

Dec. 21, 1948.

W. MESSINGER ET AL

2,456,883

JORDAN APPARATUS

Filed Sept. 27, 1945

3 Sheets-Sheet 1

Fig. 1.

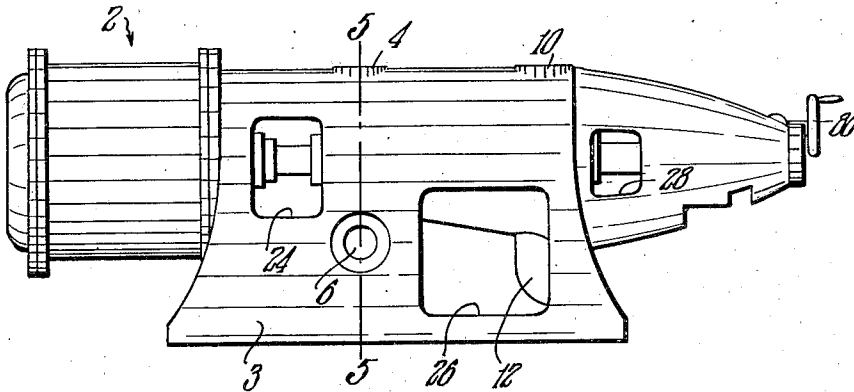
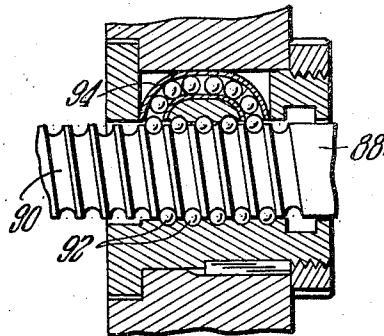


Fig. 2.

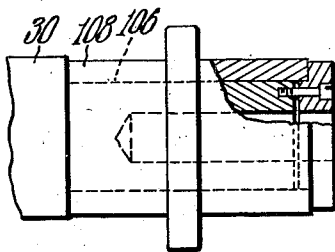


Fig. 3.

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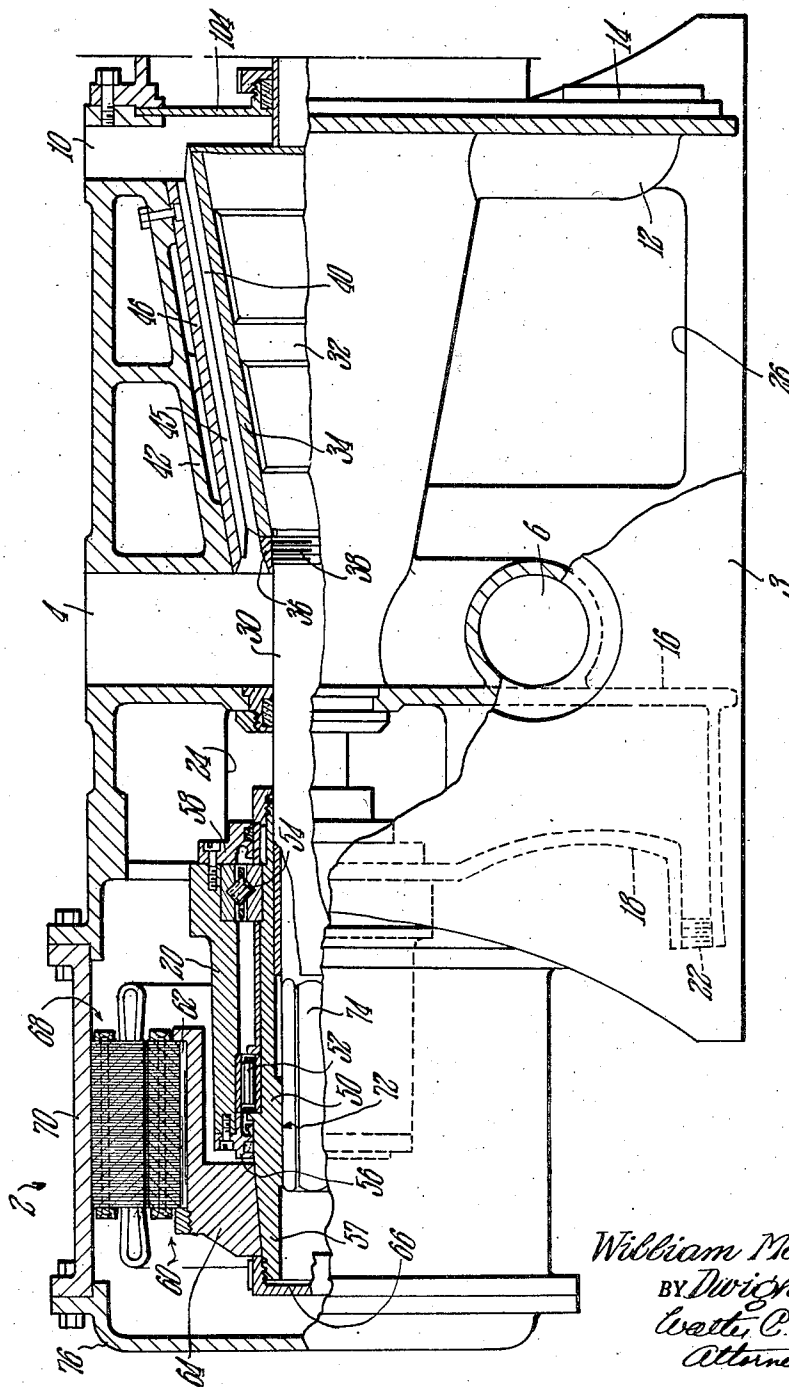
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3 Sheets-Sheet 2



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Fig. 5.

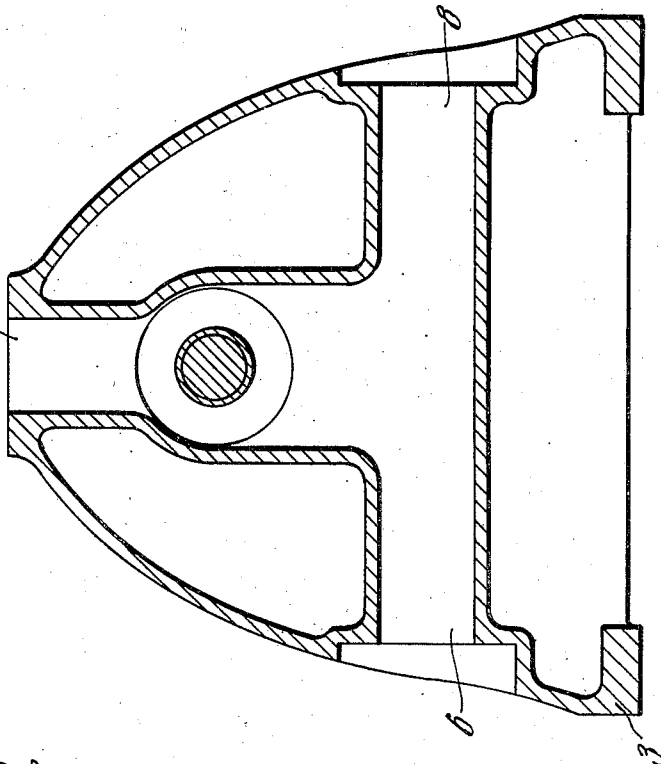
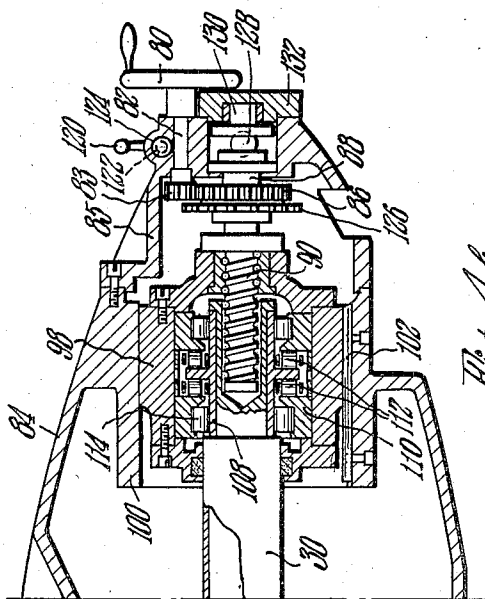


Fig. 4a.

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UNITED STATES PATENT OFFICE

2,456,883

JORDAN APPARATUS

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Application September 27, 1945, Serial No. 618,912

3 Claims. (Cl. 92—27)

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This invention relates to improvements in Jordan or refiner apparatus such as used in preparing fibers for paper making, and which includes a Jordan and driving means therefor. The invention seeks to solve certain problems which this type of apparatus has heretofore presented.

One of the principal problems encountered in prior Jordans or refiners is that they are made up of several components such as a shell for housing stationary knives and containing the liquid as it flows through the machine; bearings for support of the plug or rotating member; a shaft which is an integral part of the plug; a coupling between driving motor and plug and the driving motor itself. These individual parts are assembled on a common base, or bases which are joined, or the motor may be mounted on a separate foundation. This makes it necessary to provide a good foundation for the machine and for the mill to use extreme care in aligning the motor and Jordan shafts.

This invention provides a unitary machine which is self-contained and may be placed on an ordinary mill floor without foundation and without the necessity of aligning any parts as these are a part of the structure and all that is necessary is to make an electrical connection to the motor and a connection to the stock flow. This means that it is possible to set a machine up in a minimum of time. It also makes it possible for the mill to replace one unit with another or to replace an existing unit with this machine without shutting down the mill which is necessary with machines of existing construction.

Another problem arises from the large amount of floor space which a battery of Jordan machines has required. Each Jordan apparatus included a Jordan comprising a shell and a plug rotatable in the shell, a drive shaft, two sliding bearings for the shaft, a motor, and a flexible and extensible coupling between the motor and the shaft. The actual floor space which has to be provided in a paper mill for the accommodation of these machines is not alone the area which the machines occupy when fully assembled. The plug must be extracted axially for renewal of the plug and shell fillings. When this operation is performed the length of the floor space which is required is the length of the assembled machine plus the length of the plug shaft. It is therefore one of the principal objects of this invention to provide a Jordan apparatus which, when assembled, is considerably shorter than such apparatus as heretofore employed, for the same size of Jordan and the same capacity driving unit. The

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shortening of the apparatus not only reduces the required width of building for housing a battery of Jordan machines, but the width of roof, floor and foundations for a projected new mill can be reduced with substantial saving in mill construction cost.

A further problem which Jordan apparatus has heretofore presented was that of lack of concentricity between the plug and the shell. This created a wide variation in clearance between the blades of the plug and the shell on one side as compared with the clearance on the diametrically opposite side.

Through the larger clearances the paper making fibers can escape without being worked upon. With small amounts of clearance the pressure can easily be built up to cause metal to metal contact between the plug and the shell knives wasting much of the material used in the knives. This condition also wastes power and causes existing units to be inefficient. There are several reasons for the eccentric position of the plug with respect to the shell. In the initial assembly of the machine in the mill, because of the length and width proportions of the base, it is easy to distort the base slightly causing a misalignment or displacing of the plug center with reference to the shell center lines. The plug shaft is connected to the motor shaft through a flexible coupling and frequently these parts are not perfectly aligned causing the Jordan plug or rotor to vibrate displacing the plug readily with respect to the shell. Also, the plug is mounted with slidable bearings whose housings require radial clearances in guides and these guides are exposed to the atmosphere, the dirt and water in the mill and these destructive elements soon cause wear which enlarges upon the initial clearances. This, too, permits the plug to become readily displaced and occupy an eccentric position in respect to the shell.

It is therefore another object of this invention to provide means for insuring the concentricity of the plug and shell. Thus a uniform clearance between the blades of the plug and the shell can be maintained over the entire periphery of the plug, which makes the cutting edges of every blade effective in its refining operation upon the paper stock. This increases the productivity of the Jordan many times as compared with the output of prior machines. The quality and uniformity of the refinement are improved because of the thoroughness of the action of all cutting blades which do not permit any unrefined stock to pass through.

It is another object of this invention to accomplish the solution of the problems set forth hereinbefore by one and the same means. That is to say, the means employed for shortening the length of the Jordan apparatus involves elimination of the flexible coupling and sliding bearing for the shaft which gave rise to the eccentricity of the plug with respect to the shell.

In the course of usage all Jordan or conical refiners blading becomes worn and it must be replaced. In the conventional Jordan it is necessary to remove the Jordan half coupling and in most designs it is necessary to remove the bearing nearest the motor end. In this machine there is no coupling to take apart. All that is necessary is to slide the shaft out of the motor quill and there are no bearings whatsoever to be dismantled.

A further object of this invention is to provide a casing for the Jordan apparatus which includes a unitary frame for supporting the Jordan and the driving means in fixed relation.

Still another problem which arises in the use of Jordan apparatus results from the fact that the gap between the blades of the plug and the shell must be varied for different operating conditions and because of wear of the blades. It is another object of this invention to provide means for quickly and easily varying the gap.

A further problem is for the operators to determine with what pressure the rotating member works against the stationary member so that he may determine what type of work is being done on his papermaking fibers. Heretofore, he has had to judge his work by listening to the sound of the machine or note the power which is being put into it by electrical readings.

This invention incorporates a pressure recording device which tells exactly the endwise pressure and it incorporates this device in such a way that disconnection may readily be made when pulling the plug, whereas other devices with pressure recorder makes it necessary to dismantle the pressure element from the machine when the plug is being pulled.

Further objects and advantages of this invention will become apparent in the following detailed description thereof.

In the accompanying drawings:

Fig. 1 is a side elevation of a Jordan apparatus embodying the novel features of this invention;

Fig. 2 is a section through a portion of the means for adjusting the plug relative to the shell;

Fig. 3 is a view of the forward end of the shaft and raceway carried thereby, with parts broken away;

Fig. 4a is a side elevation, partly in section and with parts broken away, of the Jordan apparatus shown in Fig. 1;

Fig. 4b is a vertical section through the forward end of the Jordan apparatus of Fig. 1, showing the plug adjusting mechanism; and

Fig. 5 is a section taken on the line 5-5 of Fig. 1.

Referring to the drawings, what is herein called a Jordan apparatus comprises a driving means 2 at the rear end and a Jordan at the forward end, both supported on a casing 3. The casing is generally of the cross-section shown in Fig. 5 and has inlets 4, 6 and 8 for receiving paper stock and has upper and lower outlets 10 and 12 (the latter shown closed by a plate 14) for discharging the refined paper stock. Transverse partitions 16 and 18 extend across the casing, as shown in Fig. 4a, and a bearing casing 20 extends rear-

wardly from the partition 18. Between the walls 16 and 18 there may be formed an outlet which has a screw plug 22 therein which may provide means for draining the rear or motor end of the casing. Openings such as 24, 26 and 28 are provided in the casing to permit access to the parts for adjustment and other purposes.

The Jordan consists of a shaft 30 having a plug which comprises a portion 32 of conical section upon which is seated a plug filling 34 locked in position by lock nut 36 engaging the threaded portion 38 of the shaft 30. The plug filling includes blades 40. The casing 3 has a conical shell portion 42 within which the plug 34 rotates, the shell having a shell filling 46 which includes blades 45 in co-operative relation to blades 40. The plug and the shell communicate at their rear edges with inlets 4, 6 and 8 through which paper stock is fed for action by the cooperating blades, and the refined stock is discharged through outlet 10 and, if desired, also through outlet 12 after removing plate 14. The driving of the shaft 30 is accomplished by the driving means 2, in a manner to be described hereinafter.

As stated in the introduction hereto, one of the problems which this invention has solved is that created by the long overall length of the apparatus due to the fact that the driving means drove the Jordan shaft through a flexible and extensible coupling and sliding bearing. By this invention the drive is effected without these elements, thus shortening the length of the machine materially. For this purpose, the driving means consist of a stator 68 and a rotor 60, and the Jordan shaft is telescoped within and supported by the rotor, thus eliminating from the overall length of the machine the length of the flexible coupling and the slidable bearing.

The means employed for mounting the shaft within the rotor comprises a quill 50 mounted for rotation in the bearing casing 20 and held against axial and radial movement by anti-friction bearings such as radial bearings 52 and two-way thrust bearings 54. Opposite ends of the bearing casing may be sealed by sealing members 56 and 58, the tapered end 57 of the quill projecting rearwardly beyond member 56. Upon this tapered end is fixed the rotor 60 of an electric motor which constitutes the driving means 2, the rotor being secured by key 62 to a motor rotor spider 64 tapered to fit upon the tapered end 57 of the quill. The spider 64 is locked in position by cap 66 threaded upon the rear end of the quill. The stator 68 of the motor may be fixed directly in a motor casing 70. The rotor of the driving means is thus supported on the outside of quill 50.

The shaft 30 is supported within the quill by a snug, sliding, non-rotatable fit, whereby the rotor will drive the shaft. By telescoping the shaft and rotor, the overall length of the machine is reduced by the length of the elements hereinbefore enumerated, i. e., the lengths of one sliding bearing and the flexible coupling, both of which are no longer necessary. For this purpose, the hollow interior of quill 50 has a portion 72 which has a polygonal section, and the rear end 74 of shaft 50 has a similar section of such dimension as to allow a snug, sliding, non-rotatable fit. The slidable feature of the mounting permits adjustment of the gap between the plug and the shell blades without interfering with the drive.

By removing end plate 76 and cap 66, the rotor 60 may be slipped off the quill for repair or replace-

ment. It will be noted that the umbrella shape of the rotor disposes the vertical plane through its center of mass substantially to intersect the bearing 52, which is a favorable condition of operating and minimizing the load force upon the bearing resulting from the overhung weight.

By telescoping the shaft and rotor and supporting the former in the latter, not only is there obtained the advantage of reduced overall length of the machine, but by eliminating the sliding bearing and its radial clearance in its housing, the gap between blades 40 and 45 may be maintained uniform over the entire periphery of the plug. This is due to the fact that the bearings of the electric motor do not permit radial movement and thus the plug and shell are maintained at all times in accurate concentric relationship.

It is necessary and desirable to provide means for adjusting the gap between the blades 40 and 45 not only for the purpose of compensating for wear of the blades but also to regulate the refining action which the apparatus performs upon the stock. Such adjustment is readily effected by operating a handle 80 at the forward end of the Jordan apparatus to move the shaft 30 and its plug axially in one direction or the other depending upon the direction of rotation of the handle.

The mechanism by which operation of handle 80 actuates the shaft 30 axially is as follows: the handle is fixed to a shaft 82 journaled in the forward end of a cap 85 at the forward end of casing 3. The shaft 82 carries a pinion 83 which meshes with gear 86 on a shaft 88 having a screw-threaded portion 90 (see Fig. 2) on its rearward end in threaded engagement through balls 92 and return passage 94 within a member 98. This member is slidably mounted within a cylinder 100 formed within housing 84, but the member is held against rotation by key 102. Rotation of handle 80 will therefore cause member 98 to slide within cylinder 100, and since the axis of cylinder 100 is made coincident with shaft 30, the member 98 will move axially of the shaft.

By mounting the forward end of shaft 30, rotatable in the member 98, but fixed against relative axial displacement with respect to it, any axial movement of member 98 causes shaft 30 to move axially. For this purpose the shaft which extends through wall 104, that separates the Jordan from the housing 84, has a reduced portion 106 (see Fig. 3) provided with the inner raceway 108 of the roller bearing; cooperating with two raceways 110, which are inserted within the member 98. Rollers 112 have their axes perpendicular to the axis of the shaft 30, and rollers 114, have their axes parallel to the shaft axis. These multiple sets of rollers operate between their raceways to permit free rotation of the shaft under the agency of axial load forces and radial load forces which may operate upon the shaft simultaneously. Since raceway 108 is fixed to shaft 30, and raceways 110 remain non-rotating with member 98, therefore sliding axial-wise movement of member 98 will move shaft 30 axially while yet permitting free rotation of the shaft.

A handle 120 journaled at 122 and carrying a cam 124 may be employed to lock shaft 82 and handle 80 in operating position. Instead of handle 80, or in addition thereto, a power drive for the shaft 88 may be provided through a sprocket 126. A thrust bearing 128 may be provided between the forward end of shaft 88 and

a block 130 held in position in the forward end of cap 85 by a cover 132.

The invention may be embodied in other specific forms without departing from the essential characteristics thereof. Hence, the present embodiments are therefore to be considered in all respects merely as being illustrative and not as being restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all modifications and variations that fall within the meaning and purview and range of equivalency of the appended claims are therefore intended to be embraced therein.

What it is desired to claim and secure by Letters Patent of the United States is:

1. A unitary self-contained motor driven Jordan comprising in combination, a supporting casing construction having forward rotatable bearing means and a conical bore in axial alignment therewith intermediate its forward and rear ends, a motor stator secured to and supported entirely by the rear end of said casing construction, a rear bearing secured to the rear end of said casing construction, a quill within said bearing, bearing means rotatably supporting said quill in said bearing and holding it against axial displacement relative thereto, a motor rotor around and fixed to said quill and disposed in operative relationship with said stator, a single shaft having a tapering plug portion intermediate forward and rear ends thereof, the forward end of said shaft disposed in said forward bearing means and the rear end thereof disposed in said quill, connections between said rear end of the shaft and quill adapted and arranged whereby said shaft and quill are relatively slidable and non-rotatable, said shaft being entirely supported by forward and rear ends of the casing construction through said forward bearing means and rear bearing, cooperating blading carried by said conical bore and plug portion, and said casing construction provided with inlet and outlet openings in communication with the conical bore thereof.

2. A unitary self-contained motor driven Jordan comprising in combination, a supporting casing construction having forward rotatable bearing means and a conical bore in axial alignment therewith intermediate its forward and rear ends, a motor stator secured to and supported entirely by the rear end of said casing construction, a hollow rear bearing support secured to the rear end of said casing construction, a quill within said bearing, separate bearing means rotatably supporting said quill adjacent its forward and rear ends in said bearing and holding it against axial displacement relative thereto, a motor rotor fixed around and to said quill and disposed in operative relationship with said stator, a single shaft having a tapering plug portion intermediate forward and rear ends thereof, the forward end of said shaft disposed in said forward bearing means and the rear end thereof disposed in said quill, connections between said rear end of the shaft and quill adapted and arranged whereby said shaft and quill are relatively slidable and non-rotatable, said shaft being entirely supported by forward and rear ends of the casing construction through said forward bearing means and rear bearing, cooperating blading carried by said conical bore and plug portion, and said casing construction provided with inlet and outlet openings in communication with the conical bore thereof, said con-

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meeting means including an axial bore provided in said quill in which the rear end of said shaft is receivable and said bore and shaft provided with angularly disposed engageable faces.

3. A unitary self-contained motor-driven Jordan apparatus comprising in combination, a supporting casing having forward rotatable bearing means and a conical bore in axial alignment therewith intermediate its forward and rear ends, a motor stator secured to the rear end of the casing and entirely supported thereby, a hollow rear bearing support secured to the rear end of the casing disposed concentrically of said motor stator spaced inwardly thereof and terminating intermediate the ends of said stator, a quill within said bearing having an outer end extending beyond the outer end of said bearing support and provided with an axial bore, separate bearing means adjacent said bearing support rotatably supporting said quill, a motor rotor around said bearing support within and operably related to said stator having a portion secured to the outer end of said quill, a single elongated main shaft having a tapering plug supporting portion intermediate forward and rear ends thereof, forward and rear ends of said shaft dis-

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posed in said forward bearing means and bore of said quill, said bore and rear end of said main shaft therein provided with complementary angularly disposed faces whereby said shaft and quill are relatively non-rotatable and the shaft may be withdrawn from said quill, cooperating blading carried by the conical bore of the casing and plug supporting portion of the main shaft, said shaft being entirely supported in the forward bearing means and quill, and means at the forward end of the casing adapted to move said main shaft axially.

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