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3,606,177

WOOD PULP GRINDER

Filed March 20, 1969

2 Sheets-Sheet 1

FIG. 1.

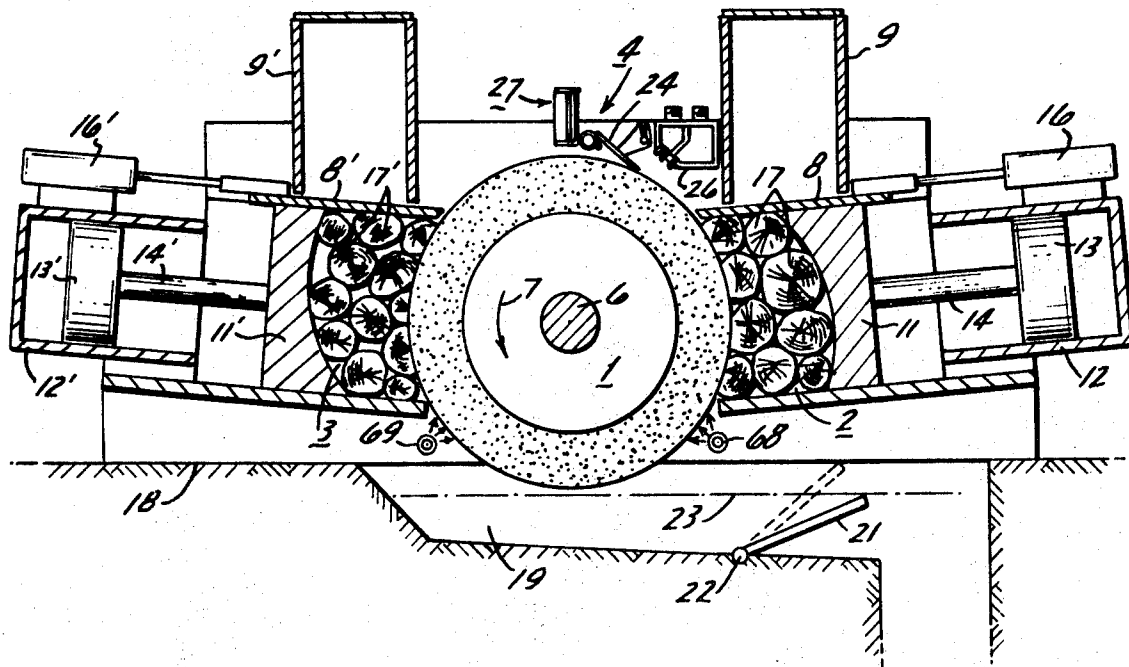
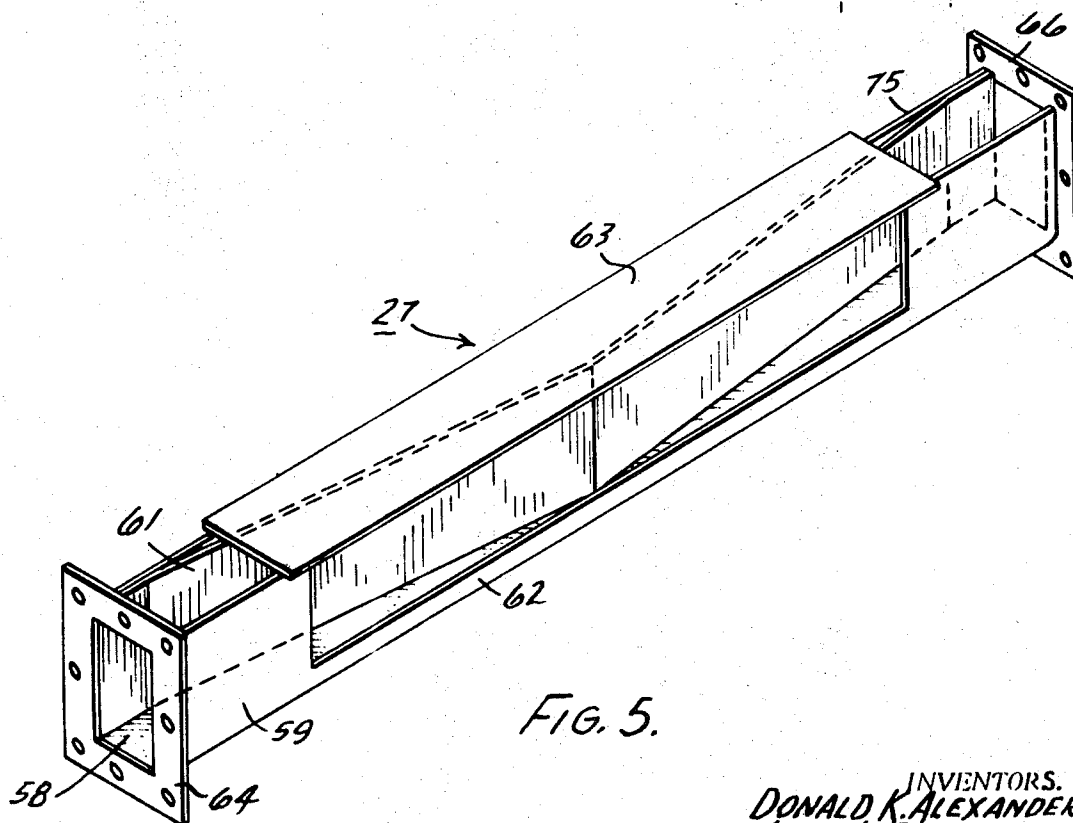


FIG. 5.

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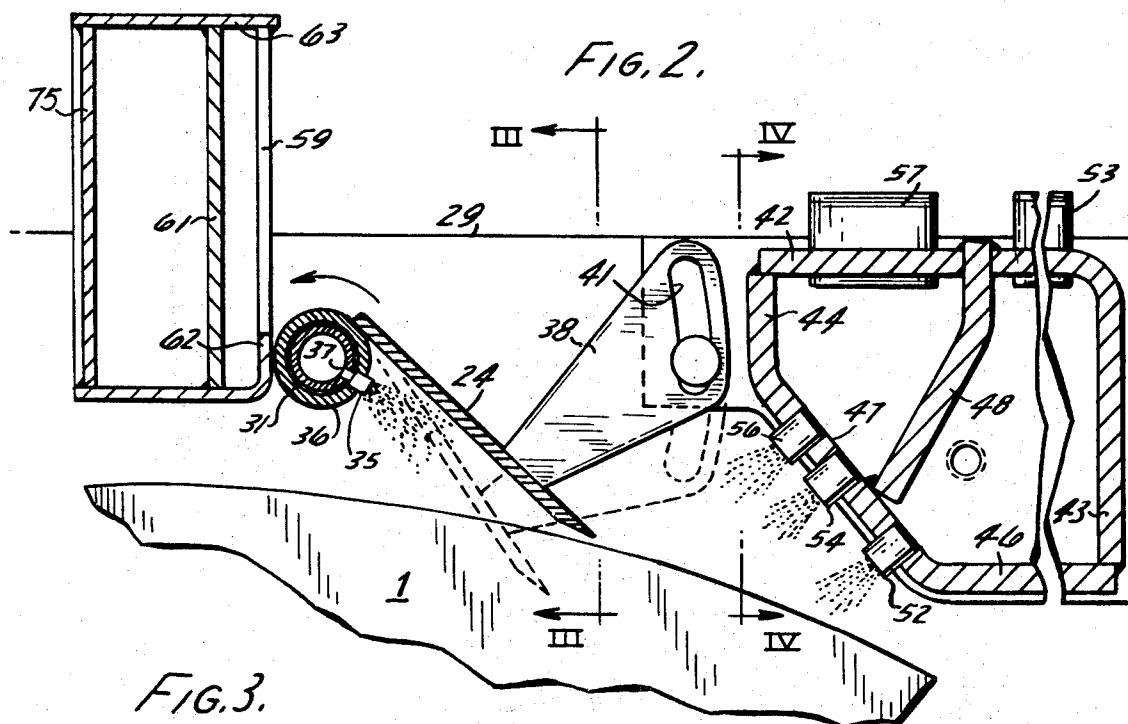
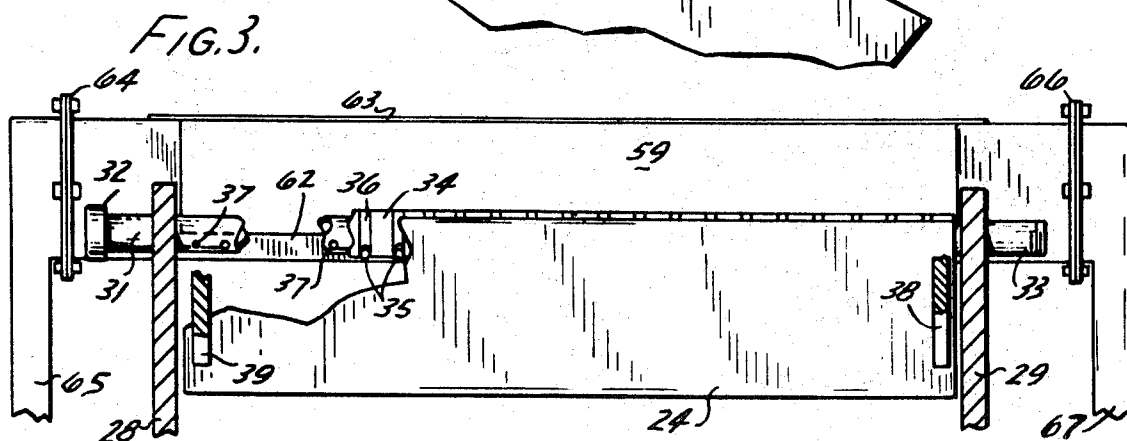
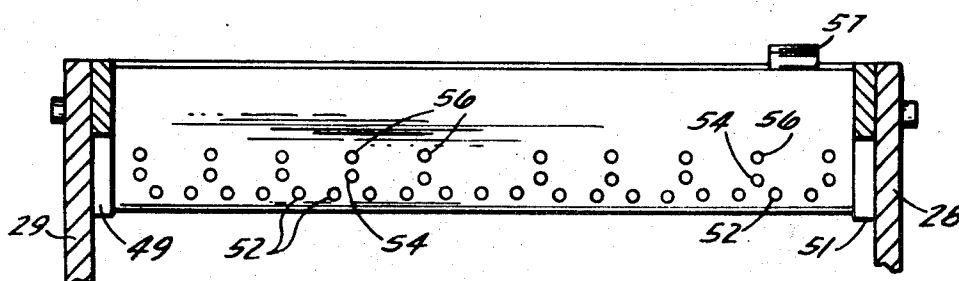


FIG. 4.

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WOOD PULP GRINDER

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U.S. Cl. 241—42

9 Claims

ABSTRACT OF THE DISCLOSURE

A top stock removal device for a pulpwood grinding machine is mounted over the grind stone in the space between an uprunning pocket and a downrunning pocket and comprises a doctor blade which is included toward the uprunning pocket, showering nozzles for the blade, and a flume for diverting stock from the doctor blade over the axially opposite ends of the grind stone.

The invention relates to the making of wood pulp for paper. More particularly, it relates to wood grinding machines of the type wherein logs are pressed sidewise against a rotating grind stone and are reduced to pulp by the abrading action of the stone periphery upon the wood.

Wood pulp grinding machines have been known for many years and have found wide acceptance in the paper industry. However, as is also well known in the art, the construction and operation of these machines present a multitude of problems from an engineering as well as from a performance standpoint.

One such problem, for instance, is the production of immense quantities of pulp in the shortest possible time and with the least possible consumption of energy.

Closely related to this problem of quantity control is the problem of quality control which involves such factors as fiber length, fines content, freeness and strength properties.

Other factors affecting the productive capacity of the grinder as well as the quality of the product are the cooling and cleaning of the stone, its grit size, surface condition and peripheral speed; the pressure with which the logs are forced against the rotating stone; the hydrodynamic lubrication and temperature conditions in the grinding zone, and the rate of pulp transfer from the grinding zone into the stock pit.

It is customary to shower the upper part of the stone with white water in the zone where it leaves the uprunning pocket and before it enters the downrunning pocket. The lower part of the stone usually dips into accumulated stock within the stock pit, but as an alternative for stone immersed grinding, provisions may be made for pitless grinding, in which case stock in the pit is kept below the stone, and jets of white water are impinged upon the stone by nozzles below the grinding pockets.

One particularly vexing problem which has been encountered with conventional two-pocket grinders during stone immersed as well as during pitless grinding is the tendency of the mechanically identical grinding pockets to produce substantially different quantities and qualities of pulp. Such unequal pocket output is undesirable and objectionable because it causes the overall output of the grinder to be of lower quantity and quality than it would be if both pockets would produce pulp in equal amounts and of equal good quality. For that reason two-pocket grinders as heretofore constructed have not been entirely satisfactory.

Moreover, unequal pocket output has heretofore made it virtually impossible to materially increase the overall pulp output of conventional two-pocket grinders by op-

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erating them at increased stone speeds and at higher grinding pressures.

Another short coming of two-pocket grinders as heretofore constructed is the occasional jamming of one or both grinding pockets. Pocket jamming, as known in the art, is a condition where the grinding rate and motive load drop off drastically, even when operating at a very high grinding pressure. Once a jamming condition is incurred, the only effective way to overcome it is to stop the stone, release the pressure upon the wood, restart the stone and reapply the pressure upon the wood. The result is at least a more or less extended production delay, and no practical and effective way to avoid pocket jamming is believed to have heretofore been found.

Generally, it is an object of the invention to provide an improved wood pulp grinder which avoids the hereinbefore outlined short comings and inadequacies of the prior art.

More particularly, it is an object of the invention to provide an improved two-pocket wood grinder which will produce pulp of satisfactory quality simultaneously in substantially equal quantities at both pockets.

A further object of the invention is to provide an improved two-pocket grinder of the above outlined character whose overall pulp output at conventional stone speeds, such as 4500 peripheral feet per minute, and at conventional grinding pressures will be substantially increased without loss of quality by increasing its stone speed or grinding pressure, or both.

A further object of the invention is to provide an improved two-pocket grinder of the above outlined character whose pockets will not jam in operation at either low or high stone speeds and grinding pressures.

With the foregoing objects in mind the invention contemplates a two-pocket grinder which is equipped with a top stock removal device, that is, with a device for removing stock from the upper part of the stone in the region where it leaves the uprunning pocket and before it enters the downrunning pocket.

In this connection it is a further object of the invention to provide a flume which forms part of the top stock removal device and which will efficiently convey large quantities of pulp and water without clogging, the flume being narrowest at its center and progressively increasing in width towards its opposite ends so as to present longitudinally diverging sluicing jets.

These and other objects and advantages are attained by the present invention, various novel features of which will become apparent from the description herein of a preferred embodiment of the invention, and will be pointed out by the appended claims.

Referring to the accompanying drawings:

FIG. 1 is a sectional, somewhat diagrammatic side elevation of a two-pocket grinder embodying the invention;

FIG. 2 is an enlarged sectional view of a top stock removal device of the grinder shown in FIG. 1;

FIG. 3 is a section on line III—III of FIG. 2;

FIG. 4 is a section on line IV—IV of FIG. 2; and

FIG. 5 is a perspective view of a plup discharge flume forming part of the top stock removal device shown in FIG. 2.

The principal components of the grinder shown in FIG. 1 are a rotary grind stone 1, an uprunning grinding pocket 2, a downrunning grinding pocket 3, and a top stock removal device which is generally designated by the reference character 4 and mounted in overlying relation to the grindstone 1 in the region between the uprunning and downrunning pockets 2 and 3.

The construction, mounting and arrangement of the grindstone and grinding pockets conform with well known engineering principles. Briefly, a suitable source of power, not shown, is connected to the shaft 6 of the grind

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stone to drive it in the direction of arrow 7. The uprunning pocket is formed by stationary bottom and side walls and a reciprocable top cover 8 which also serves as a bottom closure for a log magazine 9 above the pocket 2. A reciprocable pressure foot 11 within the pocket 2 is connected to a double acting hydraulic cylinder 12 comprising a piston 13 and piston rod 14. The top cover 8 is connected to another double acting hydraulic cylinder 16, and suitable valve mechanism, not shown, is provided to control admission of pressure fluid to the cylinders 12 and 16.

During grinding, fluid pressure acting upon the piston 13 forces the pressure foot 11 against a charge of logs 17 within the pocket 2 to provide the necessary pressure of the logs against the grind stone. The top cover 8 is maintained in the closed position in which it is shown in FIG. 1, and a supply of logs, not shown, may be stored in the magazine 9.

In order to initiate a new grinding cycle the pressure upon the piston 13 is reversed to cause withdrawal of the pressure foot 11, and logs are dropped from the magazine 9 into the empty pocket by withdrawal of the top cover 8.

The foregoing explanations with respect to the uprunning grinding pocket 2 analogously apply to the downrunning grinding pocket 3. That is, the downrunning grinding pocket comprises a top cover 8' and reciprocable pressure foot 11' which are actuated by double acting hydraulic cylinders 12' and 16', respectively. A log magazine 9' corresponding to the log magazine 9 is mounted above the grinding pocket 3. Logs 17' in the pocket 3 are pressed against the down running side of the grind stone by the pressure foot 11' and piston 13, while the logs 17 in the pocket 2 are pressed against the uprunning side of the stone by the pressure foot 11 and piston 13.

A concrete foundation 18 for the grinder is provided with a stock trough 19 below the grind stone 1 and grinding pockets 2 and 3. Pivotaly mounted within the stock trough 19 is a dam 21 which may be raised and lowered by a suitable adjusting mechanism, not shown. The side and bottom walls of the trough 19 in conjunction with the dam 21 form a pit in which the pulp output of the grinding pockets together with a copious flow of white water, as described more fully hereinbelow, may accumulate.

Depending on the degree of upward adjustment of the dam 21 about its pivot axis 22, the stock of the pulp and water accumulating in the pit will rise to a higher or lower level before it overflows the dam. For pitless grinding the dam 21 may be adjusted to the full line position in which it is shown in FIG. 1. Stock accumulating in the pit will then overflow the dam at the level which is indicated by the dash-dotted line 23 and which is lower than the lowest point on the periphery of the stone 1. For stone immersed grinding, the dam 21 may be adjusted upward to the dotted line position in which it is shown in FIG. 1 and which causes the lower part of the stone dip into accumulated stock within the stock pit.

The top stock removal device 4 as shown in FIG. 1 comprises a doctor blade or blade deflector means 24; a duct and nozzle assembly 26 for showering the grind stone 1 with white water in the region between the pulp discharge side of the uprunning grinding pocket 2 and the doctor blade 24; and a pulp discharge flume or conduit means 27 extending lengthwise of the doctor blade in back of the latter.

Referring to FIGS. 2 and 3, the doctor blade 24 extends lengthwise between opposite side walls 28, 29 of the grinder frame and is slanted toward the periphery of the grind stone 1 in back of the uprunning grinding pocket 2. As best shown in FIG. 3, a pipe 31 extends through aligned holes in the side walls 28, 29, one end of the pipe being closed by a cap 32 and the other end having threads 33 for connection with a white water supply line, not shown.

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The pipe 31 is secured in axially fixed position on the side walls 28, 29, as by welding, and in the space between the side walls the pipe is surrounded by alternate wide and narrow spacers 34 and 36 in axially abutting relation to each other. The spacers 34 and 36 are rotatable on the tube 31, and the doctor blade 24 is secured along its rear edge, as by welding, to the wide spacers 34 which are circumferentially solid. The narrow spacers 36 have radial apertures to accommodate nozzles 35 which are screwed into holes 37, respectively in the pipe 31. In the assembled condition of the parts as shown in FIG. 2 water admitted into the open end of the pipe 2 is showered upon the region of stone 1 in back of the doctor blade 24 through the nozzles 35. The amount of water discharged from the nozzles 35 may be regulated by a valve, not shown, in the supply line which is connected to the pipe 31.

The doctor blade 24 is secured against displacement from its pivotally adjusted position about the axis of the pipe 31 by a wing plate 38 adjacent the inner side of the frame wall 29, and by a corresponding wing plate 39 (FIG. 3) adjacent the frame wall 28. Each wing plate has an arcuate slot 41 to provide for downward adjustment of the doctor blade as the stone diameter decreases due to wear and refinishing of the stone periphery.

The duct and nozzle assembly 26 comprises an elongated plate metal box having top and rear walls 42, 43, a vertical front wall section 44, a horizontal bottom wall section 46, and an inclined forward wall section 47 between the front and bottom wall sections 44 and 46. A partitioning wall 48 divides the interior of the box 42-47 into forward and rearward compartments which extend side by side in the axial direction of the stone. The opposite ends of the box 42-47 are closed by vertical plates 49, 51 (FIG. 4) which are bolted to the inner sides of the frame walls 28 and 29.

The lower part of the inclined wall section 47 has a transverse row of holes at equal relatively close spacings from each other, each hole mounting a nozzle 52 through which water may be showered from the rear compartment of the box 42-47 upon the underlying periphery of the grind stone 1. A pipe nipple 53 in the top wall 42 provides a water inlet to the rear compartment. The amount of water emitted from the nozzles 52 may be regulated by a valve in a white water supply line, not shown, which is connected to the nipple 53.

As shown in FIGS. 2 and 4, a second row of nozzles 54 are mounted in the inclined forward wall section 47 at equal spacings from each other which are about twice as wide as the spacings between the nozzles 52. The nozzles 54 communicate with the forward compartment of the box 42-47 and are staggered with respect to the nozzles 52.

An additional row of nozzles 56 are mounted in the inclined forward wall section 47 above the nozzles 54 and communicate with the forward compartment of the box 42-47. An inlet nipple 57 for the forward box compartment is mounted in the box top wall 42 ahead of the partitioning wall 48. A pipe line, not shown, is connected to the nipple 57 and includes a valve for regulating the flow of white water into the forward box compartment and from the latter through the nozzles 54 and 56 upon the periphery of the stone 1.

The water in the rearward and forward compartments of the shower box 42-47 is preferably maintained at a relatively high pressure, say around 30 or 40 p.s.i., and the orifices of the nozzles 52, 54 and 56 are properly dimensioned to produce powerful jets of white water which impinge the periphery of the stone across the full width of the latter and produce the threefold effect of cleaning the stone, cooling it, and washing the pulp output of the uprunning pocket upward upon the doctor blade 24.

The pulp discharge flume 27 in back of the doctor blade 24 is best illustrated by FIG. 5. It has a plane bottom

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wall 58 which is of somewhat greater length than the spacing between the frame sidewalls 28 and 29. Relatively opposed wall portions 59 and 61 rise from the bottom wall 58 and extend longitudinally of the flume inwardly from its opposite ends in converging relation to each other. The wall portion 59 has opposite end sections of the same height as the wall portion 61, and between these end sections the wall portion 59 is cut out and presents a straight, elongated section 62 of reduced height and of about the same length as the length of the doctor blade 24. The wall portion 61 is of uniform height throughout its length from one end of the flume to the other. Substantially midway between its opposite ends the wall portion 61 is bent one way, and at a short distance from each end it is bent the other way, so that end sections of the wall portion 61 are spaced equal distances from the respective opposite end sections of the wall portion 59, and so that the wall portion 61 is spaced a minimum distance from the low wall section 62 midway between the opposite ends of the flume. A top cover 63 of shorter length than the bottom wall 58 extends between the wall portions 59 and 61 and is centered between the opposite ends of the flume so as to leave the flume uncovered for a relatively short distance adjacent each end. Connecting flanges 64 and 66 are secured to the wall portions 58, 59 and 61 at the opposite ends, respectively, of the flume, and a stiffening wall 75 extends between the flanges 64, 66 at the concave side of the bent wall portion 61.

As shown in FIGS. 2 and 3 the flume 27 is supported on the side frame members 28, 29 so that its opposite end portions overhang the frame, and the wall section 62 extends close to the rear of the pipe 31. The flume is thus arranged in pulp receiving relation to the doctor blade 24, and the bent sections of the wall portion 61 in conjunction with the wall portions 58, 59 and 62 provide sluicing jets which assist discharge of the stock from opposite ends of the flume. Fall tubes 65, 67 are secured to the end flanges 64, 66, respectively, of the flume and lead into the stock trough 19.

A pipe 68 provides for showering of the stone at its entrance into the grinding pocket 2, and another pipe 69 provides for showering of the stone at its emergence from the grinding pocket 3.

In order to operate the grinder at best efficiency, the dam 21 is adjusted to the full line position in FIG. 1 to provide for pitless grinding, and the stone is showered by the nozzles 35, 52, 54, 56 and by the pipes 68 and 69. The pulp produced by the grinding pocket 2 is intercepted by the doctor blade 24, washed into the flume 27 and conveyed into the stock trough 19 by the fall tubes 67 and 65.

The pulp produced by the grinding pocket 3 is discharged from the outlet side of the pocket directly into the stock trough 19.

The provision of the top stock removal device 4 enables the downrunning grinding pocket 3 to produce the same quantity and the same quality of pulp as is produced by the uprunning grinding pocket 2. It also avoids jamming of the downrunning grinding pocket even if the stone is driven at relatively high speeds and the wood in the pockets 2 and 3 is subjected to a relatively high grinding pressure.

In order to maximize the overall pulp output of the herein disclosed grinder, the stone may be driven at a substantially higher peripheral speed and a much higher grinding pressure may be applied to the wood in the grinding pockets than is customary in two-pocket grinders of conventional construction. Proper regulation of the white water flow, particularly from the nozzles 35, 52, 54 and 56 will under these circumstances insure a high quality and increased quantity of the pulp produced by both pockets.

It should be understood that it is not intended to limit the invention to the herein disclosed details of construction, and that it includes other forms and modifications which are embraced by the scope of the appended claims.

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The embodiments of the invention in which an exclusive property right is claimed are defined as follows:

1. A wood pulp grinder including a rotary stone, an uprunning grinding pocket, a down running grinding pocket, and a top stock removal device comprising blade deflector means for separating stock from said stone, and spray means cooperating with said blade deflector means for directing stock away from said stone.

2. A wood pulp grinder as set forth in claim 1 wherein said spray means comprises a duct adjacent said uprunning grinding pocket, and wherein said blade deflector means comprises a doctor blade slanted downwardly toward said uprunning pocket in the region between said duct and said down running grinding pocket and a conduit means associated with said doctor blade for receiving stock therefrom and directing it axially beyond said stone.

3. A wood pulp grinder as set forth in claim 2 wherein said duct is internally longitudinally partitioned forming side-by-side compartments extending axially of the stone, one forwardly of the other towards said duct means with separate water inlets communicating, respectively, with each of said compartments, and at least one longitudinal row of nozzles being mounted on each compartment at a side thereof facing said stone.

4. A wood pulp grinder as set forth in claim 3 wherein said conduit means extends axially across said stone and has a stock inlet opening facing said doctor blade, and stock discharge openings at the axially opposite sides, respectively, of said stone.

5. A wood pulp grinder as set forth in claim 4 said conduit means comprises a bottom wall, and relatively opposed wall portions rising from said bottom wall and extending longitudinally of said conduit means inwardly from its opposite ends in converging relation to each other.

6. A wood pulp grinder of the rotary stone type having an uprunning grinding pocket, a downrunning grinding pocket, and a top stock removal device comprising a doctor blade mounted above said stone in the region between said downrunning and uprunning pockets and slanted toward the latter, duct means overlying said stone in the region between said uprunning pocket and said blade, nozzles connected with said duct means for showering water upon said stone ahead of said blade, a flume mounted in back of said blade and adapted to receive stock from the latter and emit it through opposite end apertures thereof at the axially opposite sides of said stone, and auxiliary duct and nozzle means mounted above said stone in the region between said blade and said downrunning pocket for showering water upon said stone in back of said blade.

7. A wood pulp grinder as set forth in claim 6 and further comprising duct and nozzle means mounted below said uprunning pocket for showering said stone ahead of its entry into said uprunning pocket.

8. A wood pulp grinder as set forth in claim 7 and further comprising duct and nozzle means mounted below said downrunning pocket for showering said stone after its emergence from said downrunning pocket.

9. A wood pulp grinder as set forth in claim 1 wherein said spray means comprises a duct adjacent said uprunning grinding pocket, and wherein said blade deflector means comprises a doctor blade slanted downwardly toward said uprunning pocket in the region between said duct and said down running grinding pocket.

References Cited

UNITED STATES PATENTS

1,057,791	4/1913	Witham	241—282
2,698,453	1/1955	Garrow	241—167X
2,703,206	3/1955	Lyall	241—282X

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U.S. Cl. X.R.

241—167, 282