107,569.

This invention relates to apparatus for dewatering ground wood, cellulose etc. and to removing black liquor from washing soda and kraft stock after it has been discharged from the digester.

For dewatering pulp machines with flat or cylindrical wires, such as deckers, wet machines etc. have been used heretofore. The initial cost of such machines is very high besides they require a permanent repeated expenditure for wires and felts which wear out within a relatively short period and have to be replaced frequently. Moreover it is almost impossible to obtain a consistency of the dewatered pulp from these machines higher than 40%.

For removing black liquor from soda and kraft stock, wash tanks and diffusers are being used at present. These apparatus require a large floor space, they are expensive on account of their large size and their operation needs much labor.

The object of my invention is to provide a simple apparatus which is able to separate water or black liquor or the like from the diluted pulp with a minimum of power, labor and upkeep to such an extent that a dry consistency of the pulp up to 50% and more may be obtained.

This apparatus consists preferably of a screw press comprising a screw of special shape and features, a perforated shell surrounding the screw and embedded in a casing which serves for collecting and leading away the water or liquor removed from the pulp, an inlet for receiving the pulp to be dewatered, and a discharge for the dewatered pulp provided with means for adjusting the outlet opening of said discharge for the purpose of regulating the density of the discharged pulp.

The most important part of the apparatus upon which the efficiency of the operation largely depends is the screw proper. I shape this screw in such a manner that the distance of the thread is largest at or near the inlet for the pulp, and becomes smaller and smaller the more the screw approaches the discharge end for the dewatered pulp. Preferably simultaneously, the thread which has its largest depth at the inlet end becomes more and more shallow the nearer it is to the discharge end of the screw. In other words, I preferably use a screw with diminishing pitch and depth of the thread for the purpose of obtaining a gradually increasing pressure on the pulp to be dewatered or washed, and a very efficient and thorough expelling of the water, black liquor or the like from the pulp.

The invention will be more fully described hereinafter, embodiments thereof shown in the drawings, and finally set forth in the claims.

In the accompanying drawings:

Figure 1 is a top plan view.

Figure 2 is a vertical longitudinal central section of Figure 1, with the apparatus showing a solid screw.

Figure 3 is another vertical longitudinal central section of a press of different form showing a conical hollow screw.

Figure 4 is a detail view of the discharge end of Figure 3;

Figure 5 is a cross section on the line 5—5 of Figure 4, showing the pressure regulating device at the discharge end of the press.

Similar characters of reference indicate corresponding parts throughout the various views.

In the drawings, the screw 1, coupled with the driving shaft 2 obtains its rotation through worm wheel 3, worm 4, wormshaft 6 and pulley 7. The square head 5 of the driving shaft 2 is slipped into the screw so that the latter can be easily withdrawn. The housing 8 covers the worm gear, and the guide bearings 9 and 10 and the thrust bearing 11, which latter takes the thrust of the screw. A ring shaped filler casing 12 with the stuffing gland 13 and openings in the casing, gives access to the stuffingboxes 14.

The main press frame 15 is provided with an inlet trough 16. This trough 16 may be open, when the pulp to be pressed is fed with a consistency of more than 4 per cent. It should be closed, however, when thin pulp with less than 4 percent consistency is to be used, so that the latter can be fed into the trough under pressure.

Connected to this frame 15 is the circular

screw casing forming the press chamber, which consists of a cylindrical part 17 and a conical part 18, to which latter the central outlet spout 19 is connected. The screw casing has circular ribs or flanges 20, against which the perforated shell 21 rests. This shell 21 is preferably a heavy bronze casting with holes drilled in it and fully surrounds the screw 1. The screw castings 17 and 18 are provided with outlets 22 which communicate with the circular clearance between the perforated shell 21 and casings 17 and 18. Through these outlets 22, the expelled water or liquor flows to a connecting gutter 23.

The control outlet spout 19 for the pulp is slightly conical and is partly closed by a tapered plug 24 which leaves a circular free aperture through which the dewatered pulp is discharged. This plug can be moved towards or away from the outlet spout by means of a spindle 25, spiral spring 26, hand wheel 27 and yoke 28, thereby changing the free area of the aperture through which the pulp is discharged and controlling the pressure in the interior of the screw room or chamber within the shell 21 and the density of the discharged pulp.

The plug 24 is attached to a cross-bar 35 having bearings 36 which slide on rods 37 carrying the yoke 28 and affixed to the spout 19. The rod 25 passes through the cross-bar 35 and into a cavity 38 of the plug 24 and is there held by a nut 39. On the rod 25 is a head 40 which can be turned on the threads of the rod 25 and controls the compression of the spring 26. The threads on the rod 25 also engage the cross-bar or yoke 28 so that by turning the wheel 27 the position of the plug 24 is adjusted. At the same time the position of the head 40 on the rod 25 fixes the degree of compression of the spring 26 so that the plug can yield, the bar 35 moving on the smooth end of the rod 25 when compression is exerted against the plug in opposition to the force of the spring 26.

Instead of using a central outlet spout, the latter may also be arranged as shown in Figure 4. The tapered plug 24 of Figures 1 and 2 is replaced in Figure 4 with a hinged cover or door 29, which is counterbalanced by means of a lever 30 and weight 31. This weight 31 controls the resistance of the door 29 and hence the pressure of the pulp in the interior of the screw room, which may be regulated by changing the position of the weight on the lever.

When using a hollow screw as shown in Figures 3 and 4, this screw may also be provided with circumferential perforations 32 on the last sections of the body of the screw near the outlet spout as shown or over its entire length which allows part of the water in the portion of the pulp near the end of the screw to flow away through these perforations 32 whereas the water in the outer portion of the pulp escapes through the perforated shell 21, thus insuring a more uniform density of the pulp discharged from the press.

For the embodiment of Figure 3, the part 18—*a* which corresponds to the conical part 18 is not conical, as the exterior of the threads of the screw in Figure 3 are of the same cylindrical contour. The screw base itself tapers and is preferably hollow. The pitch and the depth diminish from inlet to outlet. In Figures 3 and 4 the outlet spout 19*a* envelops the end of the screw which projects from the casing and the opening to which is attached the closure 29, as shown at 19′. The open outlet end of the screw may be regulated in the space between it and the casing, by a ring shaped plug similar to that in Figures 1 and 2, or the closure on the hinged door 29 of Figure 4 may be disposed at the ends of the screw in Figures 1 and 2 in place of the plug.

Screw presses have a tendency to clog up if the pulp gets too dense before it reaches the outlet spout. If such a clogging up arises, the press has to be stopped and part 18 of the press chamber, which is fastened to part 17 with hinged bolts, has to be removed. Care has to be taken not to remove the screw 1 itself at the same time, as this would require to clean out the press chamber 17 and the inlet trough 16 entirely before the screw can be put back into its original position.

To avoid the unhandy and tiresome dismantling and cleaning out of the press when the screw press has clogged up, I provide the outlets 22 with hinged covers 33, or similar shutting off devices and after having shut these covers 33, I feed water under pressure through the water connection 34 on the press chamber 18, after the pulp supply has been cut off. At the same time I reverse the rotation of the screw by means of the reversing drive 35, 36 or any other kind of reversing gear or by reversing the motor in case of the screw press being driven by a reversible motor. The water in the press chamber 18 will pass through the perforations in the shell 21 into the screw room or chamber, softening and dissolving therein the stoppage. After the latter has been overcome, the water connection 34 will be shut, the covers 33 at the outlets 22 will be opened again and the screw put back into working rotation, whereupon the pulp supply can be opened again.

It is possible to overcome the clogging up of the screw press with these manipulations, without dismantling or cleaning out the press by hand.

I have shown several embodiments of my invention to describe the same, and have in connection therewith described certain operative details of construction, but I do not desire to be limited thereto, since the underlying principles of my invention are pointed out in the appended claims.

I claim:

1. The combination with a casing containing a screw and having inlet and outlet ends, of means for operating the screw to advance the pulp toward the outlet end, means for operating the screw in a reverse direction, and means for supplying a cleaning fluid to the interior of the casing so as to flush the pulp material toward the inlet end while the screw is operated in a reverse direction.

2. An apparatus for expelling water or black liquor or the like from pulp, comprising a screw press frame, an inlet trough on said frame, a screw passing through said inlet trough, means for rotating said screw, a casing forming a press chamber, a perforated shell in said press chamber, forming a screw chamber, the press chamber having outlet openings through which the water or liquor expelled from the pulp escapes, the casing having a reduced conical portion with an outlet for said screw chamber, a plug cooperating with said outlet, a spiral spring for supporting the plug, a yoke connected to the outlet, a spindle in said yoke, and a hand wheel on the spindle for adjusting the clearance between the plug and the outlet.

3. In apparatus of the kind described, a feed screw in a screw chamber formed by a perforated shell, means for operating the screw to advance pulp through the screw chamber and means for reversely operating the screw, means for supplying a cleaning fluid through the perforated shell into the interior of the screw chamber so as to flush the pulp therein during the reverse movement of the screw, comprising a casing forming a conduit around the perforated shell and an inlet for supplying the conduit with flushing liquid under pressure.

4. In apparatus of the kind described, a perforated shell forming a screw chamber, a feed screw therein adapted to be operated in one direction to move pulp through the screw chamber and to be operated reversely to loosen the pulp when clogged, the chamber having inlet and outlet ends and the screw and chamber cooperating to have diminishing capacity toward the outlet end, and means for supplying a cleaning fluid through the perforated shell to the interior of the chamber so as to flush the pulp material therein during reverse operation of the screw, comprising a casing forming a conduit around the perforated shell and an inlet for supplying the conduit with flushing liquid under pressure.

5. In apparatus of the kind described, a perforated shell forming a screw chamber, a feed screw therein, the chamber having inlet and outlet ends, the screw and chamber being constructed and arranged to advance the pulp material toward the outlet end when the screw is operated in one direction, means for operating the screw reversely to loosen the pulp when it becomes clogged in the chamber, and means for supplying a cleaning fluid to the interior of the chamber so as to flush the pulp material toward the inlet end when the screw is operated in the reverse direction, comprising a casing forming a conduit around the perforated shell and an inlet for supplying the conduit with flushing liquid under pressure.

6. In a screw press: a press frame; an outlet trough on said frame; a feed screw having the pitch of its thread diminishing from the inlet side to the outlet side so that the pitch is largest at the inlet side and smallest at the outlet side; means for rotating said screw to move the pulp toward the outlet trough; a casing forming a press chamber; a perforated shell around the screw and separating the press chamber from the screw chamber; the press chamber having outlet openings and closure means for said openings; adjustable means for regulating the pressure of the pulp in said screw chamber; means for operating the screw reversely to loosen the pulp when it becomes clogged in the screw chamber; and means for flushing the pulp on reverse operation of the screw and when the press chamber closure means are closed, comprising an inlet connection for the casing through which to supply flushing liquid under pressure to the press chamber and thence through the perforations of the shell into the screw chamber.

7. The combination with a casing having an inlet and a perforated shell forming a press chamber with the casing and providing a screw chamber leading from the inlet to an outlet, of a feed screw in the screw chamber, means for operating the screw to move the pulp from the inlet toward the outlet and means for reversing the operation of the screw, and means adapted, when the screw is operated reversely, for flushing the pulp in the screw chamber, comprising a fluid feed connection for introducing fluid under pressure into the press chamber and thence to pass through the perforations of the shell into the screw chamber.

8. In apparatus of the kind described, inner and outer barrels forming respectively a screw chamber and a press chamber, together with means for admitting fluid into the press chamber when the screw chamber is to be flushed, the inner barrel being perforated to allow liquid to pass from one of said chambers to the other, the outer barrel being provided with outlets, closures for the outlets, to be closed when flushing, a discharge plug for the outlet end of the screw chamber, to be closed when flushing, a feed screw within the screw chamber and reversible means for rotating the screw, said screw being rotated in one direction to advance and press the material and being driven in a reverse direction to cause the flushing

fluid admitted into the screw chamber through the perforations of the inner barrel, to move from the discharge end to the feed end of the press chamber.

9. The combination of a casing containing a screw and having inlet and outlet ends, means for operating the screw to advance the pulp toward the outlet end, means for operating the screw in a reverse direction, and means for supplying a cleaning fluid to the interior of the casing so as to flush the pulp material toward the inlet end while the screw is operated in a reverse direction, said screw having the pitch of its threads diminishing from adjacent the inlet end to adjacent the outlet end.

In testimony that I claim the foregoing as my invention, I have signed my name hereto.

RICHARD T. LANG.