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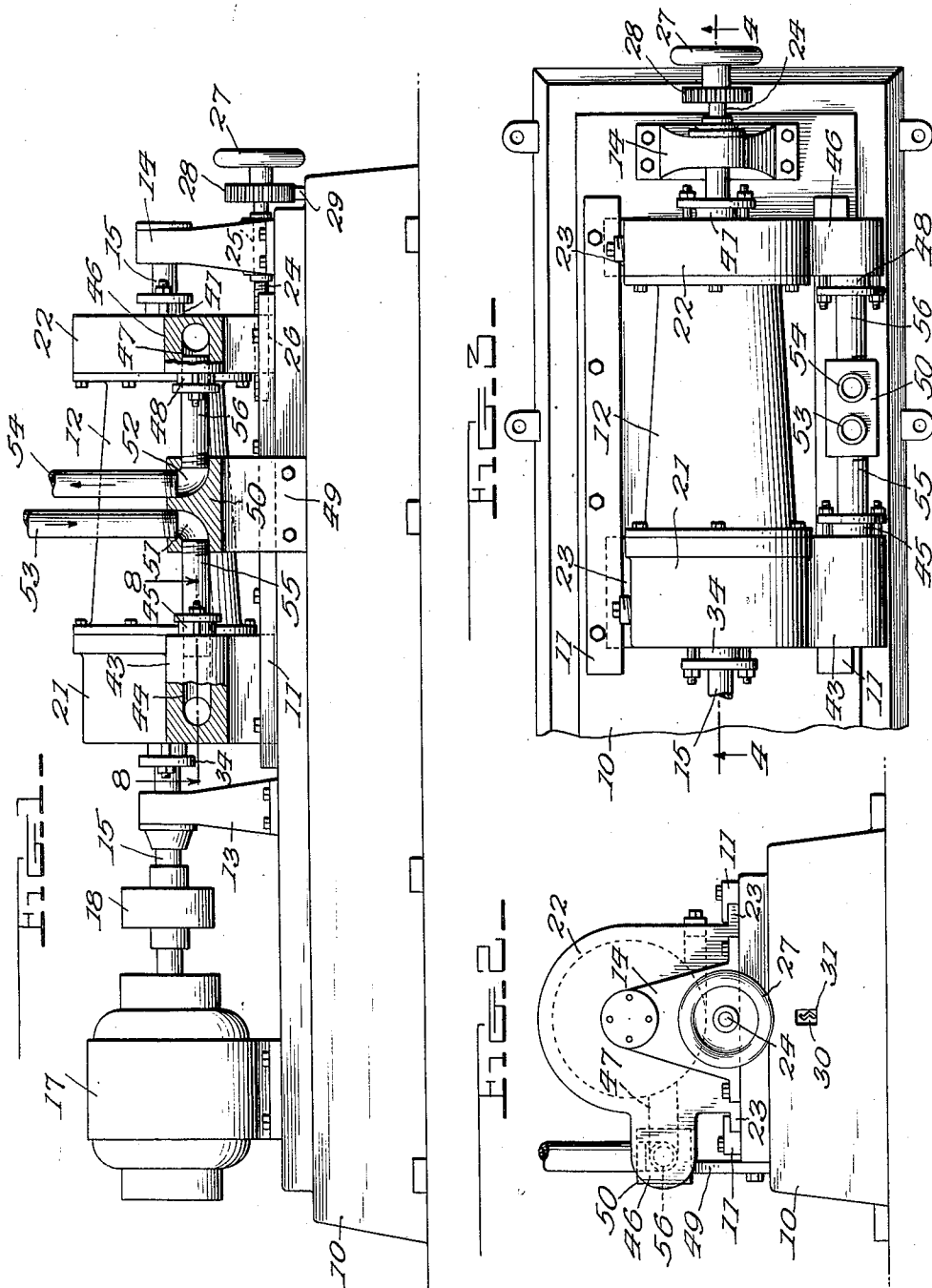
H. D. WELLS

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PAPER STOCK REFINING MACHINE

Filed Sept. 17, 1947

3 Sheets-Sheet 1



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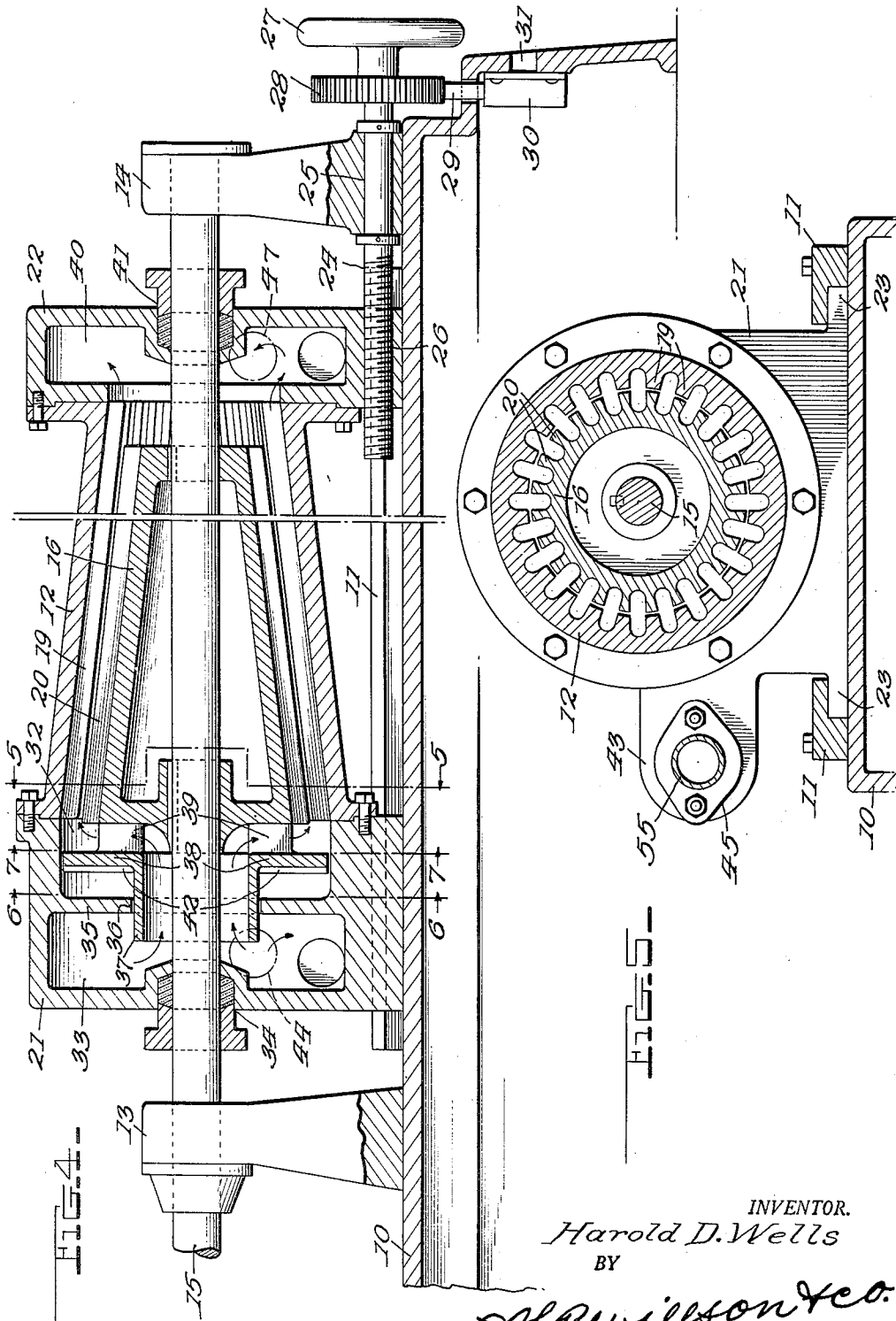
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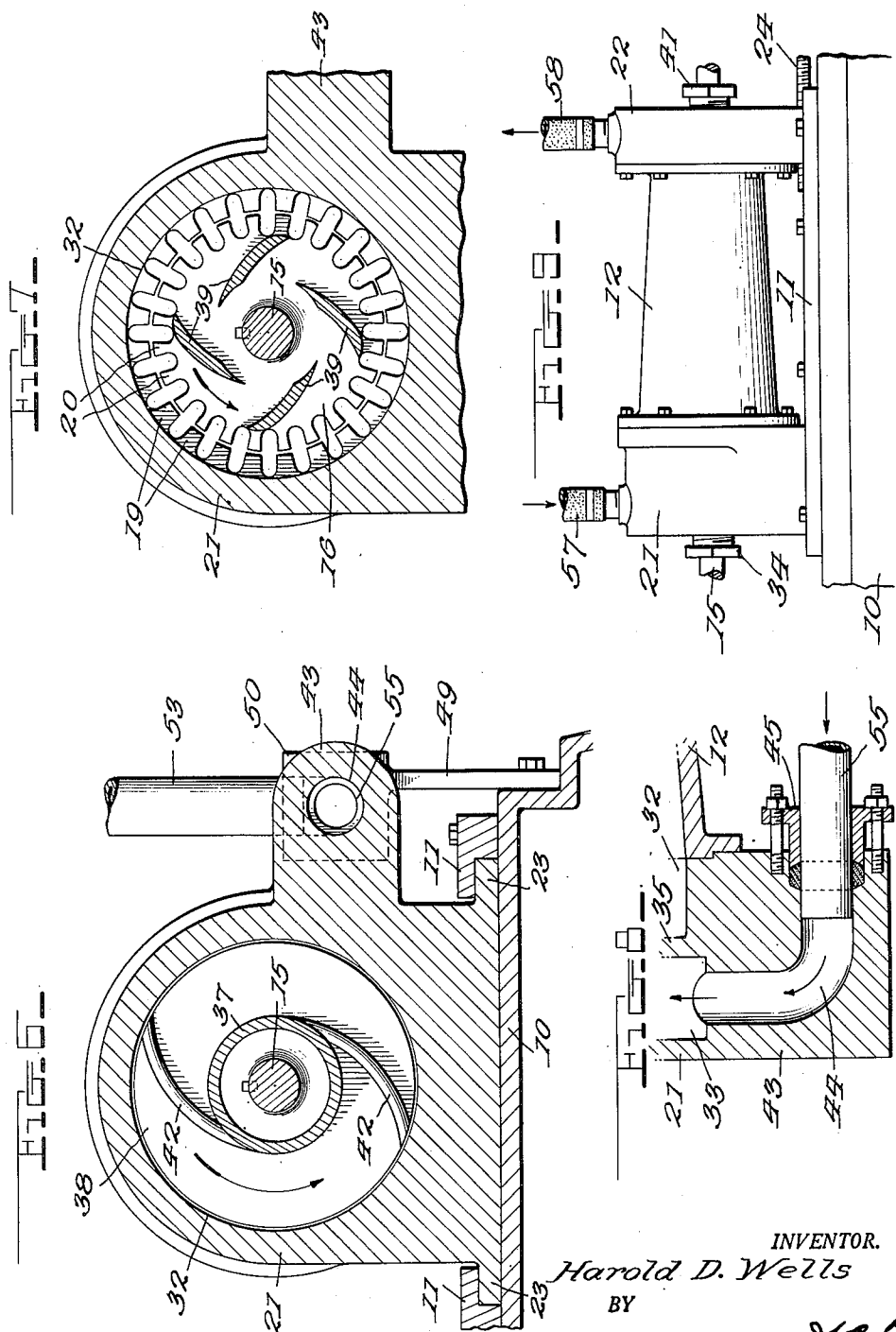
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

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PAPER STOCK REFINING MACHINE

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6 Claims. (Cl. 92—27)

1 The invention relates to a new and improved Jordan engine for continuously hydrating, brushing and refining paper stock with greater speed and efficiency, with more dependability, and at lower cost, effecting a marked advance over the usual Hollander type beater requiring hours of beating to produce anywhere near comparable results.

The present Jordan is of the general type in which an internally ribbed tapered shell and a peripherally ribbed rotary tapered plug therein, are relatively adjustable axially to vary the extent of stock refinement, and one object of the invention is to provide a novel construction which will insure dependable impelling of the paper stock through the Jordan ribs or blades against the natural resistance forces, in any relative adjustment of said shell and plug, for hydrating, brushing and refining the stock with closer uniformity.

Another object is to provide a novel construction permitting the use of rigid piping for conducting the stock into and from the Jordan shell even though this shell may be the element of the shell-and-plug assembly which receives the axial adjustment aforesaid, thereby overcoming the necessity of using flexible hoses with their disadvantages, for conducting the stock.

Figure 1 of the accompanying drawings is a side elevation partly broken away and in section showing a Jordan constructed in accordance with the invention.

Fig. 2 is an end elevation.

Fig. 3 is a partial top plan view.

Fig. 4 is an enlarged longitudinal sectional view partly in elevation, substantially on line 4—4 of Fig. 3.

Figs. 5, 6 and 7 are transverse sectional views on the correspondingly numbered lines of Fig. 4.

Fig. 8 is a detail horizontal section on line 8—8 of Fig. 1.

Fig. 9 is a fragmentary side elevation showing a slightly different form of construction.

A horizontally elongated base 10 is provided having two parallel longitudinal ways or tracks 11 which are instrumental in mounting the tapered shell 12 for axial adjustment. At the opposite ends of this shell, bearing posts 13 and 14 are fixedly mounted, said bearing posts having suitable ball and/or roller bearings in which a horizontal shaft 15 is mounted, said shaft carrying the tapered plug 16 within the shell 12. A driving motor 17 for the shaft 15, is suitably mounted on the base 10, the motor shaft being connected with said shaft 15 by a suitable flexible coupling or the like 18. The shell 12 is pro-

2 vided with internal ribs or blades 19 and the plug 16 is provided with peripheral ribs or blades 20, the two sets of ribs or blades being cooperable in producing the required actions upon the pulp as it is impelled through the channels between said ribs or blades. During such passage of the pulp or stock, the plug 16 is driven at an unusually high speed (from 1200 to 1800 R. P. M.) and the required refining will thus be produced with a great saving of time over the ordinary Jordan which usually rotates at from 300 to 400 R. P. M.

An end closure 21 is secured to the larger end of the shell 12 and another end closure 22 is secured to the smaller end of said shell. Both of these end closures rest slidably upon the base 10 and they are provided with lateral flanges or the like 23 which slidably engage the tracks or ways 11. An adjusting screw 24 is rotatably mounted in a bearing opening 25 in the post 14 and is threaded through an opening 26 in the end closure 22 for adjusting the shell 12 axially with respect to the plug 16, thus varying the space between the shell and plug ribs or blades according to the consistency to which the stock is to be refined. The screw 24 is provided with a hand wheel 27 and with a toothed wheel 28, the latter being cooperable with a lock-operated dog 29. The operating lock 30 for this dog may well be mounted within the base 10 as seen in Fig. 4, and this base may have a suitable opening 31 through which to insert the lock key. By inserting this key and releasing the dog 29, the screw 24 may be readily rotated to make the required axial adjustment of the shell 12. By then projecting the dog 29 into engagement with the toothed wheel 28 and withdrawing the key, it is insured that no one shall tamper with the adjustment unless authorized to do so and equipped with the proper key. During any adjustment of the shell 12, the plug 16 is of course held against any axial movement, due to the fact that it is tightly keyed to the shaft 15, and this shaft is held by its supporting means against endwise shifting, as well as against lateral play.

The end closure 21 is in the form of a casing having an inner cup-like chamber 32 which directly communicates with the larger end of the shell 12, said inner chamber 32 having a cylindrical side wall, the diameter of which is equal to the internal diameter of the shell 12, measured from the bottom of one of the longitudinal grooves in the shell to the bottom of the diametrically opposite longitudinal groove, the grooves referred being of course those between the ribs or blades 19.

The end closure 21 is also provided with an

outer stock-receiving chamber 33, the outer wall of which has a suitable stuffing box 34 through which the shaft 15 passes. Between the inner and outer chambers 32 and 33, there is a transverse partition 35 in the end closure 21, said partition being disposed in a plane at right angles to the axis of the shaft 15 and having an opening 36 of circular outline, said opening being of much greater diameter than said shaft and being concentric with the latter. An open-ended sleeve 37 extends rotatably and slidably through the opening 36, about .005" clearance being provided between said sleeve and the wall of the opening. The inner end of this sleeve 37 is provided with an annular flange 38 within the chamber 32 and in running contact with the peripheral wall of this chamber, about .005" clearance being provided between said flange and side wall. This flange is in spaced relation with the partition 35 and with the larger end of the rotary plug 16. In the space between the flange and plug, radially delivering impeller blades 39 are provided, said impeller blades being preferably pitched spirally as shown in Fig. 7. In the present disclosure, these blades are integrally connected with the flange 38 and with the plug 16, but they could of course be otherwise connected with these parts. Regardless of the kind of connection, the blades 39 connect the flange 38 and sleeve 37 with the plug 16 for rotation as a single unit. Whenever the shell 12 is longitudinally adjusted, the flange 38 of course remains stationary with the plug 16 and the end closure 21 slides with respect to said flange and the sleeve 37. This sleeve receives the stock from the chamber 33 and the outward forcing of the stock by the blades 39 causes it to travel through said sleeve. Moreover, these blades impel the stock through the channels between the shell 12 and the plug 16 against the natural resistance forces, and the stock is thus rapidly given the desired treatment. It will be noted that the close rotatable and slidable engagement of the outer surface of sleeve 37 with the wall of opening 36 in flange 35 provides a seal between these parts to insure that the stock will pass from the outer chamber through the sleeve to the impeller blades in the inner chamber. Likewise the close rotatable and slidable engagement of the edge or periphery of flange 38 with the side wall of chamber 32 will also provide a seal between these parts. This double seal is important since it insures practically all of the stock being directed to the impeller blades 39 irrespective of the relative adjustment of the cone and shell. It is of even greater importance when the larger ends of the cone and shell are at the inlet end of the machine since impeller must move the stock longitudinally from the large end of the plug to the small end of the plug against the centrifugal hydraulic forces set up by the rapidly rotating plug, that try to move the stock toward the large end of the Jordan. It is this combined hydraulic action that causes better paper-making hydration instead of the usual cutting of the fibres short. The refined stock leaving the shell 12 enters a receiving chamber 40 in the end closure 22, from which chamber it is discharged as herein-after explained. The outer wall of the chamber 40 is provided with an appropriate stuffing box 41 through which the shaft 15 extends.

The side of the flange 38, toward the partition 35, is provided with two radially delivering ribs 42 which are preferably spirally pitched as seen in Fig. 6. Any stock entering the space between

the flange 38 and partition 35 is constantly wiped away from said flange by the ribs 42 and is thus prevented from becoming packed and interfering either with plug operation or shell adjusting. This agitation of the stock in the space between the flange 38 and the partition 35 is important in obtaining an efficient pumping action of the stock through the Jordan, since the centrifugal action created by the blades 42 will throw outwardly any sand, broken glass, metal particles, etc. usually found in paper stock, and will cause thick clean fibers to seal and maintain the seal at 36 between the partition and the sleeve 37.

The end closure 21 is provided with a laterally projecting lug 43 having an inlet passage 44 for the stock to be treated, the inlet end of said passage 44 having a suitable stuffing box 45. The axis of this stuffing box and the adjacent end of the stock inlet passage 44, is horizontal and parallel with the axis of the shaft 15. A lateral lug 46, similar to the lug 43, is formed on the end closure 22, said lug having a stock-discharge passage 47, the outer end of which terminates in a stuffing box 48 which is spaced from and axially aligned with the stuffing box 45. A vertical bracket 49 is suitably secured to the base 10 and is provided with a head 50 between the two stuffing boxes 45 and 48, said head having two elbow-like ports 51 and 52. A main stock supply pipe 53 is secured to the head 50 in communication with the port 51, and a main stock discharge pipe 54 is secured to said head 50 in communication with the port 52. A short stock supply pipe 55 is secured to head 50 at one of its ends, in communication with port 51, and extends at its other end slidably through the stuffing box 45; and a short stock discharge pipe 56 is secured at one of its ends to said head 50, in communication with the port 52, the other end of said pipe 56 extending slidably through the stuffing box 48. Whenever the shell 12 is axially adjusted, all of the piping remains rigid and stationary, and the stuffing boxes 45 and 48 simply slide upon the pipes 55 and 56, it being thus unnecessary to provide flexible hoses for conducting the stock to the chamber 33 and from the chamber 40. However, if such hoses should be desired in some installations, they could of course be used, as shown at 50 57 and 58 in Fig. 9.

From the foregoing, taken in connection with the accompanying drawings, it will be seen that novel and advantageous provision has been made for carrying out the objects of the invention, and while preferences have been disclosed, variations may of course be made within the scope of the invention as claimed.

In operation, the invention greatly increases hydration, brushing and refining, by performing continuously in a short time the work that heretofore required hours of beating in a Hollander beater. It eliminates most of the cutting action of the Hollander and also the cutting action of the usual Jordan by greatly improving the hydrating forces. These forces include (1) rapid rotation of the bladed or ribbed plug coacting with the correspondingly bladed or ribbed shell; (2) maintaining exactly the proper clearance between the blades or ribs for best hydration; (3) increasing the internal friction of fiber on fiber caused by the impelled forces in the paper stock coacting with the centrifugal forces in the stock caused by high-speed rotation of the plug; (4) causing high pressure and then to vacuum cycles by the vacuum eddies following each blade or rib

of the plug, causing with high-speed rapidity these myriads of pressure-to-vacuum cycles. These numerous pressure-to-vacuum cycles working on the fibers, as well as the brushing action of the blades, performs the necessary hydrating and other refinement in unusually short order.

I claim:

1. A Jordan comprising an elongated internally ribbed tapered shell provided with a stock outlet at one end; a closure for the other end of said shell, said closure having an inner cylindrical cup-like chamber axially aligned with said shell and directly communicating with said other end of the latter, said closure also having an outer chamber provided with a stock inlet and having a partition between said inner and outer chambers, said partition being disposed in a plane at a right angle to the axis of said shell and having an opening of circular outline axially aligned with said shell; a rotatably mounted shaft coaxial with said shell and extending through the latter and said closure; a peripherally ribbed tapered plug secured to said shaft within said shell; a cylindrical stock-conducting sleeve extending slidably and rotatably through said opening of said partition, said sleeve having its outer surface in slidable and rotatable engagement with the walls of said opening to provide a seal between the two chambers to cause the stock to pass through said sleeve from the outer chamber to the inner chamber, the inner end of said sleeve having an annular peripheral flange within said inner chamber, said flange being disposed in spaced relation with said partition and the adjacent end of said plug and having its outer edge rotatably and slidably engaging the side wall of said inner chamber to provide a seal between the portions of the inner chamber on opposite sides of said flange; radially delivering impeller blades in the space between said plug and said flange for radially moving the stock from the inner end of said sleeve and feeding it longitudinally between the shell and plug, said impeller blades being connected with said flange and said plug and tying said flange, sleeve, and plug together for rotation as a single unit; means rotatable with said flange for throwing the stock in the space between said partition and said flange toward said seals; and adjusting means for relatively moving said plug and shell axially to vary the peripheral space between said plug and shell.

2. In a Jordan, a shell with a frusto-conical bore and a stock inlet portion at its large end, a coacting frusto-conical plug in the bore of said shell and mounted on a rotatable shaft extending through said inlet portion, said shell and plug being relatively adjustable in an axial direction, said inlet portion having an annular partition separating an outer stock inlet chamber and an inner cylindrical chamber in communication with the large end of said bore, said partition having a central circular opening concentric with said shaft, a cylindrical sleeve rotatable and slidable in said opening and affording communication between said chambers, an annular peripheral flange at the inner end of said sleeve disposed in said cylindrical chamber in spaced relation with said partition and the large end of said plug, the outer edge of said flange being in rotatable and slidable engagement with the side wall of said cylindrical chamber, radially delivering impeller blades in the space between said flange and the large end of said plug, said sleeve, flange and impeller blades being rotatable

with said plug, and means in the space between said partition and said flange for moving the stock in said space toward said partition and radially outward in said space.

3. A structure as specified in claim 2 in which said means comprises ribs projecting from the face of said flange opposite said partition and extending in a generally radial direction.

4. A Jordan comprising an elongated base, an elongated internally ribbed tapered shell disposed above said base and provided with a stock outlet at its smaller end, and end closure for the smaller end of said shell provided with a stock outlet, an end closure for the larger inlet end of said shell, said inlet end closure having an inner cylindrical cup-like chamber axially aligned with said shell and directly communicating with said larger end of the latter, said inlet closure having an outer chamber provided with a stock inlet and also having a partition between said inner and outer chambers, said partition being disposed in a plane at a right angle to the axis of said shell and having an opening of circular outline axially aligned with said shell, a shaft rotatably supported from said base and extending coaxially through said shell and also through said end closures, a peripherally ribbed tapered plug fixed to said shaft within said shell, a cylindrical stock-conducting sleeve extending slidably and rotatably through said opening in said partition, said sleeve having its outer surface in slidable and rotatable engagement with said opening to provide a seal between the two chambers to cause the stock to pass through said sleeve from the outer chamber to the inner chamber, the inner end of said sleeve having an annular peripheral flange within said inner chamber, said flange being disposed in spaced relation with said partition and the adjacent end of said plug and also having its outer edge in rotatable and slidable engagement with the side wall of said inner chamber to provide a seal between the portions of said inner chamber on opposite sides of said flange, radially delivering impeller blades in the space between the large end of said plug and said flange for radially moving the stock from the inner end of said sleeve and feeding it longitudinally between the shell and plug against the centrifugal hydraulic forces caused by the rapid rotation of said plug, said impeller blades being connected with said flange and said plug and tying said flange, sleeve and plug together for rotation as a single unit, means in the space between said partition and said flange for moving the stock in said space toward said seals, means supporting said shell and its end closures on said base for axial sliding movement and means for moving said shell and its end closures on said base.

5. In a Jordan, an elongated base having a flat top with opposed longitudinal extending tracks thereon, an internally ribbed tapered shell disposed above said base for longitudinal adjustment thereon and provided with a stock outlet at its smaller end, an end closure secured to the larger inlet end of said shell and provided with a stock-receiving chamber, another end closure secured to the smaller end of said shell and provided with a stock-discharge chamber, said closure at the inlet end of the shell having a stock-inlet passage leading to said stock-receiving chamber, said closure at the outlet end of the shell having a stock-discharge passage leading from said stock-discharge chamber, the outer ends of said passages being open toward each

other and being parallel with the direction of adjustment of said shell upon said base, a packing gland at the outer end of each of said passages, said end closures being slidable upon the top of said base to support said shell between them and having portions to slidably engage said tracks, bearings rising from said base and spaced from said end closures, a shaft rotatably mounted in said bearings and extending coaxially through said shell and through its end closures, a peripherially ribbed tapered cone fixed to said shaft within said shell and having its large end at the large end of said shell, a bracket secured to said base and located between the outer ends of said passages, a short stock-supply pipe secured at one of its ends to said bracket and having its other end received slidably in the gland at the outer end of said stock-inlet passage, a short stock-discharge pipe also secured at one of its ends to said bracket and having its other end received slidably in the gland at the outer end of said stock-discharge passage, a main stock supply pipe secured to said bracket, a main stock-discharge pipe also secured to said bracket, said bracket having one port placing said short and said main stock-supply pipes in communication with each other, and another port in said bracket placing said short and main stock-discharge pipes in communication with each other, and an adjusting shaft having a portion swiveled for rotation in one of said bearings and a screw threaded portion threadedly engaged with one of said end closures.

6. In a Jordan, an elongated base having longitudinally extending tracks, a tapered shell and a coacting cone therein, stock inlet and stock discharge closures secured to the ends of said shell and supporting it longitudinally above said base, bearings rising from said base and spaced from said end closures, a shaft for said cone rotatable in said bearings, said end closures having base portions slidably engaged with said tracks and each being formed on one side with

an integral lug, said lugs having stock passages with cylindrical portions opening toward each other and having their axes parallel to said shaft, the passage in one of said lugs being in communication with the interior of said inlet end closure and the passage in the other of said lugs being in communication with the interior of said discharge end closure, a bracket secured to and rising from said base, said bracket having a head disposed between said lugs and formed with a main stock inlet passage and a main stock discharge passage, two pipes fixed to and projecting in opposite directions from said head, one of said pipes being in communication with said main stock inlet passage and being slidable in said passage in the lug on said inlet end closure and the other of said pipes being in communication with said main stock discharge passage and being slidable in said passage in the lug on said discharge end closure and means between one of said bearings and one of said end closures for slidably adjusting the latter along said tracks.

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