April 3, 1951 C. W. MORDEN 2,547,830

TREATING AND REFINING MACHINE FOR PULP MATERIALS

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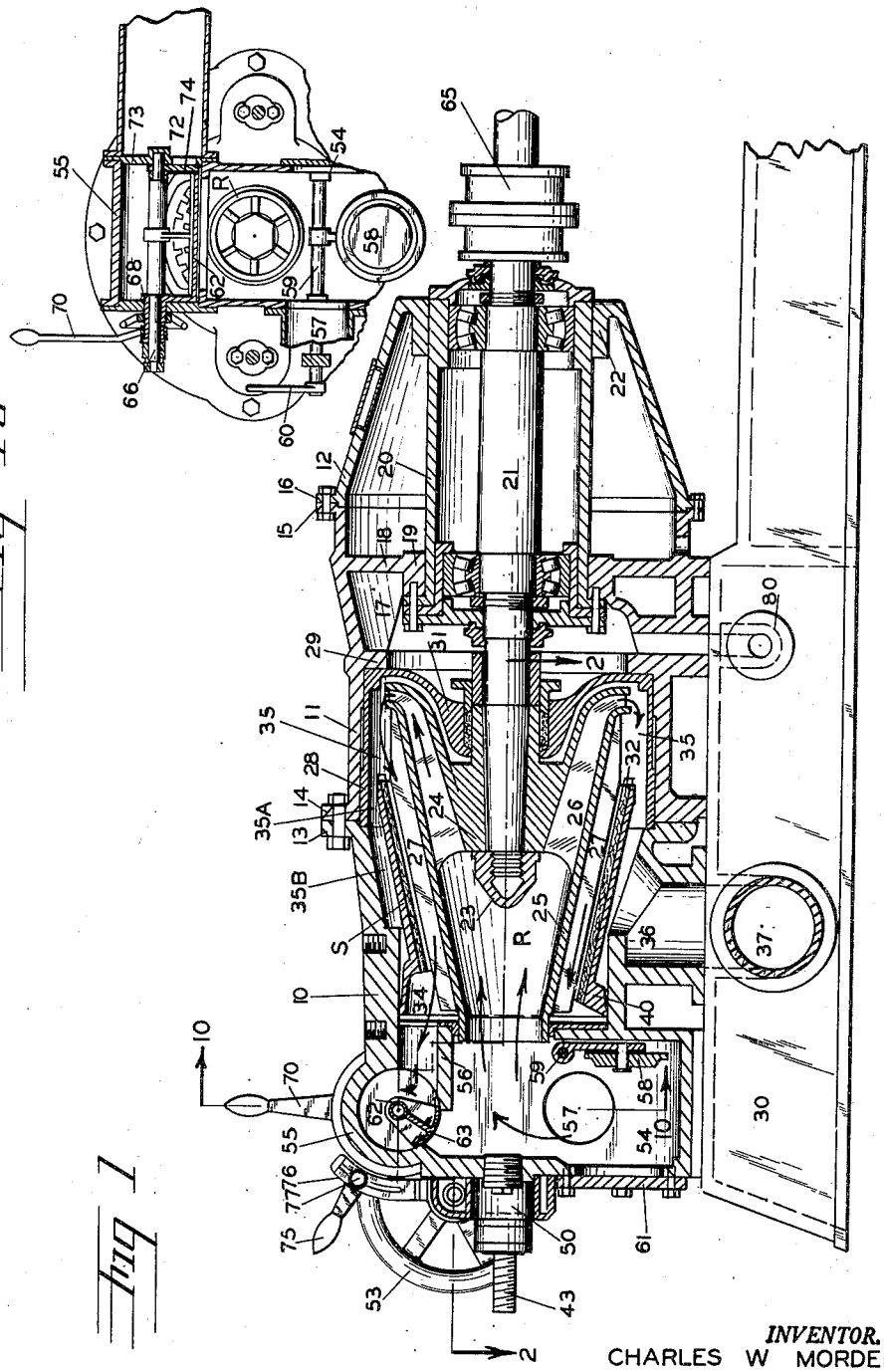


Fig. 1



Fig. 10

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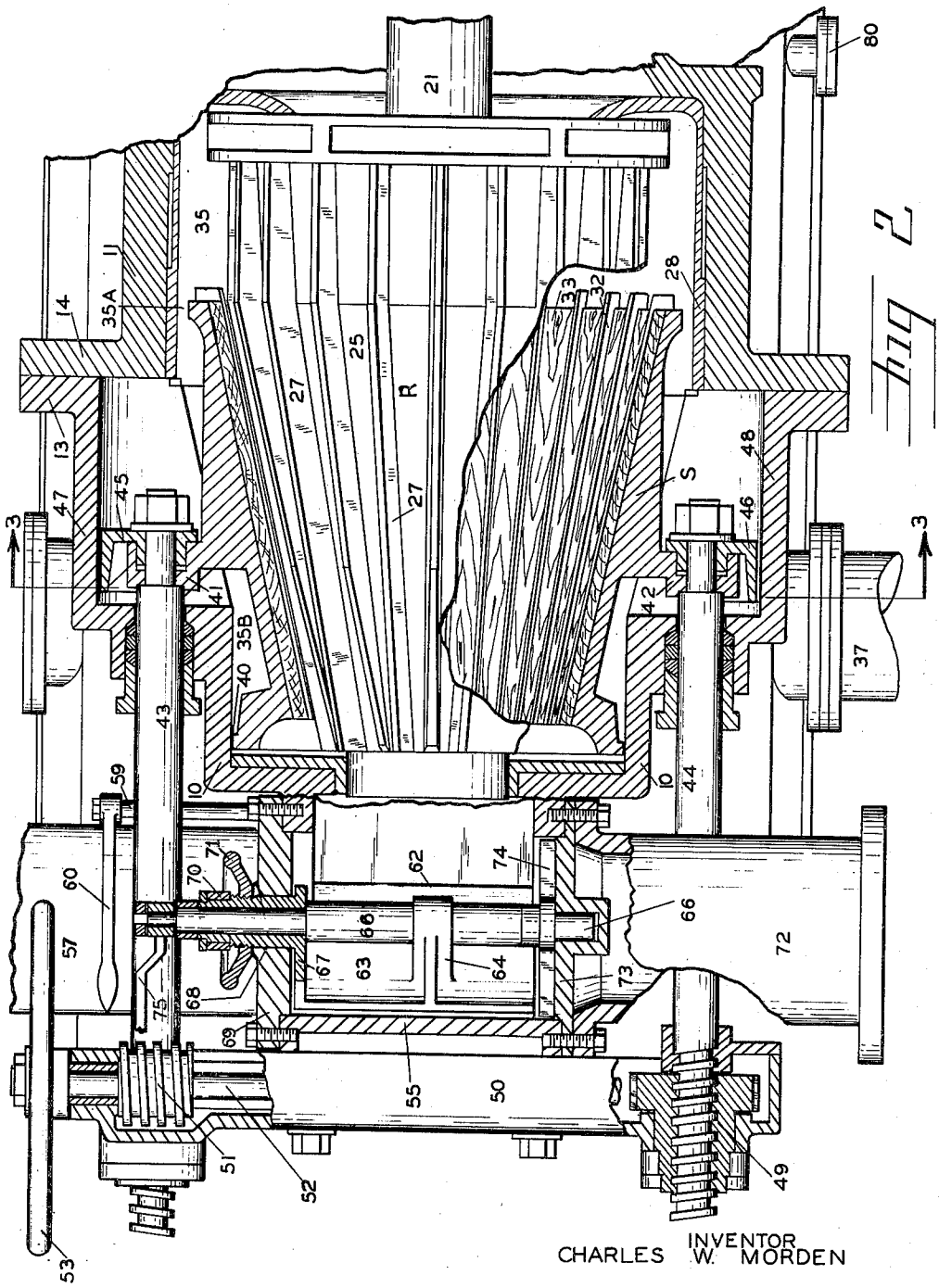


Fig 2

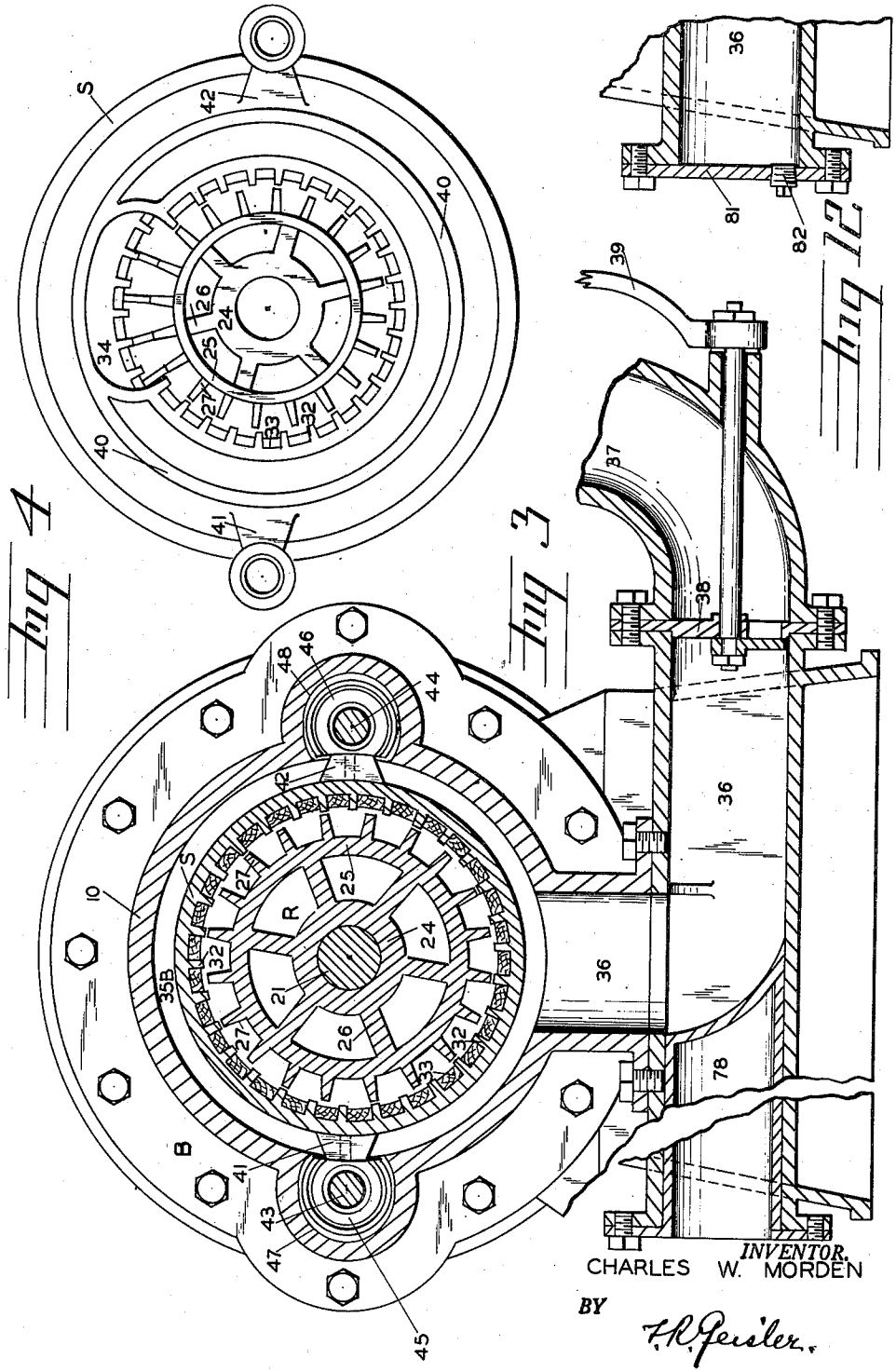
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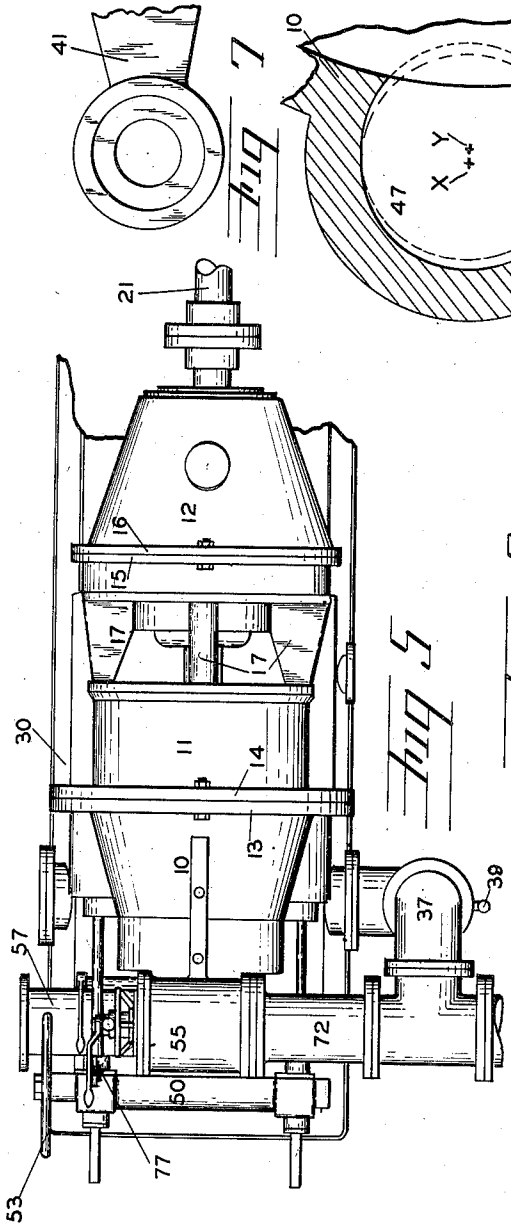


Fig. 7

Fig. 8

Fig. 6

Fig. 5

Fig. 9

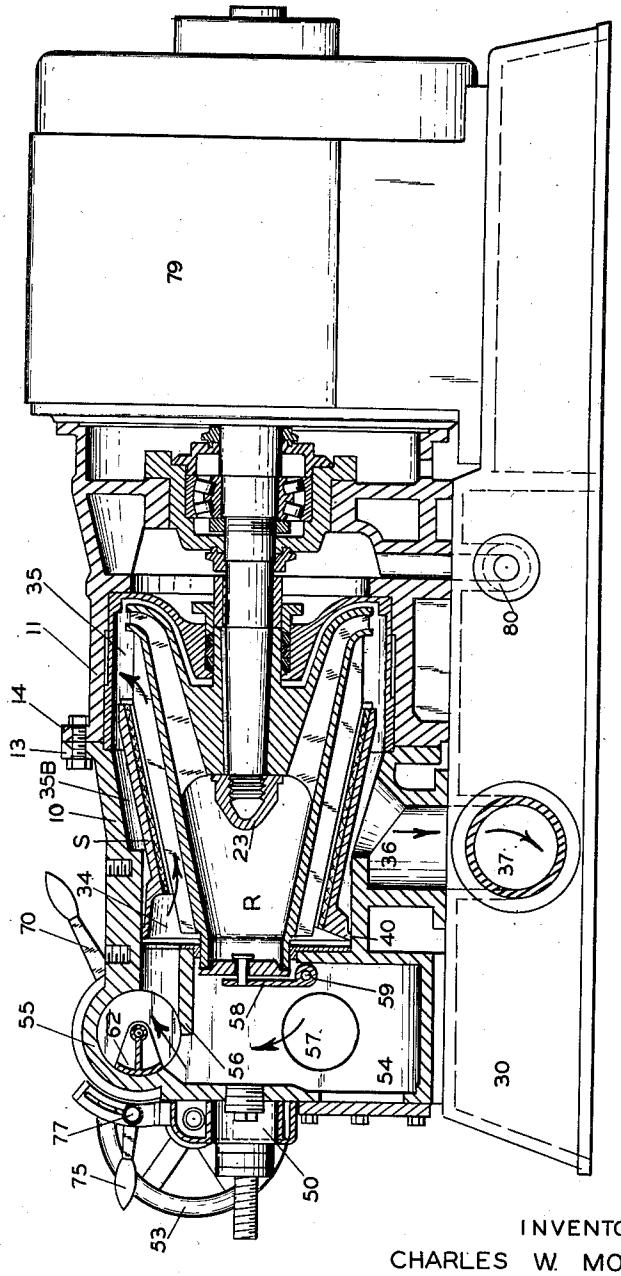
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Fig. 11



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TREATING AND REFINING MACHINE FOR PULP MATERIALS

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6 Claims. (Cl. 92—27)

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This invention relates in general to the treating and refining of pulps made from various types of fibrous materials and intended for use primarily in the manufacture of paper and paper products.

Different types of fibrous material or pulp, adapted for different types or grades of manufactured paper, require somewhat different treatments for best results. I have found, however, that a machine which is adapted to function either as a hydrating unit or as a refining unit or as a combined hydrating and refining unit, can be used in a variety of ways and thus can be employed for giving a variety of mechanical treatments suitable respectively to different types of pulp material.

I have also discovered that, with such a pulp treating or refining machine, having a conically shaped plug or rotor with attritioning means on its outer surface and a non-rotating shell surrounding the rotating element, with coacting attritioning means on the inside surface of the shell, notably improved results are obtainable if the rotating element and non-rotating shell are so arranged with respect to each other that a slight flexibility in the alignment of their axes is made possible.

More specifically, I have discovered, after considerable experimenting with such a machine, that if the non-rotating shell is so mounted that a slight flexibility in the position of its axis is permitted, while the axis of the rotating element is maintained in fixed position, the treatment given the pulp produces notably better results. The flexibility or amount of self-adjustment permitted in the relative positions, is of course only very slight, but even one one-thousandth of an inch correction toward a uniform running relationship of the opposed attritioning bar faces makes considerable difference in the results produced by the machine. By providing such flexibility in the positioning of the axis of the shell, for example, the rotor and shell become self-aligning with the result that more uniform running relationship of the opposed attritioning surfaces is automatically provided.

One of the main objects of the present invention is to provide an improved machine for refining and treating fibrous material in which a slight variance in the position of the axis of the non-rotating shell with respect to the axis of the rotating element is possible at all times, so that any minor adjustment necessary to maintain more uniform running relationship between the two members will automatically take place.

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Another object of the present invention is to provide an improved pulp-treating machine having a rotor and a flexibly-positioned shell which will be particularly adapted for the treating of a wide variety of material, including coarser material than that ordinarily treated in such machines, and including long tough fibres, such as flax stalk and the like, which, in other machines of this general type, might have a tendency to clog the machine.

Another object of this invention is to provide a machine of the type above indicated in which continuous treatment may be given to the pulp, either with or without recirculation of the pulp within the machine during its treatment.

Other objects and advantages obtainable with my improved machine will become apparent with the following description and explanation. In this description of my machine and explanation of its manner of use, reference is made to the accompanying drawings, in which:

Fig. 1 is a sectional elevation of the machine taken approximately along the longitudinal center line;

Fig. 2 is a horizontal section corresponding to the line 2—2 of Fig. 1, with part of the rotating member shown in full, and with part broken away to show a portion of the lower half of the surrounding shell, this figure being drawn to a larger scale;

Fig. 3 is a vertical transverse section corresponding to line 3—3 of Fig. 2;

Fig. 4 is a front end elevation of the rotor and shell showing these elements entirely removed from the rest of the machine;

Fig. 5 is a top plan view of the entire machine drawn to a smaller scale;

Fig. 6 is a corresponding side elevation;

Figs. 7, 8 and 9 are fragmentary details of the elements included in one of the side mountings for the shell, Fig. 7 showing a side arm or lug on the shell; Fig. 8 a section through one of the side chambers on the housing, and Fig. 9 one of the shell-supporting shoes attached to the side arms of the shell, these detail views being taken in the same vertical transverse plane as Fig. 3 but drawn to a larger scale;

Fig. 10 is a fragmentary sectional elevation taken on line 10—10 of Fig. 1 and drawn to a slightly larger scale;

Fig. 11 is a sectional side elevation similar in part to Fig. 1, but illustrating the control valves in different position, and also showing the machine designed to have the motor for driving the rotor incorporated in the main housing of the

machine instead of having the driving done from an external motor; and

Fig. 12 is a fragmentary sectional view of a portion of the base and discharge passageway shown in Fig. 3 illustrating an additional optional waste outlet.

Referring first to Figs. 1, 5 and 6, the housing of the machine comprises three main sections, 10, 11 and 12. The shape of each of these sections will be apparent from the figures and need not be described in detail. Sections 10 and 11 have peripheral flanges 13 and 14 respectively which are bolted together, and section 12 is similarly secured to section 11 by bolts extending through the adjacent flanges 15 and 16 of sections 11 and 12 respectively. Housing sections 10 and 11 are secured to a suitable base indicated in general by the reference character 30.

An intermediate portion of housing section 11 has the upper half open and is formed with an integral longitudinal rib 17. The lower half of the housing at this point forms a sump provided with a bottom drain 80. Section 11 is also formed with an interior wall 18 having a central opening and a surrounding boss 19 which serves for a support for one end of the cylinder housing 20 in which suitable bearings for a rotor shaft 21 in turn are mounted. The other end of cylinder housing 20 is similarly supported in a boss 22 provided at the outer end of housing section 12, as clearly indicated in Fig. 1, and suitable seals are provided at each end of the cylinder housing 20 to prevent loss of lubricant from the shaft bearings and to exclude water and other foreign materials from the bearings.

Shaft 21, which constitutes the rotor shaft, has its inner end formed with a slight taper, and keyed thereon is the rotor element R. A dome-shaped nut 23 holds the rotor element in place on the tapered end of the rotor shaft 21.

The rotor element R, which constitutes one of the principal elements of the machine, is in the shape of a hollow cone frustum and comprises an inner body portion or hub 24 to which the outer wall 25 is attached through the medium of vanes 26. Thus an interior passageway is provided through the rotor element R from one end to the other. As will be noted from Fig. 1, the inner body portion 24 of the rotor element is flared outwardly at the large diameter end, and the outer wall 25 is also correspondingly flared outwardly slightly at that end of the rotor element so that the interior passageway through the rotor is turned more or less to a radial direction at its termination at the large diameter end of the rotor. On the outside face of the outer wall 25 of the rotor a plurality of attritioning bars 27 are located (see also Figs. 2, 3 and 4).

Section 11 of the housing carries a cylindrical inner lining 28. The cylindrical portion of this lining 28 extends to a shoulder 29 on the inside of housing section 11 and the lining 28 then turns inwardly, as shown in Fig. 1, and terminates in a central boss 31 which carries a packing gland to confine the material being treated in the machine to that portion of the housing in which the rotor element is located.

A bed plate shell S surrounds the rotor element R and constitutes another of the principal elements of the machine. The shell S has the same general shape as the rotor element, that is to say, it is in the shape of a cone frustum. On the inner face of the shell a plurality of metal attritioning bars 32 are located, these being shown more clearly in Figs. 2, 3 and 4, and these bars form an interior attritioning surface on the shell surrounding the exterior attritioning surface of the rotor element. Wooden fillers 33 are placed between these bars 32 and assist in causing the material passing between the rotor and the shell to remain in contact with the treating faces of the bars 32. Preferably the bars 32 on the inside surface of the shell S and the bars 27 on the outside surface of the rotor R do not lie in the same longitudinal planes but are slightly oblique with respect to each other so as to produce a shearing action. As shown in Fig. 2, these bars 32 extend for a short distance beyond the large diameter end of the shell, the reason for which will be explained later.

At the front or small diameter end of shell S the periphery wall of the shell is enlarged for a short distance at the top so as to form a special cavity or receiving chamber 34. Into this chamber the pulp to be treated by the attritioning bars of the rotor and shell is introduced in one method of pulp treatment provided for by my machine, and, in another method of treatment possible with my machine, the pulp passes through this chamber after treatment by the attritioning bars. These various methods of treatment will be explained more fully later. This chamber 34 is clearly shown in Fig. 4, as well as in Fig. 1. The attritioning bars of the shell do not extend into this chamber and thus the surface of the rotor forms the bottom wall of this chamber.

The forward end of shell S has a peripheral flange or outer ring 40 (Figs. 1 and 4), into which the top wall of chamber 34 merges. The outer circumference of this flange or ring 40 is of the proper diameter to permit longitudinal sliding movement of the shell in housing section 10. The shell S has a pair of diametrically opposite integral side arms 41 and 42 (Figs. 2, 3 and 4). These arms terminate in shouldered bosses, the form of which will be more clearly seen in Fig. 2. The reduced diameter ends of a pair of horizontal shafts 43 and 44 extend through these side arms 41 and 42 respectively and through shoe elements 45 and 46 carried by the respective side arms. Suitable nuts on the ends of the shafts 43 and 44 keep the shafts and shoe elements attached to the side arms 41 and 42.

The shafts 43 and 44 pass through openings in the front walls of a pair of side chambers 47 and 48 formed in the sides of housing section 10, which openings are large enough to allow for slight play of the shafts therein. Resilient packing is provided in these openings to prevent pulp material from passing out of the chambers 47 and 48 around the shafts, and also to act as a cushioning medium for the shafts and to tend to center the shafts in the openings, and thus center the shell when the rotor is at rest. For such packing I find it satisfactory to use woven type asbestos material coated with graphite, which is harder than the packing around the rotor shaft, for example. Other materials could also be used.

The forward or outer ends of the shafts 43 and 44 have screw threads, as clearly shown in Fig. 2, and these screw threads on each of the shafts are engaged by the screw threads on the interior of a worm gear 49, one of which worm gears is shown in Fig. 2. The worm gears 49 are journaled in a housing section 50, which in turn is secured on the front wall of housing section 10 of the machine. Each of the worm gears 49 receives rotary motion from a co-operating worm screw 51 which is keyed to a shaft 52. One of

these worm screws 51 on shaft 52 is shown in Fig. 2. A hand wheel 53 is mounted on the outer end of the shaft 52. Thus, as apparent from Fig. 2, turning of the hand wheel 53 will produce longitudinal or axial movement of the shell S in the machine.

The side chambers 47 and 48, located in the sides of the main housing section 10, are so formed that their interior curved walls are not actually cylindrical, as might at first be assumed, but the interior bores of these chambers, as illustrated more clearly in Fig. 8, are formed by shifting the centers of the curved surfaces a fraction of an inch laterally. In other words, as illustrated in Fig. 8, the point x indicates the center of the curved surface, or the axis of the semi-cylindrical interior surface of the left half of chamber 47 and the point y similarly indicates the axis of the remaining portion of a semi-cylindrical surface on the right. The radii of the curved surfaces are the same in both cases. Thus the interior wall of each of the chambers 47 and 48 is of a curvature which may be said to be slightly elongated laterally.

The shoes 45 and 46 (see Figs. 2, 3 and 9) have their outside peripheries in the form of an incomplete circle, the radius of which is slightly less than the radius of curvature of each side of the interior walls of the chambers 47 and 48.

From Fig. 3 it will be apparent that the shoes 45 and 46, and therewith the arms 41 and 42, and consequently the shell itself, can move laterally slightly and, to a less extent, vertically within the machine housing, but will of course be held against rotation. Thus, referring to Fig. 2, the forward end of the shell S, through its ring or flange 40, is longitudinally slidable within the housing, whereas the center portion of the shell, where the side arms 41 and 42 are attached, is mounted not only for slidable movement but also for slight lateral movement and, to a less extent, for slight vertical movement as well. Such a mounting which allows for a slight limited radial movement of the shell might be described as a semi-floating type of mounting for the bed plate shell in my improved machine, and provides some self-adjustment of the attritioning surface of the shell with respect to the attritioning surface of the rotor, and is an outstanding feature.

While the longitudinal adjusting or positioning of the shell, attainable through manipulation of the hand wheel 53, is very important not only for compensating for normal wear of the attritioning bars of rotor and shell but also in controlling the treatment received by the pulp or other material in passing between the rotor and shell, this semi-floating mounting of the shell provides additionally for a certain amount of flexibility which automatically permits the shell to adjust itself by securing more perfect running relationship between the attritioning bars of the rotor and those of the shell. As I mentioned at the beginning of this specification, I have found that a slight flexibility in the axial positioning of the bed plate shell produces notably better results in the effective treatment of the material handled by the machine.

Exterior of the large diameter end of the rotor an annular space 35 is provided within the housing section 11. An annular passageway 35A, around the large diameter end of the shell, connects with an annular chamber 35B in housing section 10. Treated pulp is permitted to pass through passageway 35A and chamber 35B during one of the methods of treatment provided for in my machine. This annular chamber 35B surrounding the shell S, connects at the bottom to a passageway 36 (see Figs. 1 and 3), which in turn is connected to outlet pipe 37. A suitable valve 38, operated by lever handle 39 located on the outside of pipe 37, as shown in Fig. 3, controls the passage or discharge of pulp or material into pipe 37 during one of the methods of treatment hereinafter to be described.

The front portion of the main housing section 10 forms a chamber 54 (see Fig. 1), extending upward from the machine base. This has a cylindrical valve housing 55 at the top (see Figs. 1 and 10.) An internal integral horizontal partition 56 partially divides the lower chamber 54 from the chamber of the valve housing 55. An inlet pipe 57 delivers the pulp or other material to be treated in the machine into the lower chamber 54. A clack-valve 58, connected to a horizontal operating shaft 59, will, when closed, prevent the passage of material from chamber 54 into the interior of the rotor R. The clack-valve 58 includes a rotatably mounted disk of suitable material, which disk, when the valve is in closed position, seals the entrance into the rotor and rotates with the rotor. A handle or lever 60 (Fig. 2), is mounted on the outer end of the valve shaft 59 for operating this valve 58. A detachable plate 61 (Fig. 1), covers a clean-out opening in the front wall of chamber 54.

A rotatable valve 62, located in the upper housing chamber 55, controls the passageway past the horizontal partition 56 between lower chamber 54 and upper chamber 55. This rotatable valve, as shown in Figs. 1, 2 and 10, consists of a section 63 of a cylindrical shell supported by a bracket 64 journaled on a horizontal shaft 66. An integral arm 67 at one end of the cylindrical shell section 63 is part of the rotatable sleeve casting 68, which extends through the end wall 69 of the rotatable valve housing and which sleeve 68 also forms a bearing for the horizontal shaft 66. A handle 70 (Fig. 1), secured to the outer end of sleeve 68, enables the cylindrical shell to be moved into the position shown in Fig. 1 for closing the passageway between lower chamber 54 and upper housing chamber 55, or moved into the open position shown in Fig. 11. A locking wheel 71, threaded on sleeve 68, enables the rotatable valve 62 to be locked in either of these positions as desired.

The other end of the valve housing or chamber 55 is connected to an outlet delivery pipe 72. A port plate 73 extends over this end of the valve chamber 55 and provides a bearing support for the inner end of the horizontal shaft 66. The lower half of this port plate contains an outlet port which is controlled by a semi-circular disc valve 74, rigidly secured to shaft 66, and in rotative engagement with the inner face of port plate 73 which controls the passage of material from the upper valve chamber 55 into the delivery pipe 72. A handle 75, secured to the outer end of shaft 66, enables the disc valve 74 to be positioned as desired, either in open or in closed or in partially open position. A slotted indicator guide 76 (Fig. 1), on the outside of the machine is provided to enable definite positioning of the disc valve 74 to be accomplished. A pin, rigidly secured to the handle 75, extends through the slot in the indicator guide 76 and a knurled nut 77 on the threaded outer end of the pin enables the handle 75 to be clamped or set in the desired

position for holding the disc valve 74 either open, closed or partially open. The upper valve chamber 55, as shown in Fig. 1, connects with the annular space in main housing section 10 at the front or small diameter end of the shell S extending around the rotor near the small diameter end of the rotor in which annular space the chamber 34 of the front end of the shell is also located, and thus valve chamber 55 also connects with shell chamber 34.

The outlet pipe 37 (Fig. 5), is joined by a T-connection to the same discharge delivery pipeline as the pipe 72. The bottom passageway 36 (Fig. 3), leading to pipe 37 also has an opposite outlet on the other side of the machine base, and a removable clean-out plug 78 provides a closure for that branch of the passageway 36.

In place of the clean-out plug 78 in the bottom of the passageway 36, a closure plate 81, as shown in Fig. 12, may be substituted. A small opening in the lower portion of this plate, in which a screw plug 82 is located, makes provision for a continuous removal and disposal of the pulp containing an excessive amount of dirt, bits of metal, or other foreign matter settling at the bottom of passageway 36 when this is desired.

The motor for the rotor R may be built in as an integral part of the machine as indicated at 79 in Fig. 11, or the rotor may be driven by an external motor connected to the rotor shaft by a flexible coupling 65 as shown in Fig. 1.

I shall now outline briefly two of the methods of treatment which may be followed in the employment of my machine.

Method A

This method, which is essentially a hydrating treatment, is illustrated by Fig. 1 of the drawings. The rotatable valve 62 is in closed position, preventing passage of material from the lower chamber 54 into the upper valve chamber 55. The valve 58 is open to allow passage of the material from lower chamber 54 into the interior of the rotor R. Disc valve 74 (Figs. 2 and 10), is open to permit the treated material from the upper valve chamber 55 to be discharged into the delivery pipe 72. Valve 38 (Fig. 3), is closed preventing the passage of any material through the passageway 36.

The material to be treated enters the lower chamber 54 from the delivery pipe 57, this entering material being presumably under moderate pressure. The material then passes into the small diameter end of the rotor, as indicated by the arrows in Fig. 1. Since the rotor is driven at relatively high speed the interior vanes of the rotor and the outwardly extending passageway in the rotor function in a manner similar to that of a centrifugal pump and produce a strong pumping action which draws the material into the small diameter end of the rotor and discharges it from the large diameter end at a relatively high hydrostatic pressure. Since the valve 38 is closed the material pumped by the rotor cannot be discharged through the passageway 36 or the annular chamber 35B or the passageway 35A around the large diameter end of the shell and consequently the material from the rotor must pass between the outer surface of the rotor and the inner surface of the bed plate shell S. The hydrostatic pressure at which the material is discharged from the rotor is sufficient to force the material to pass between the rotor and shell in spite of the opposing force developed by the bars on the outer surface of the rotating rotor. As the material starts to pass between the rotor and shell it strikes against the projecting ends of the bars 32 which extend beyond the end of the shell and which perform a sort of breaker action for the material. After the material has been forced between the two attritioning surfaces and subjected to the treatment by this method, the treated material then passes from the space in front of the small diameter end of the shell within main housing section 10 into upper valve chamber 55, and finally through the open disc valve 74 and into the outlet pipe 72.

Modification of this treatment may be made by partially opening the rotatable valve 62. This will cause some of the treated material in the upper valve chamber 55 to return to the lower chamber 54 and become mixed with the incoming fresh material and then caused to pass through the rotor again with the fresh material. The percentage of material recirculated in this manner will of course depend upon the positioning of the valve 62, as will be apparent.

During this general method of treatment, regardless of whether any or part or all of the material is recirculated in the machine, the fact that the shell S, in addition to being properly positioned longitudinally by the wheel 53 and intermediate means, is permitted some amount of flexibility or self-alignment enables more effective treatment of the material to be performed.

Should any foreign objects, such as bits of metal (commonly referred to a "tramp metal"), or dirt of heavier specific gravity than the pulp, be present in the incoming material received from pipe 57, the heavier bits will be collected at the bottom of chamber 54. The lighter bits, such, for example, as paper clips and fasteners, will tend to be drawn into the rotor and will be delivered from the large diameter end of the rotor with sufficient rotating velocity so that the resulting centrifugal force will cause such bits of metal to continue to move around on the inner face of the outer wall of the annular space 35 while the moving pulp, being of lighter specific gravity, is forced inwardly in order to pass between rotor and shell. These bits of metal finally find their way through passageway 35A into the annular chamber 35B, and thence drop into the passageway 36. Under such conditions the passageway 36 serves as a sump from which this "tramp metal" or other foreign objects can easily be removed either by taking out the clean-out plug 78 (Fig. 3) from time to time, or, if the closure plate 81 (Fig. 12) has been substituted, the small opening in which the plug 82 is located, will enable a continuous discharge of that portion of the pulp at the bottom of passageway 36 containing an excessive amount of dirt and other foreign material to be maintained if desired.

Method B

In this method, which is illustrated in Fig. 11, and which is essentially a refining treatment, the valve 58 is closed to prevent the delivery of material into the small diameter end of the rotor passageway. The rotatable valve 62 is open permitting the material from lower chamber 54 to pass into the upper valve housing chamber 55. Disc valve 74 (Fig. 2), is closed, preventing material from passing from the upper valve chamber 55 into the outlet pipe 72, and valve 38 (Fig. 3), is open.

Material delivered from the pipe 57 passes from the lower chamber 54 into the upper valve cham-

ber **55** and thence into the space in front of the small diameter end of the shell around the small diameter end of the rotor, with which space chamber **34** of the shell is connected. The rotating attritioning bars of the rotor exert a centrifugal pumping action on this material and cause this material to pass between the attritioning surfaces of the rotor and bed plate shell from the small to the large diameter end. The treated material is then delivered to the annular space **35** around the large diameter end of the rotor from which it moves through passageway **35A** and annular chamber **35B** into the passageway **36**, and is finally discharged through the discharge pipe **37**.

This method is particularly suitable in cases where coarse material, such as pulp screenings, or where long tough fibers, such as flax stalk, are included in the material to be treated. Since such material tends to enter into chamber **34** before passing between the attritioning surfaces of rotor and shell, it is first forced down directly on top of the bars of the rotor which constitute the bottom of chamber **34**. This enables larger particles of material, which would otherwise be too large to pass between the attritioning surfaces, to be broken up first. It also causes long fibers like flax stalk to be cut up and prevents roping or clogging by such fibers which might occur, for example, if these long, tough fibers were first passed into the interior of the rotor, in the manner described under Method A, which might result in these fibers collecting on the ends of the pump blades of the rotor or roping in the inlet of the rotor and gradually blocking the interior rotor passageway.

Thus in my machine, in the two general methods described, which include hydrating and refining treatments, the direction of flow of the material between the attritioning bars of the rotor and shell can be reversed. In either case, however, the positioning of the attritioning surface of the shell with respect to that of the rotor will, to a limited extent, be self-adjusting due to the semi-floating mounting of the shell, as previously pointed out, a more efficient treating of the material will be attained.

I claim:

1. In a pulp treating and refining engine of the character described, a conically-shaped rotor having an exterior attritioning surface, said rotor provided with an interior passageway, pumping means in said interior passageway, a valve controlling the entrance into said passageway at the small diameter end of said rotor, a non-rotating shell having an interior attritioning surface surrounding said rotor, a mounting support for said shell, said shell loosely mounted in said support for slight, limited, radial movement, whereby said shell can shift its axial position slightly radially to provide some self-adjustment of the attritioning surface of said shell with respect to the attritioning surface of said rotor in their operating relationship, an annular passageway extending around the large diameter end of said shell, an outlet connected with said annular passageway, a valve controlling the flow through said outlet, an entrance chamber for said machine adjoining the small diameter end of said rotor and so arranged that pulp material from said entrance chamber can pass into said rotor interior passageway when said rotor-passageway-entrance valve is open, a valve housing chamber connected with said entrance chamber, a valve in said valve housing chamber controlling the passage of pulp material between said entrance chamber and said valve housing chamber, said valve housing chamber leading to said attritioning surfaces at the small diameter ends of said rotor and shell, a second outlet connected to said valve housing chamber and a second valve in said second outlet, whereby, by the proper setting of said rotor-passageway-entrance valve and said valve in said valve housing chamber and said outlet valves the direction of travel of the pulp material between the attritioning surfaces of said rotor and shell can be reversed, and, when desired, a percentage of treated material can be recirculated in said machine.

2. A pulp treating and refining engine of the character described comprising a conically-shaped rotor having an exterior attritioning surface, said rotor provided with an interior passageway, pumping means in said interior passageway, a clack-valve controlling the entrance into said passageway at the small diameter end of said rotor, a non-rotating shell having an interior attritioning surface surrounding said rotor, a pulp receiving chamber at the small diameter end of said shell, said pulp-receiving chamber extending a short distance over the small diameter end of said rotor, said shell attritioning surface including bars with their ends extending a short distance beyond the large diameter end of said shell, a mounting support for said shell, said shell loosely mounted in said support for slight, limited, radial movement, whereby said shell can shift its axial position slightly radially to provide some self-adjustment of the attritioning surface of said shell with respect to the attritioning surface of said rotor in their operating relationship, whereby to aid in obtaining maintained precision in the attritioning action of said rotor and shell surfaces, manually controlled means for adjusting the position of said shell longitudinally in relation to said rotor, an annular passageway extending around the large diameter end of said shell, an outlet connected with said annular passageway, a valve controlling the flow through said outlet, a foreign matter sump and drain in said outlet, an entrance chamber for said machine adjoining the small diameter end of said rotor and so arranged that pulp material from said entrance chamber can pass into rotor interior passageway when said clack-valve is open, a rotary valve housing chamber connected with said entrance chamber and with said pulp-receiving chamber, a rotary valve in said valve housing chamber controlling the passage of pulp material between said entrance chamber and said rotary valve housing chamber, a second outlet connected to said rotary valve housing chamber and a second valve in said second outlet, whereby, by the proper setting of said clack-valve and said rotary valve and said outlet valves, the direction of travel of the pulp material between the attritioning surfaces of said rotor and shell can be reversed, and, when desired, a percentage of treated material can be recirculated in said machine.

3. In a pulp treating and refining engine of the character described including a conically-shaped rotor having an exterior attritioning surface and a non-rotating shell having an interior attritioning surface surrounding said rotor, a housing located externally of said shell, the large diameter end of said shell spaced free from the inside wall of said housing, supporting means on the outside of said shell, means on the inside of said housing cooperating with said supporting

means for supporting said shell in said housing, said supporting means and said cooperating means providing a limited free mounting for the large diameter end of said shell within said housing to enable slight radial movement of the large diameter end of said shell to take place within said housing when such radial movement is required for bringing the attritioning surface of said shell into better cooperating relationship with the attritioning surface of said rotor.

4. In a pulp treating and refining engine of the character described including a conically-shaped rotor having an exterior attritioning surface and a non-rotating shell having an interior attritioning surface surrounding said rotor, an interior passageway through said rotor, pumping means in said interior passageway, a supporting housing located externally of said shell, the large diameter end of said shell spaced free from the inside wall of said housing, a pair of supporting arms extending from the outer surface of said shell to said housing, recessed chambers in said housing for the outer ends of said arms, said chambers being of sufficient size to enable said arms to have slight limited movement in said chambers in a radial direction with respect to the shell axis, whereby said shell can shift its axial position slightly radially to provide some self-adjustment of the attritioning surface of said shell with respect to the attritioning surface of said rotor in their operating relationship, and means for adjusting the position of said shell longitudinally in relation to said rotor.

5. In an engine of the character described, a conically-shaped rotor having an exterior attritioning surface, a non-rotating frusto-conical shell having an interior attritioning surface surrounding said rotor, a housing surrounding said shell, an annular chamber on the inside of said housing extending around said shell near the large diameter end of said shell, the large diameter end of said shell spaced from said surrounding housing whereby to provide an annular passageway from the large diameter end of said shell to said annular chamber within said housing, an outlet for said annular chamber, a pair of supporting arms extending from the outer surface of said shell to said housing, recessed chambers in said housing for the outer ends of said arms, said chambers being of sufficient size to enable said arms to have a slight limited movement in said

chambers in a radial direction with respect to the shell axis, whereby said shell can shift its axial position slightly radially to provide some self-adjustment of the attritioning surface of said shell with respect to the attritioning surface of said rotor in their operating relationship.

6. In a pulp treating and refining engine having a conically-shaped rotor with an exterior attritioning surface and a non-rotating shell with an interior attritioning surface surrounding said rotor, a portion of the wall of said shell enlarged at the small diameter end of the shell and spaced at greater distance from the corresponding portion of the rotor attritioning surface so as to form with the rotor a pocket-like pulp-receiving chamber located above the attritioning surface of the rotor at the small diameter end, from which the pulp passes between the attritioning surfaces of rotor and shell, a mounting support for said shell, said shell loosely mounted in said support for slight, limited, radial movement, whereby said shell can shift its axial position slightly radially to provide some self-adjustment of the attritioning surface of said shell with respect to the attritioning surface of said rotor in their operating relationship, whereby to aid in obtaining maintained precision in the attritioning action of said rotor and shell surfaces, and means enabling pulp to pass into said pulp receiving chamber for treatment between said attritioning surfaces.

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