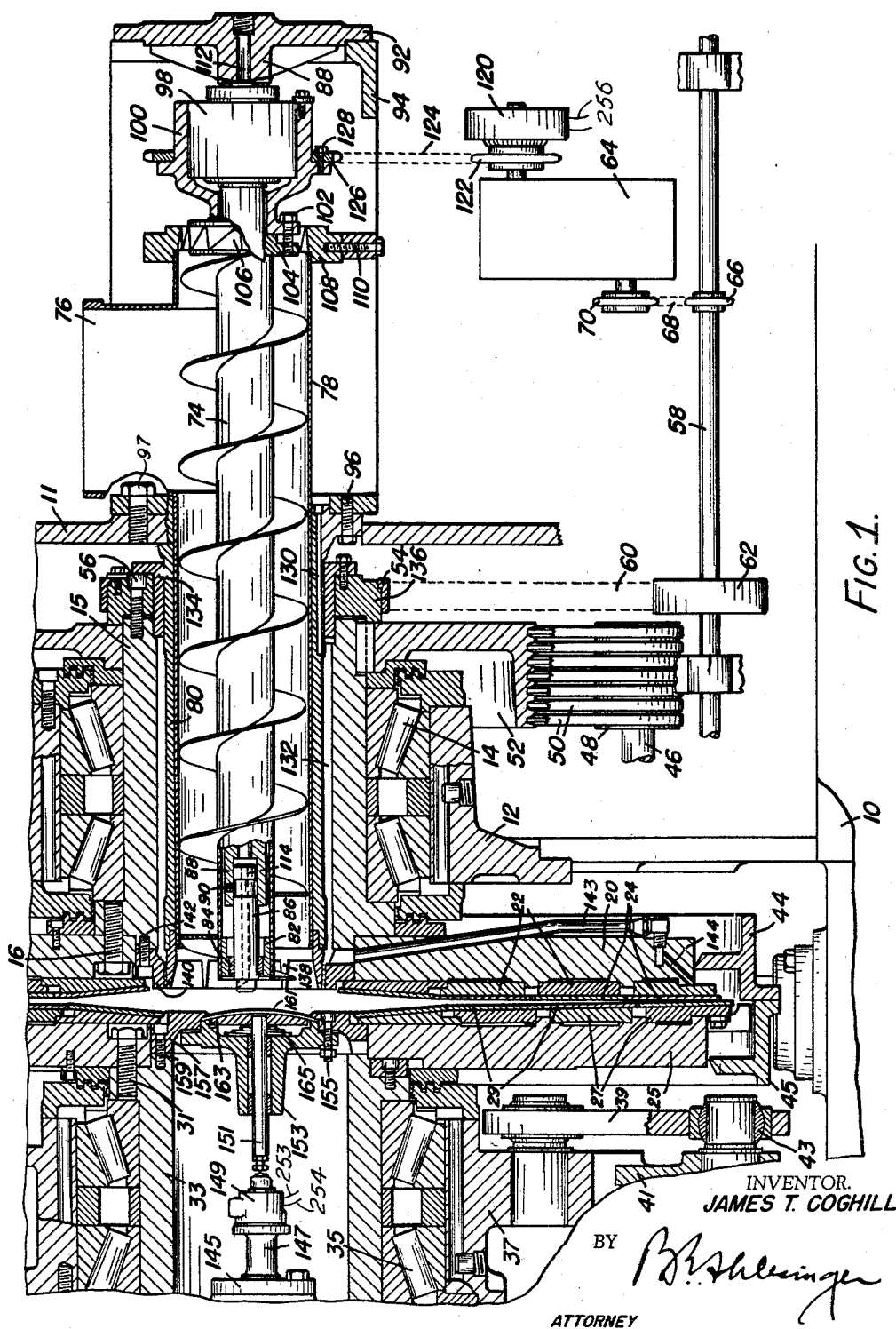


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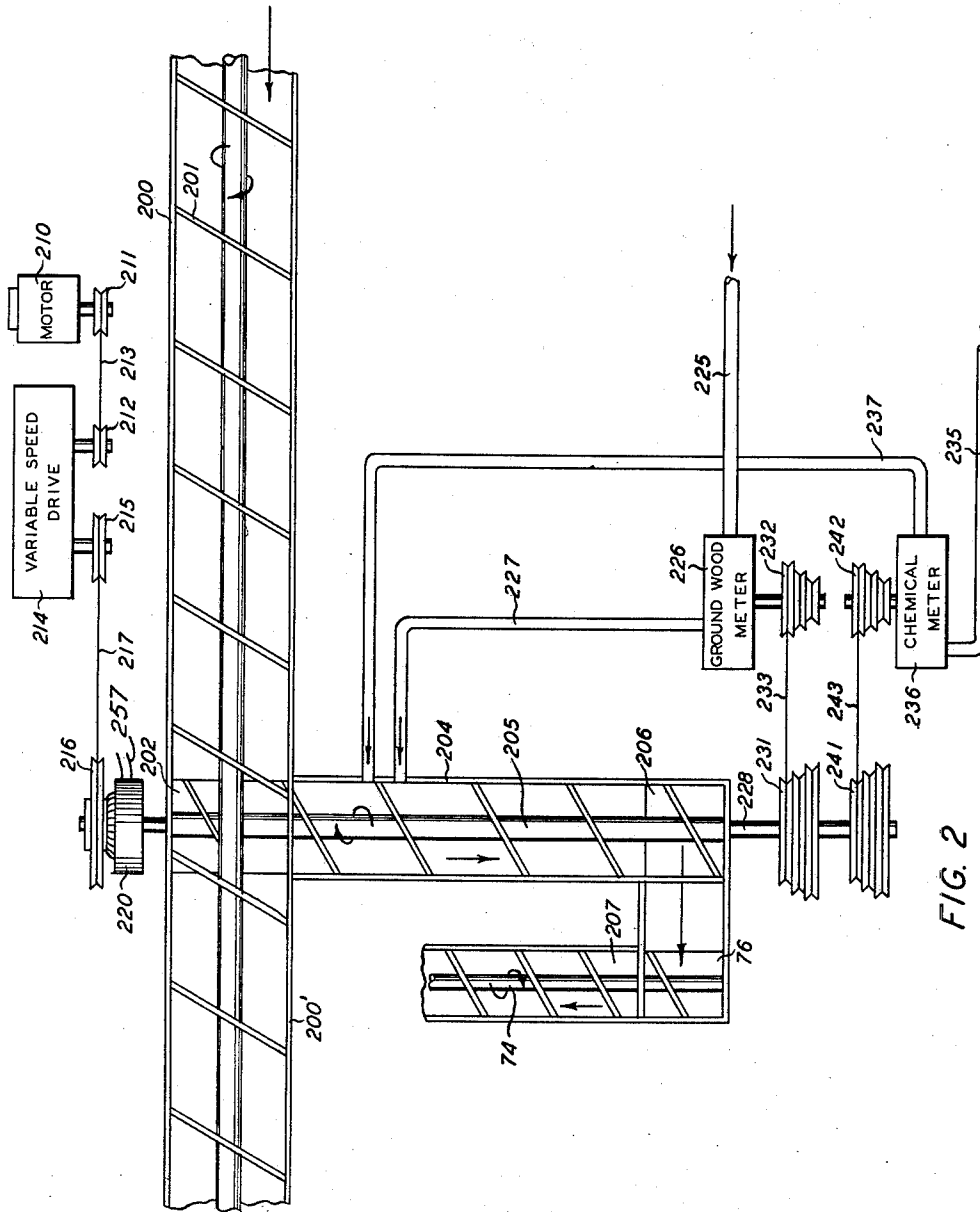
Feb. 12, 1963

J. T. COGHILL
FEED MECHANISM FOR MACHINES FOR
PROCESSING FIBROUS MATERIAL

3,077,007

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

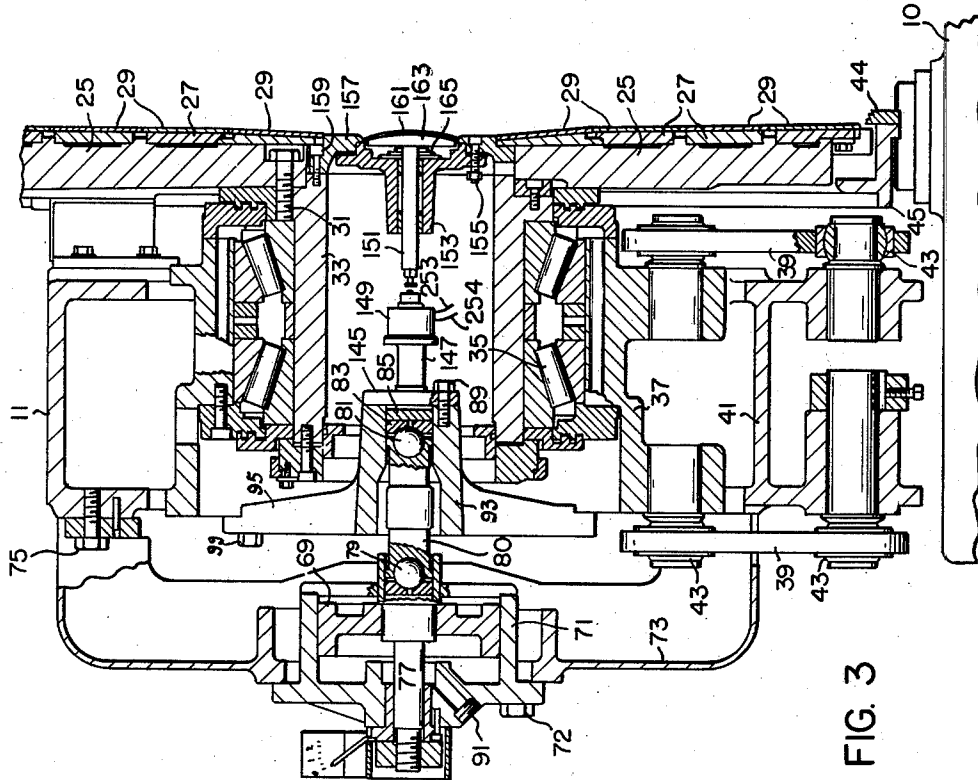


FIG. 3

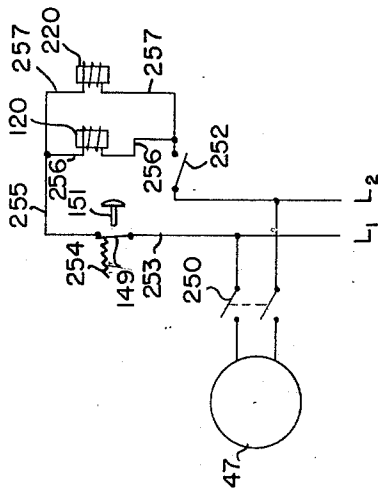


FIG. 4

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1

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FEED MECHANISM FOR MACHINES FOR PROCESSING FIBROUS MATERIAL

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6 Claims. (Cl. 19-66)

The present invention relates to machines for processing fibrous material and particularly to machines for processing wood pulp for making paper. In a more specific aspect, the invention relates to machines for mechanically processing wood pulp according to the method disclosed in the Hill and Edwards Patent No. 2,516,384, granted July 25, 1950. This application is a continuation-in-part of my pending application Serial No. 697,166, filed November 18, 1957, now Patent No. 3,028,632. The present application deals specifically with mechanism for feeding stock to machines for processing fibrous material, and more particularly with mechanism for feeding pulp to machines for processing wood pulp for making paper.

In a machine built according to my copending application Serial No. 697,166, above-mentioned, the pulp, or other stock, which is to be treated, is rolled transversely in a tractive contact with and under compression between two opposed working surfaces that are knurled to provide the required traction. In this machine both working surfaces rotate. However, only one, that attached to the herein-called "driving plate," is driven positively. The other, that attached to the herein-called "floating plate," rotates because the pulp between the working surfaces acts to transmit the motion of the driving plate to the floating plate. Both working surfaces rotate in the same direction. The axes of the two plates are offset from one another, however, so as to achieve a relative gyratory or orbital motion of the working surfaces, and the floating plate is pressed toward the driving plate under a regulatable pressure so that the floating plate is free to float axially toward and from the driving plate responsive to the balance of forces between the pulp and the pressure. In this machine control of the rotational speed of the floating plate is attained by tilting the floating plate relative to the driving plate. The direction of tilt, and the amount of tilt control the relative speeds of the two plates. By tilting the floating plate in one direction about the axis of tilt, the floating plate can be made to run faster than the driving plate. If the floating plate is tilted in the opposite direction, the floating plate will run slower than the driving plate.

In this machine the stock is fed between the working surfaces by a feed screw which is mounted coaxial with the driving plate and which is disposed so that it feeds pulp from a hopper into the space between the two working surfaces.

In this machine if stock is fed to the working surfaces faster than they can process it, the working surfaces accept only as much as they can process and the excess stock backs up against the feed screw ultimately causing it to plug. If the plugging is not noticed, and if the machine is not stopped promptly, the stock will pack in so tightly around the feed screw that the machine has to be taken apart to clean the stock out.

This tendency to plug presents a definite limitation, also, to the operation of various known types of disc refiners, both single and double disc machines. For this reason there is a definite limit to the consistency of the pulp which can be handled in a conventional disc refiner. It is well known that some disc refiners have a tendency to plug, or to feed out stock in slugs when the consistency of the stock exceeds 6% or so; there are violent surges in power due to filling and unfilling of the plates.

2

A primary object of the present invention is to provide means for preventing plugging of the feed screw in a machine of the character described.

A related object is to provide means for stopping the feed mechanism when the stock piles up between the working surfaces and pressure develops in the feeding zone of the machine.

Another object of the invention is to provide means for automatically stopping the feed mechanism of the machine when pressure develops in the feed zone between the working surfaces, and for automatically restarting the feed mechanism when this pressure is relieved, and the working surfaces are ready to take and to operate upon more stock.

Other objects of the invention will be apparent hereinafter from the specification and from the recital of the appended claims.

In the drawings:

FIG. 1 is a fragmentary, central, vertical longitudinal section through a machine of the type disclosed in my copending application above-mentioned, showing, in part, one embodiment of feed mechanism built according to this invention for feeding stock between the working surfaces of the machine;

FIG. 2 is a fragmentary, somewhat diagrammatic sectional view showing further parts of the feed mechanism, and in particular the means for conveying stock to the hopper of the machine;

FIG. 3 is a fragmentary, central, vertical longitudinal section through the machine, showing further parts to the left of those shown in FIG. 1; and

FIG. 4 is an electrical diagram showing how the electromagnetic clutches are connected in circuit with the pressure-operated switch that controls operation of the feed mechanism of the machine.

When the present invention is employed in a machine of the character disclosed in my pending application Serial No. 697,166 above-mentioned, the stock is fed to the space between the working surfaces, as before, preferably by a feed screw mounted coaxial with the driving plate of the machine. Mounted coaxially with the floating plate and in opposed relation to the inner end of the feed screw, however, is a plunger. This plunger is spring-actuated in one direction. If stock piles up between the working surfaces, because it is being fed into the working space faster than the working surfaces can handle it, the plunger is forced rearwardly against the resistance of the spring by the pressure of the pulp, to open a switch which is spring-pressed to closed position. This stops the drive to the feed screw. As soon as the pressure of the pulp is relieved, however, the spring returns the plunger to its normal position; and feed of the stock resumes.

Referring now to the drawing for a more detailed description of the invention, 10 denotes the base of the machine. Upon this is mounted a frame 11 in which is secured an annular bracket 12. Journaled in this bracket by means of antifriction bearings 14 is a sleeve 15. Secured to this sleeve by bolts 16 is the driving plate or disc 20; and fastened to the front face of the driving plate or disc 20 are a plurality of concentric rings 22. These rings have knurled plates 24 secured on their front faces which have tiny protuberances projecting into the working space of the machine. Together the plates 24 constitute one working surface of the machine.

The floating plate of the machine is denoted at 25. It has a plurality of concentric rings 27 fastened to it, to which are secured knurled plates 29, similar to plates 24, which have tiny protuberances thereon opposed to the projections or protuberances of plates 24 and extending into the working space of the machine. The plates 29 together constitute the other working surface of the ma-

chine. The stock, which is to be treated, is fed into the space between the working surfaces; and the stock is rolled tractively in contact with, between and over the opposed working surfaces in the operation of the machine.

The plate 25 is secured by bolts 31 to a sleeve member 33 which is journaled on antifriction bearings 35 in a floating housing 37. The floating housing 37 is supported in a frame 41 by means of a plurality of links 39. Each of these links is mounted at its opposite ends on ball members 43 to permit tilting adjustment of the floating plate.

The working surfaces are surrounded by two ring-shaped casings 44 and 45 which can be secured together to enclose the working area of the machine.

The drive plate 20 is driven from a motor 47 (FIG. 4) through a shaft 46, a pulley 48, multiple V-belts 50, and a pulley 52 which is fastened and keyed to sleeve 15. A second, smaller pulley 54 is secured by screws 56 to sleeve 15. This pulley drives a countershaft 58 through a flat belt 60 and a pulley 62. The countershaft 58 drives a conventional gear reduction unit 64 through a sprocket 66, a chain 68 and a sprocket 70.

The floating plate or disc 25 is urged under regulatable pressure toward the driving plate or disc 20 by hydraulic pressure applied to a piston 69 (FIG. 3) which is reciprocable in a cylinder 71, the piston being connected to the housing 37 at the rear thereof. The cylinder 71 is secured by means of bolts 72 to a bracket 73 which is secured by means of bolts 75 to the frame 11. The piston is fastened to a piston rod 77 which is formed with a cup-shaped recess in its inner end in which is mounted a race for a ball 79. Ball 79 is also engaged in a cup-shaped recess in the rear end of a thrust rod 80. A cup-shaped recess in the front end of this thrust rod holds another ball 81 which seats against race 83 that in turn seats against a thrust disc 85. The thrust disc engages against an end plate 145, which will be referred to further hereinafter. This end plate is secured by means of bolts 89 to the front end of a bracket 93 which has four radiating arms 95 that are fastened by means of bolts 99 to the floating housing 37. The motive fluid is supplied to and exhausted from the rear end of the piston 69 through a duct 91 in the rear end of the cylinder 71.

All of the above described structure, much of which is shown only fragmentarily, is disclosed in detail in my copending application above mentioned; and reference may be had to that application for a more detailed description of this structure. The present invention relates to the means for feeding stock into the space between the working surfaces and to the means for preventing plugging of that stock in the feed screw if it happens that the stock is fed faster than it can be handled by the working surfaces as might be the case, for instance, if the stock is slippery and is difficult to roll tractively in contact between and over the working surfaces.

The feed means comprises a feed screw 74 which is mounted to rotate within a hopper 76 and within a tubular extension 78 of the hopper. This tubular extension 78 is coaxial with sleeve 15 and is mounted within a stationary tubular member 80 that is secured to the frame 11 and is mounted within the bore of sleeve 15.

The feed screw 74 is supported at its front end from a plunger 86 by means of a bushing 82 and a bearing sleeve 84. This plunger is mounted in a recess in the front end of a rod or tube 88, being secured therein by a set-screw 90 which engages in a peripheral recess in the plunger. The rod or tube 88 is formed at its rear end with a head 92 which is secured to a bracket 94. This bracket is fastened by screws 96 to the tubular member 80; and screws 97 fasten the bracket to the frame 11.

The rod or tube 88 carries a conventional anti-friction bearing 98 on which is journaled a cup-shaped member 100 that is secured at its inner end by means of bolts 102 to a rotary member 104 that is fastened to feed

screw 74. The rotary member is provided around its periphery with angularly spaced vanes 106. It cooperates with a stationary, internally-vaned member 108 to prevent stock from being fed rearwardly from the hopper 76. The cooperating vaned members scissor the stock inward as the vaned member 106 rotates with the feed screw 74. The internally vaned member 108 is supported from the bracket 94, being secured thereto by bolts 110.

The rod or tube 88 is provided with an axially extending duct 112; and the plunger 82 is provided with an axially-aligned, axially-extending duct 114. The latter duct is diagonally inclined at its inner end and opens into the working space between the two working surfaces of the machine. Steam may be admitted into the outer end of the duct 112 to supply steam to pulp when the pulp requires heating so that it will roll tractively between the working surfaces without smearing, or when treatment at higher temperatures is desired to obtain other pulp properties which affect the qualities of the paper produced therefrom, such as softness or high tearing strength.

The gear reduction unit 64, already referred to, drives the feed screw through an electromagnetic clutch 120, when that clutch is engaged, a sprocket 122, a chain 124, and a sprocket 126. The sprocket 126 is fastened to the cup-shaped member 100 by screws 128.

There is a duct 130 in tubular member 80 which communicates with the annular space 132 formed between the stationary member 80 and the rotating sleeve 15. Cooling water may be pumped through this duct 130 into the space 132 to cool the bearings 14. A sealing member 134 is mounted in the bore of pulley 54 to surround the tubular member 80 and prevent leakage of the coolant rearwardly along member 80.

The tubular member 80 carries at its front, inner end a ring-shaped part 138. This part is provided on its periphery with a left-hand screw thread which opposes the right-hand internal screw thread of a ring 140 that is fastened by screws 142 to sleeve 15. The ring 140 rotates, of course, with sleeve 15. The opposed, cooperating threads of parts 138 and 140 prevent pulp fibers from feeding back into the space 132 between the sleeve 15 and the stationary tubular member 80, for the space 132 communicates at its front with the space between the opposed threads, and the water flowing from the space 132 flushes out the stock from between the threads. The water is also conducted by the tube 143 and 144 into casings 44 and 45 to help flush treated stock away from the machine.

As previously stated, a regulatable, fluid-pressure load is applied to the stock, during the traversing roll of the stock between the rotating working surfaces. The fluid-pressure actuated piston applies the load, as described in detail in my copending application above mentioned, through an end plate 95, which is fastened to a non-rotatable floating housing 37.

Mounted on the inner end of this end plate is a spool 147 which carries a normally-closed limit switch 149, which is spring-pressed to closed position by a coil spring illustrated diagrammatically in FIG. 4 and denoted at 254. This limit switch is connected electrically to the electromagnet clutch 120 in the drive to the feed screw 74. It is adapted to be actuated by a plunger 151 which is slidably mounted in a member 153 that is secured by means of bolts 155 to a plate 157. Plate 157 is fastened by means of screws 159 in the front end of rotary sleeve 33.

Between the plate 157 and the member 153 there is clamped a flexible diaphragm 161 which is supported by the forward convex face of the head 163 of the plunger 151. A helical coil spring 165 is interposed between this head 163 and the confronting surface of member 153. This spring constantly urges the plunger 151 away from the switch 149. If the head 163 is forced far enough rearwardly, however, by pressure of the pulp

between the feed screw 74 and the diaphragm 161, the plunger 151 will trip the switch 149 to deenergize the clutch 120 and stop the drive to the feed screw, thus preventing further feed of the stock into the working space of the machine until the pressure of the stock in the working space is relieved. Then the spring 165 will disengage the plunger 151 from the switch 149; and the feed of the pulp to the working space will start again. This mechanism operates as a safety mechanism to protect the machine against plugging of stock in the feeding zone between the working surfaces in case more stock is being fed than the working surfaces can traverse.

The volume of stock fed to the hopper 76 is controlled by the mechanism now to be described.

Stock is supplied to the hopper 76 by a conveyor system comprising a trough or conveyor 200 (FIG. 2), and a feed screw or worm 201 which rotates in that trough and conveys pulp or other stock therealong to an opening 202 in the bottom of the trough which is intermediate the ends of the trough. The stock for the machine drops through this opening into a second trough or conveyor 204, and excess or overflow of stock is carried off by the screw 201 along the portion 200' of the conveyor 200 which extends beyond the opening 202.

Conveyor or trough 204 is disposed below conveyor or trough 200 and extends at right angles thereto. There is a feed screw 205 which rotates in the trough 204 and conveys the pulp or other stock along the trough to an opening 206 through which it drops down a chute 207 into the hopper 76. Feed screw 74 is disposed parallel to but is offset from and below feed screw 205.

The feed screw 201 may be driven by any suitable means (not shown) in conventional manner. The feed screw 205 is driven from a motor 210 through pulleys 211 and 212, a connecting belt 213, a conventional variable speed drive unit 214, pulleys 215 and 216, a connecting belt 217, and an electromagnetic clutch 220.

When high-yield pulp is to be processed in the machine, it is frequently necessary to add groundwood to the pulp to prevent the pulp from slipping on the working surfaces. Sometimes, also, it is necessary to add a chemical, such as alum, to the pulp coming from the beater or other refiner. Groundwood and/or a chemical can be added to the pulp in the conveyor 204 before the pulp is delivered to the hopper 76.

Groundwood can be supplied through a pipe 225 through a conventional metering device 226, and a pipe 227. The metering device 226 can be driven from the shaft 228, to which the feed screw 205 is secured, through a set of conventional cone pulleys 231 and 232, and a connecting belt 233.

The chemical can be supplied through a pipe 235, a conventional metering device 236, and a pipe 237. The metering device 236 can be driven from the shaft 228 through a set of conventional cone pulleys 241 and 242, and a connecting belt 243.

The flights or convolutions of the screw 205 mix the groundwood and/or chemical thoroughly with the pulp from conveyor 200 as they feed the pulp along to chute 207. The variable speed drive 214 controls the tonnage of pulp fed to the machine and permits of varying the percentage of groundwood or chemical in the total tonnage of pulp fed.

The electromagnetic clutch 220 is wired in parallel with the clutch 120 (FIGS. 1 and 4) through electrical connections including the lines 256 and 257. When the clutch 120 is engaged to drive feed screw 74 the clutch 220 is also engaged to drive feed screw 205; and vice versa, when the clutch 120 is disengaged, to stop feed of the pulp into the space between the working surfaces of the machine, the clutch 220 is disengaged to stop feed of the pulp to the hopper 76. Thus stock is prevented from piling up in and over the hopper when the feed screw 74 is stopped. Of course, feed of the groundwood and the chemical, respectively, can be shut off entirely

by disconnecting belts 233 and 243, respectively. The clutch 220 and the variable speed drive unit 214 permit of controlling fully the volume of stock fed to the machine.

In the use of the machine illustrated, the plate or disc 25 is tiltably adjusted in accordance with the desired speed of rotation of this floating plate or disc relative to the speed of rotation of driving plate or disc 20. The plate or disc 20 is driven from a motor 47 through pulley 48, belts 50 and pulley 52. The motor 47 can be started by closing the main line switch 250 which connects the motor with the main lines L_1 and L_2 . When the plate or disc 20 has gotten up to speed, a switch 252 is closed to engage the electromagnetic clutches 120 and 220. This causes stock to be delivered to hopper 76 and causes the feed screw to be driven to feed stock from the hopper into the working space between the working surfaces. As the plate or disc 20 revolves, acting through the stock between the plates, it drives the floating plate or disc 25 which is pressed toward plate 20 by fluid pressure. Since the axes of plates 20 and 25 are offset from one another, the stock will be rolled transversely between and over the working surfaces outwardly toward the peripheral edges of the working surfaces. The casings 44 and 45 have discharge ports in them through which the treated stock may be discharged from the machine. If the stock is fed too fast into the working space plunger 151 will be forced rearwardly by the pressure of the stock, and limit switch 149 will be opened to disconnect lines 253 and 255 (FIG. 4) and stop the drive to the feed screw 74 and the drives to the feed screw 205 and the meters 226 and 236 until the pressure of stock in the working space is relieved. Then the drive to the feed screws and meters will be resumed.

While the invention has been described in connection with a specific embodiment thereof, it will be understood that it is capable of further modification, and this application is intended to cover any variations, uses, or adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth, and as fall within the scope of the invention or the limits of the appended claims.

Having thus described my invention, what I claim is:

1. A machine for processing stock, having two opposed working plates which are disposed to form between them a working space, means for feeding stock into said working space to be treated, a reciprocable plunger disposed at one side of said working space and centrally relative to one of said plates in position to be engaged by stock in said working space and to be subject directly to pressure of said stock, spring means for urging said plunger constantly in one direction toward said working space, and means operative when said plunger is moved a predetermined distance in the opposite direction against said spring means by pressure of stock in said working space to stop said feeding means.

2. A machine for processing stock, having two opposed working plates which are disposed to form between them a working space, means for feeding stock into said working space to be treated, means including an electrically-operable clutch for driving said feeding means, a member movably mounted at one side of said working space to be engaged by stock in said working space and to be subject directly to pressure of said stock, said member being movable relative to both said plates, spring means for urging said member constantly inwardly of said working space, and an electrical switch operative when said movable member is moved in the opposite direction a predetermined distance against said spring means by pressure of stock in said working space to open said clutch and stop the drive to said feeding means.

3. A machine for processing stock, having two opposed

working plates which are disposed to form between them a working space, one of said working plates, at least, being rotatable, means for feeding stock into said working space to be treated comprising a rotary feed screw disposed coaxially with said one working plate to deliver stock into said working space as the feed screw rotates, and means for driving said feed screw, a member reciprocably mounted centrally of the other working plate at the opposite side of said working space from said feed screw to be reciprocable relative to the other of said plates and to be subject directly to pressure of said stock, spring means for urging said member constantly in one direction toward said working space, said member being movable in the opposite direction against the resistance of said spring means by pressure of stock in said working space, and means operatively connected to said member to be actuated thereby when said member is moved a predetermined distance in said opposite direction to stop said screw driving means.

4. A machine for processing stock, having two opposed working plates which are disposed to form between them a working space, one of said plates, at least, being rotatable, means for feeding stock into said working space to be treated comprising a rotary feed screw disposed to extend in the direction of the axis of said one working plate and to deliver stock into said working space as the feed screw rotates, and means including an electromagnetically-operated clutch for driving said feed screw, a plunger reciprocably mounted at the opposite side of said working space from said feed screw coaxially of said feed screw to be reciprocable relative to the other plate in the direction of the common axis of said plunger and said screw, spring means for urging said plunger constantly toward said feed screw, said plunger being disposed to be subject directly to pressure of stock in said working space and to be movable in the opposite direction against the resistance of said spring means by pressure of said stock, and an electrical switch operatively connected to said plunger and disposed to be tripped when said plunger is moved a predetermined distance in said opposite direction, said switch being connected to said clutch to open said clutch to stop the drive to said feed screw when said switch is tripped by said plunger in its movement in said opposite direction.

5. A machine for processing stock having two opposed working plates which are disposed to form between them a working space, means for rotating at least one of said plates, a tubular member disposed coaxially with the axis of rotation of said one plate and communicating at its

forward end with said working space, means for feeding stock through said tubular member into said working space, a first ring member secured to said tubular member at the forward end thereof and provided with a peripheral thread, a second ring member secured to said one working plate and surrounding said first ring member, said second ring member having an internal thread opposed to the thread of said first ring member but of opposite hand to the thread of said first ring member, the thread of said first ring member being left hand when said working plate rotates clockwise looking at the working plate from the direction from which the stock is being fed, and being right hand when said rotating plate rotates counter-clockwise looking from the same direction, and means for supplying liquid to the rear of the space between said opposed threads to flush away any stock which reaches that point.

6. A machine for processing stock, having two opposed working plates which are disposed to form between them a working space, at least one of said plates being rotatable, a stationary tubular member disposed coaxially with the axis of rotation of said one plate and communicating at its forward end with said working space, a feed screw rotatably mounted within said tubular member and extending through said tubular member to the forward end of said tubular member, means for rotating said feed screw to feed stock through said tubular member into said working space, a first ring member secured to said tubular member at the forward end thereof and provided with a peripheral thread, a hollow shaft secured to said one working plate and surrounding said tubular member and radially spaced therefrom a slight distance, a bearing member in which said shaft is journaled, a second ring member secured to said hollow shaft and surrounding said first ring member, said second ring member having an internal thread opposed to the thread of said first ring member but of opposite hand to the thread of said first ring member, and means for supplying liquid into the space between said hollow shaft and said tubular member to flush out stock from between said threads and to cool said bearing.

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