Aug. 18, 1936. C. D. DE MERS 2,051,202

APPARATUS FOR CONTROLLING THE PROCESSING OF PULP STOCKS

Filed March 2, 1934 2 Sheets-Sheet 1

Fig. 1

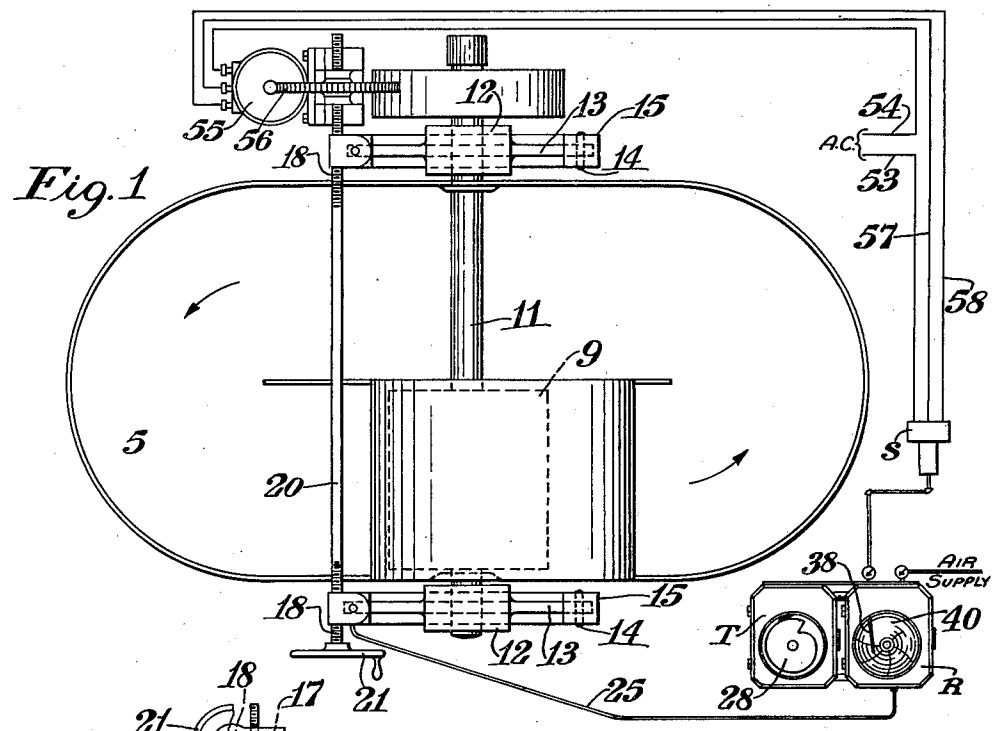
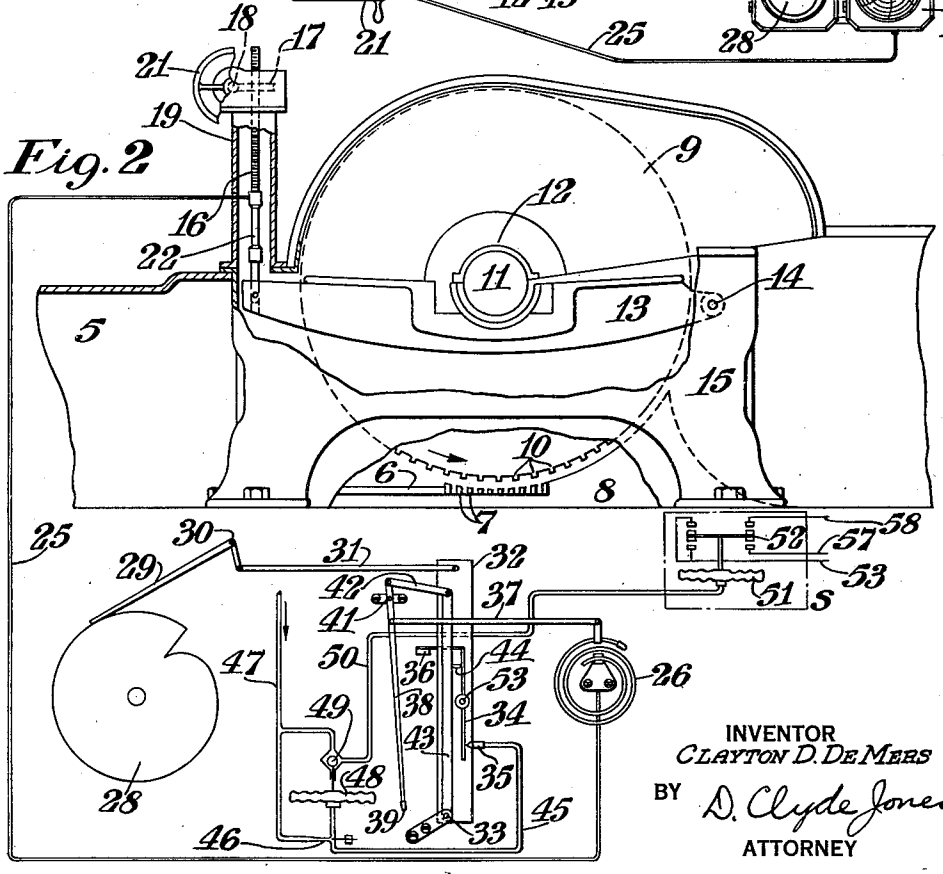


Fig. 2



INVENTOR
CLAYTON D. DE MERS
BY D. Clyde Jones
ATTORNEY

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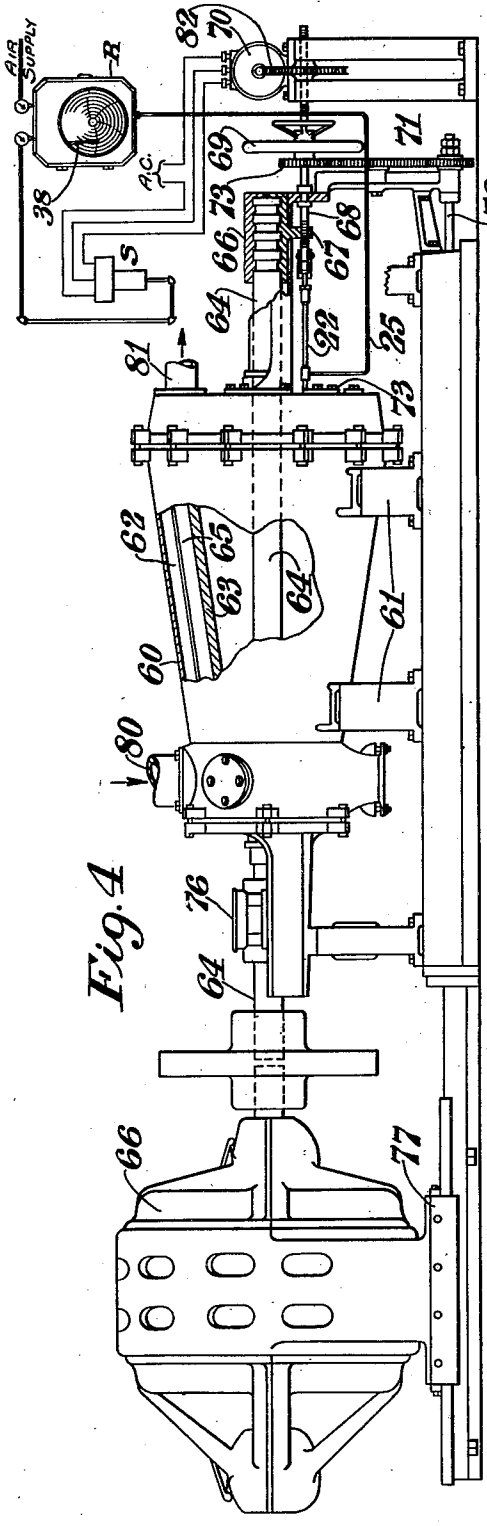


Fig. 4

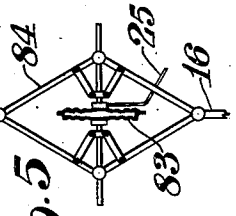


Fig. 5

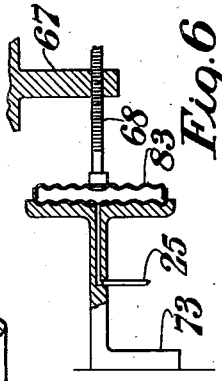


Fig. 6

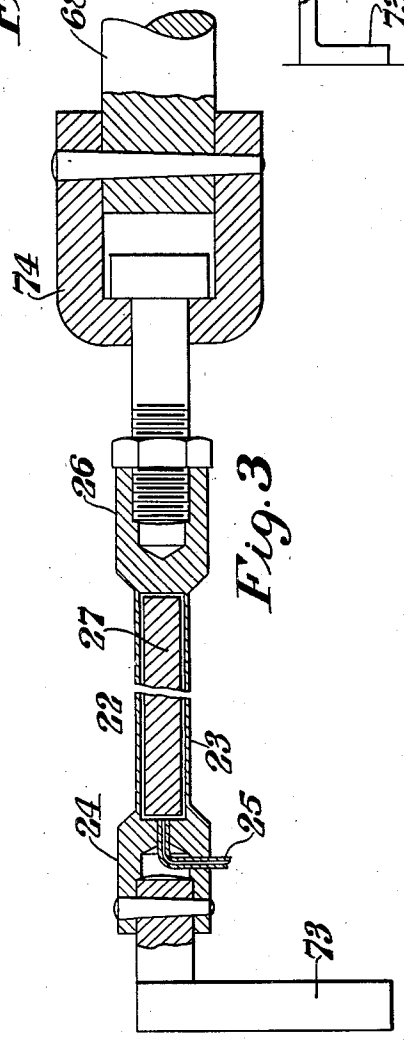


Fig. 3

INVENTOR
CLAYTON D. DEMERS
BY D. Clyde Jones
ATTORNEY

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2,051,202

APPARATUS FOR CONTROLLING THE PROCESSING OF PULP STOCKS

Clayton D. De Mers, Rochester, N. Y., assignor to Taylor Instrument Companies, Rochester, N. Y., a corporation of New York

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9 Claims. (Cl. 92—24)

This invention relates to the method of and to apparatus for controlling the processing of pulp stocks.

In the treatment of stock for making paper such as wood, rope, or rag pulp, it is customary to pass this stock between a set of fixed and a set of rotating bars, the distance between said sets being adjustable in accordance with the desired characteristics of the finished paper.

For example, in a beater the bed plate is provided with parallel bars cooperating with a rotatable beater roll which is likewise provided with parallel bars extending in the same direction as the bars on the bed plate. The beater roll is adjustable toward or away from the bed plate, and in the past it has been the practice to rely on a schedule of hand adjustment or positioning thereof as shown by a roll position indicator, to give a desired grade of pulp stock. Such practice, however, has failed to give the best results because the beater roll should be positioned in accordance with the consistency of the stock passing between its bars and the bars on the bed plate, whereas up to the present time the beater roll has not been adjusted with respect to this variable.

In the case of a Jordan engine, it has been the practice to measure the electrical energy consumed in operating it, as a means for indicating the spacing between the set of bars on its plug and the set of bars on its shell. It has also been the practice to use a gauge comprising a graduated scale mounted on a rotating part of the Jordan engine and a cooperating pointer mounted on a part thereof movable in adjusting the position of its plug, to indicate the space between this plug and its related shell. However, there is a wide variation in the amount of friction encountered in the Jordan engine so that the spacing indication by measurement of energy consumption is only remotely accurate, and there is so much lost motion in the adjustable parts of the engine that the spacing indication by the use of a gauge, is only a rough approximation.

In accordance with the present invention, an arrangement is provided for continuously weighing the beater roll to indicate the proper adjustment thereof, which weight is a function of the consistency of the stock passing under this roll.

In accordance with a further feature of the invention, automatic mechanism is provided for changing the position of the beater roll in accordance with time and in accordance with the varying weight of the roll as changed by the varying consistency of the stock passing thereunder.

In accordance with an additional feature of the invention, a pressure indicating device is employed to indicate the pressure applied to the plug by the stock as it passes between the rotating plug bars and the stationary bars on the shell of a Jordan engine.

In accordance with still another feature of the invention, a regulating arrangement is provided whereby a predetermined pressure is maintained on the plug of a Jordan engine in accordance with the varying consistency of the stock passing therethrough.

For a clearer understanding of the invention, reference is made to the drawings in which Fig. 1 is a plan view of a beater, together with the controlling mechanism of the present arrangement; Fig. 2 is an end elevation of the beater structure shown in Fig. 1, together with a diagrammatic showing of the control mechanism therefor; Fig. 3 is a sectional view of a tension or compression element forming a part of the indicating and controlling mechanism suitable for use either with a beater or with a Jordan engine; Fig. 4 is a front elevation of a Jordan showing the indicating and controlling mechanism of the present invention; Fig. 5 is a fragmentary view of a modified arrangement which can be substituted for the tension element employed in the linkage of the beater; and Fig. 6 illustrates an alternative arrangement for sensing the compression applied to the plug of the Jordan engine of Fig. 4.

Referring especially to Fig. 1, 5 designates the tub of a beater in which a charge of paper stock is placed and is caused to recirculate in the direction indicated by the arrows. In accordance with the usual construction, a bed plate carrying the spaced parallel metal bars 7, extends approximately half-way across the tub. This bed plate also includes a portion 8, known as the "backfall", over which the stock passes to develop a hydraulic head so that the stock moves in the path indicated by the arrows. A rotatable beater roll 9 is provided about its periphery with a series of spaced parallel bars such as 10, extending in the same direction as the bars 7 so that as the beater roll rotates in the direction indicated by the arrows, the stock passes between the stationary bars 7 of the bed plate and the rotating bars 10 of the roll, with the result that this stock is brushed to break any lumps therein.

In the operation of the beater, it is necessary from time to time to change the spacing be-

tween the bars 7 and 10 in order gradually to process the stock from lumps and pieces of coarse fibers to a well hydrated and uniform mass of fine stock and to take care of different kinds and conditions of stock. For the purpose of adjusting the beater roll 9, the shaft 11 of this roll is mounted in suitable bearings 12 which are respectively carried by a lighter bar 13 at each side of the beater. Each lighter bar is pivoted at 14 on a suitable support 15, while its free end is suspended by a linkage generally designated 16, the upper end of which is screw-threaded to engage the interiorly threaded worm gear 17. Each worm gear is suitably supported against vertical movement, in a bracket 19 carried on the support 15. In order to adjust the linkages simultaneously so that the free ends of the lighter bars 13 and therefore the position of both ends of the shaft 11 of the beater roll, can be moved an equal amount, the worm gears 17 are arranged to be adjusted by a single handle. This adjustment is effected by rod 20 which is rotatable by hand wheel 21 and which is provided with spaced worms 18 engaging with the worm gears 17. In this manner by the rotation of the rod 20 the linkages 16 are varied in length to vary uniformly the position of the beater roll bars 10 with respect to the bars 7 on the bed plate.

In accordance with the present invention, there is provided as a part of one of the linkages 16, a hollow volumetric stress responsive element 22 which is so constructed that it changes its volume in response to a change in the tension or compression applied thereto so that it actuates an indicating and recording device R to show accurately the tension or compression applied to this element. Structurally the element comprises a hollow shell 23 (Fig. 3) of ferrous material which has but slight elasticity under heavy loads. The ends of this shell are respectively provided with internally-threaded heads 24 and 25 by which it may be connected in the linkage 16. The interior of this shell communicates through a capillary tube 25 with the interior of a pressure-responsive spring such as a Bourdon spring 26 (Fig. 2) or its equivalent. The shell 23, capillary tube 25 and the responsive spring 26 are preferably filled with transmitting fluid such as mercury. In order that the element 22 and its related parts will operate independently of temperature changes there is provided within the shell 23, a core 27 of invar or other similar material, the parts being so designed that the unequal expansion of the material of the shell and the unequal expansion of the mercury are equalized by the slight expansion of the invar core.

It has been found that the tension indicated by the recording device R and its related tension element 22 in effect weighs the beater roll, and this weight is determined both by the consistency of the stock passing under the beater roll and by the closeness of the bars on the beater roll to the bars on the bed plate. By noting the tension indicated and recorded by the instrument R, the operator can determine the correct positioning of the beater roll with respect to its cooperating bed plate.

In the operation of the beater it is customary during each beating cycle to start with the roll raised up from the bed plate a given distance, for example one inch, then to lower the roll in gradual step according to a given schedule until a predetermined lower limit is reached. Thereafter the roll remains in this position during the remainder of the beating cycle. In order to effect this result there is associated with the instrument R, a cooperating instrument T (Fig. 1), the mechanism within these two instruments being diagrammatically shown at the lower part of Fig. 2. The instrument T includes a clock driven cam 28 on the periphery of which a bell crank cam follower 29, engages. This follower is pivoted at 30 and its other end is connected by a link 31 to a swinging support 32, which is pivoted at 33 on the frame. The support 32 also has pivotally mounted thereon at 53, a baffle 34 which cooperates with a nozzle 35, the upper end of the baffle being provided with a small weight 36 tending to swing the baffle 34 toward the nozzle. The Bourdon spring 26, previously mentioned, has its free end connected by a link 37 to the index or pen arm 38, the lower end of which arm may be provided with a stylus 39 to mark a pressure curve on the chart 40 (Fig. 1). The upper end of the pen arm is connected by a link 42 to the upper end of a movable lever 43 also pivoted at 33 in the frame. Lever 43 is provided with a pin 44 which by clockwise movement of the lever tends to move the lower end of the baffle away from the nozzle. The nozzle 35 communicates through conduit 45 and the constriction 46 with a pressure-fluid supply pipe 47. This supply pipe also communicates through the constriction 46 with a diaphragm 48 which actuates a valve 49 to control the flow of pressure fluid from the supply pipe 47 through the conduit 50 to the diaphragm 51. The diaphragm 51 actuates the movable member 52 of an electro-pneumatic switch generally designated S.

In the operation of this system, as the clock-actuated cam rotates, it changes the position of its follower 29 which, in turn, operates through the link 31 and the lever 32 to change the position of the pivot 53 of the baffle 34. During the time that the instrument is operated, of course, the pressure fluid flows through the pipe 47, constriction 46, conduit 45 and the nozzle 35. If the tension on the element 22 increases, indicating that the consistency of the stock has changed, the Bourdon spring will tend to wind up. This will cause the link 37 to swing the upper end of the pen arm 38 counter-clockwise, which movement through link 42 connected thereto, will also swing the lever 43 so that its pin 44 will move away from the baffle 34. The weight 36 on the baffle 34 will cause the lower end of the baffle to move toward the nozzle with the result that the pressure will build up in the conduit 45. This causes the diaphragm 48 to expand so that its valve 49 tends to cut off pressure fluid and permits the fluid in the conduit to escape. Diaphragm 51 will therefore tend to collapse, causing member 52 to engage the lower contacts of the electro-pneumatic switch S. The closure of this switch completes a circuit from the alternating current source including the conductor 53, movable member 52 of the switch, conductor 57, one winding of the motor 55, conductor 54, to the other side of the alternating current source. The motor through the worm gear drive 56 and also worm 18 and gear 17 adjusts the free end of the lighter bars 13, so that the beater roll is lowered into proper position with respect to the bed plate 7.

In the event that the tension on the element 22 decreases, the Bourdon spring 26 will unwind, with the result that the instrument will function as previously described, but in the opposite sense so that the diaphragm 51 of the electro-pneumatic switch S will tend to expand and

thereby cause member 52 to engage its uppermost set of contacts. The closure of these contacts completes a circuit from the alternating current source, conductor 53, movable member 52 of the switch S, conductor 58, reverse winding of the motor 55, conductor 54, to the other side of the alternating current source. The motor 55 will thus operate in the reverse direction and through the worm gear drive 56, and also through the worm 18 and gear 17, will adjust the free end of the lighter bars 13 so that the roll is raised into proper position with respect to the bed plate 7. In this manner the motor 55 adjusts the spacing between the bed plate and the beater roll according to a predetermined schedule of time and pressure, as established by the timing cam 28.

The invention can also be applied to a Jordan engine as shown in Fig. 4. As is well-known, the Jordan engine comprises a shell 60 mounted on supports 61 of a fixed base, said shell having an inlet pipe 80 and an outer pipe 81 through which the pulp under a uniform pressure head, passes. The interior of this shell which has the shape of a truncated cone, is provided with parallel bars 62. Within the shell there is a truncated cone-shaped plug 63 which is mounted on a shaft 64, extending through and suitably journaled in bearings 66 and 76 adjacent the ends of the shell. This plug is provided about its periphery with parallel bars 65 extending in the same direction as the bars 62 on the shell. The shaft 64 is coupled to a driving motor 66 mounted on a base 77 in such a manner that the motor 66 and the plug 63 can be moved as a unit along the axis of the shaft 64, to vary the space between the sets of bars 62 and 65, respectively mounted on the shell 60 and the plug 63.

The manner of adjusting the spacing between the plug and the shell will be understood by reference to the right-hand portion of Fig. 4 wherein it will be noted that the notched bearing 66 engages notches in the shaft 64. Thus when the bearing 66 is moved toward the right or to the left, as illustrated, shaft 64 will be moved therewith. The bearing 66 has a threaded lug 67 which makes threaded engagement with a threaded link 68. This link, which may be rotated by the hand-wheel 69 or by the motor 70, is provided with a gear 73, operating through a train of gears 71 to rotate the shaft 72. This shaft makes threaded engagement (not shown) with a portion on the base 77 of the motor so that the position of the motor 66 and the shell 63 can be simultaneously adjusted.

In order to indicate and to control the spacing between the bars on the shell and the bars on the plug, a compression element 22 is provided. One end of this element is fixed on the bracket 73 mounted on the end of the shell, while the other end of this element is connected in the link 68 by a swivel connection 74. A capillary tube 25 connects the element 22 to a regulating device R similar to that shown in the lower part of Fig. 2 except that the clock controlled cam 28 and its related mechanism have been omitted. However, if any predetermined variable schedule of plug adjustments is desired, then the complete regulating mechanism of Fig. 2 will be utilized.

It will be understood that during the operation of the Jordan engine, the instrument R and its compression element 22 cooperate to control the switch in the same manner as described in connection with the beater illustrated in Figs. 1 and 2. This switch completes circuits through the respective windings of the motor 70, so that it rotates either in a forward or in a reverse direction and through the worm and gear 82, rotates the link 68 in one direction or the other. This rotation of the link 68 moves the bearing 66 endwise and with it the shaft 64, so that the plug 63 is adjusted toward or away from the shell in accordance with pressure exerted on the plug by the stock passing through the Jordan engine.

In Fig. 5 there is indicated an arrangement whereby a simple capsular diaphragm 83 and its related mercury-filled capillary tube 25 may be used as a tension-sensing device instead of the element 22. As illustrated in this figure, a toggle joint generally designated 84, is connected in the link 16 of Fig. 2 so that under the weight of the beater roll certain of the elements of the joint engages the opposite faces of the diaphragm to compress it. The force thus applied to the diaphragm actuates the instrument R in the manner previously described.

Similarly in Fig. 6 there is shown an arrangement whereby the capsular diaphragm 83 and its mercury-filled tube system can replace the element 22 in the Jordan engine controlling system of Fig. 4. To effect this replacement the bracket 73 is shaped so that its free end engages one face of the diaphragm, while the other face of this diaphragm is engaged by one end of the threaded link 68.

I claim:

1. In a pulp stock processing machine including a bed plate provided with a set of spaced bars and including a roll having a set of spaced bars parallel to and cooperating with the first set, links for supporting the ends of said roll, a force-sensitive element in one of said links, and means responsive to the force applied to said element for adjusting the spacing between said sets of bars.

2. In combination, a pulp stock processing machine including two members between which the pulp stock passes, at least one of said members being rotatable and being adjustable with respect to the other member, means including a motor for adjusting the relation between said members and means including a stress-sensitive element responsive to the pressure on one of said members for controlling the operation of said motor.

3. In combination, a pulp stock beater including two members between which the pulp stock passes, at least one of said members being rotatable and at least one of said members being adjustable with respect to the other member, means including a motor for adjusting the relation between said members, and means including a force-sensitive element responsive to a portion of the weight of one of said members as modified by the buoyancy of said stock for controlling the operation of said motor.

4. In combination, a pulp stock processing device including two members between which the stock passes, at least one of said members being rotatable and at least one of said members being adjustable with respect to the other member, a motor for adjusting the relation between said members, and means including a stress-sensitive element responsive to change in pressure on said members by the stock as it passes between said members, and a timing device for operating said motor to adjust the relation between said members according to a predetermined schedule.

5. In combination, a Jordan engine including

two members between which the stock passes, at least one of said members being rotatable and at least one of said members being adjustable with respect to the other member, means including a motor for adjusting the relation between said members, and means including a stress-sensitive element responsive to the pressure on one of said members for controlling the operation of said motor.

6. In combination, a pulp stock processing machine including two spaced sets of relatively movable cooperating bars, a stress-sensitive device responsive to the pressure exerted on one of said sets of bars by the pulp stock passing between said sets of bars, and means controlled by said device for adjusting the spacing between said sets of bars.

7. In combination, a pulp stock processing machine including a set of fixed bars and a set of movable bars cooperating therewith, a stress-sensitive device responsive to the force exerted on one of said sets of bars by the pulp stock passing between said sets of bars, timing mechanism, and means jointly controlled by said device and by said timing mechanism for maintaining a predetermined schedule of spacing between said sets of bars.

8. In a pulp stock processing machine including two members between which the stock passes, at least one of said members being rotatable and at least one of said members being adjustable with respect to the other member, positioning mechanism for one of said adjustable members including a stress-sensitive element, and means responsive to the stress developed in said element as the stock passes between said members for adjusting said positioning mechanism.

9. In a pulp stock processing machine including a bed plate provided with a set of spaced bars and including a roll having a set of spaced bars parallel to and cooperating with the first set, links for supporting the ends of said roll, a stress-sensitive element in one of said links, and indicating means responsive to the force applied to said element.

CLAYTON D. DE MERS