

[54] **PULPING AND FINISHING APPARATUS**

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[52] U.S. Cl. 146/174

[51] Int. Cl. A23n 3/00

[58] Field of Search 146/172, 173, 174, 175, 176

[56] **References Cited**

UNITED STATES PATENTS

2,142,649	1/1939	Lindley.....	146/174
2,477,620	8/1949	Kerr.....	146/174

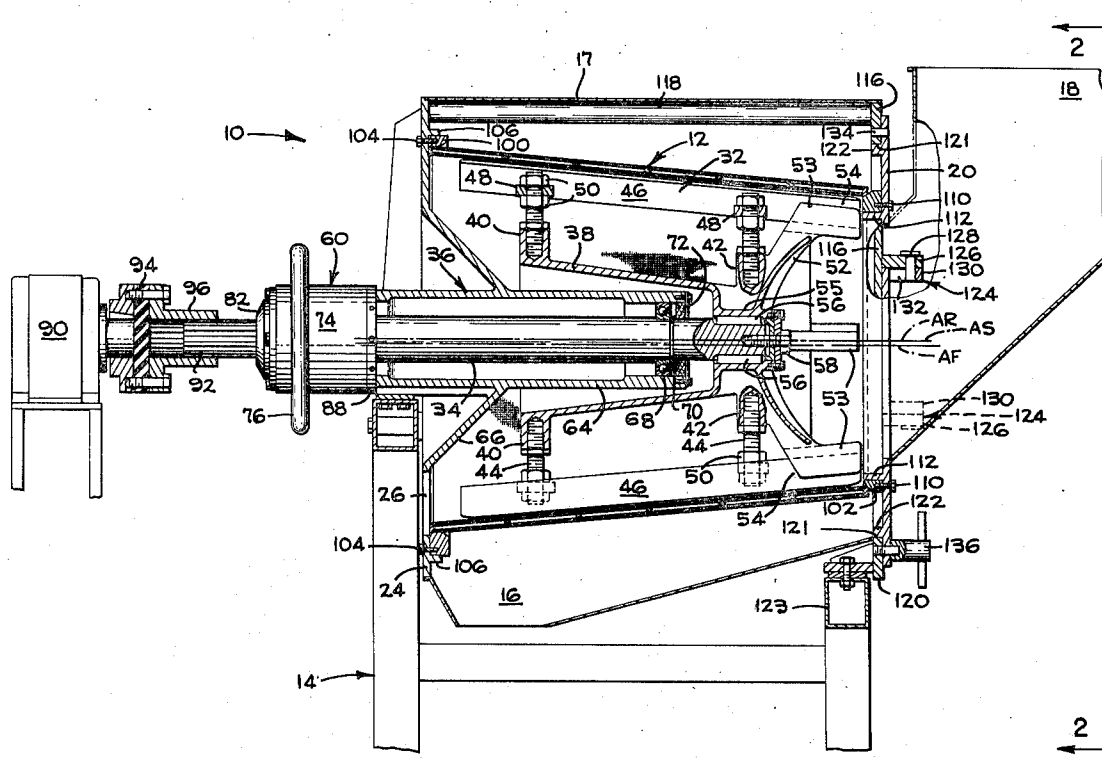
Primary Examiner—Willie G. Abercrombie
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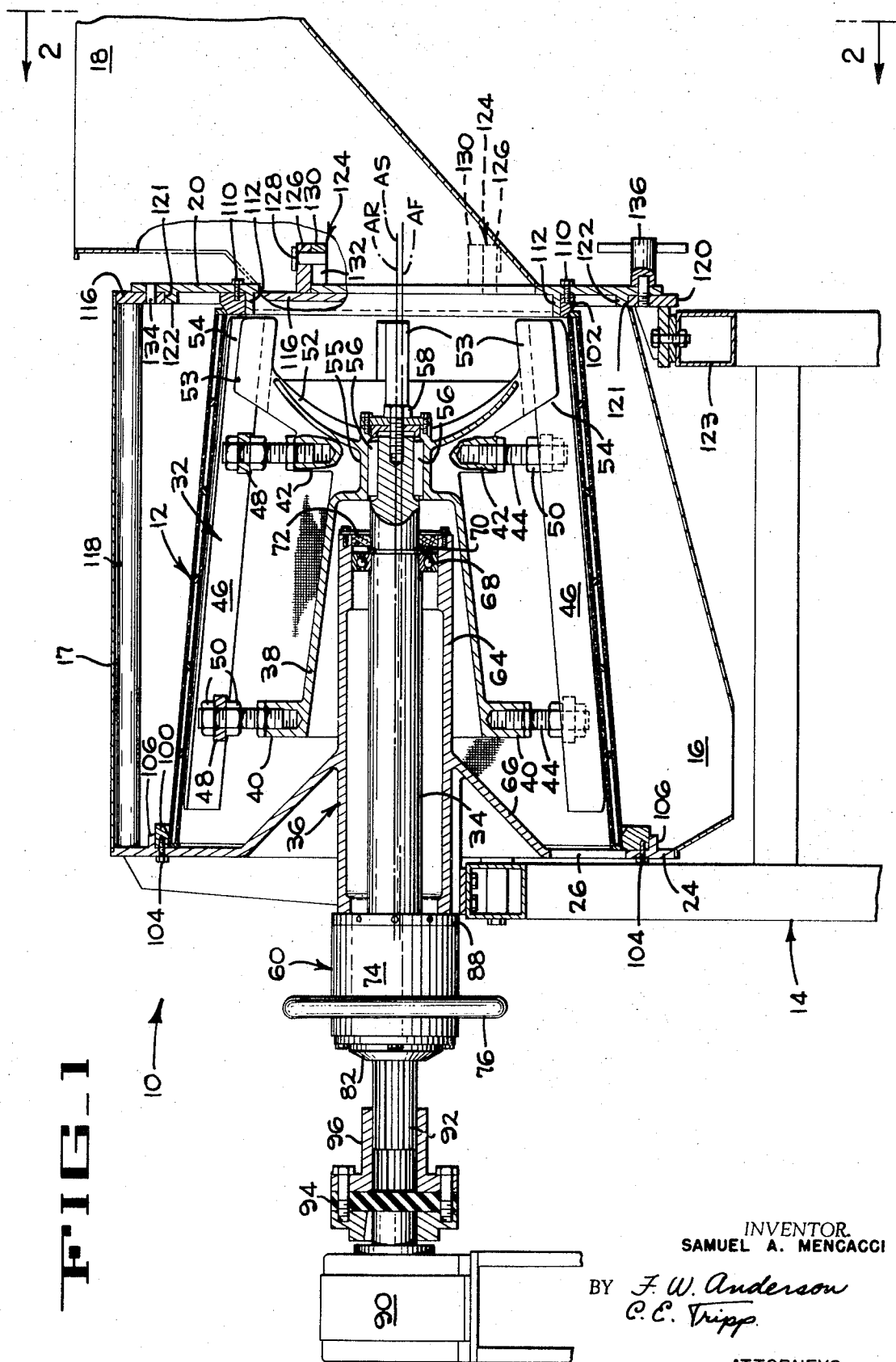
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ABSTRACT

A pulping and finishing apparatus having a frame and a frusto-conical screen which is perforated at least in its lower portion, and which has a driven frusto-conical rotor therein. The rotor is journaled in a cantilever bearing assembly which extends inwardly of the screen from its large end. An end plate is pivotally mounted on the frame at the small end of the screen and may be pivoted between a normally closed position and an open position for ease in removing the screen for cleaning or replacement. The screen may be adjusted to place the screen axis either concentric with the rotor axis or eccentric relative thereto. The rotor may also be adjusted so as to affect axial movement of the rotor within the screen during operation thereby varying the spacing between the rotor blades and the screen.

11 Claims, 10 Drawing Figures





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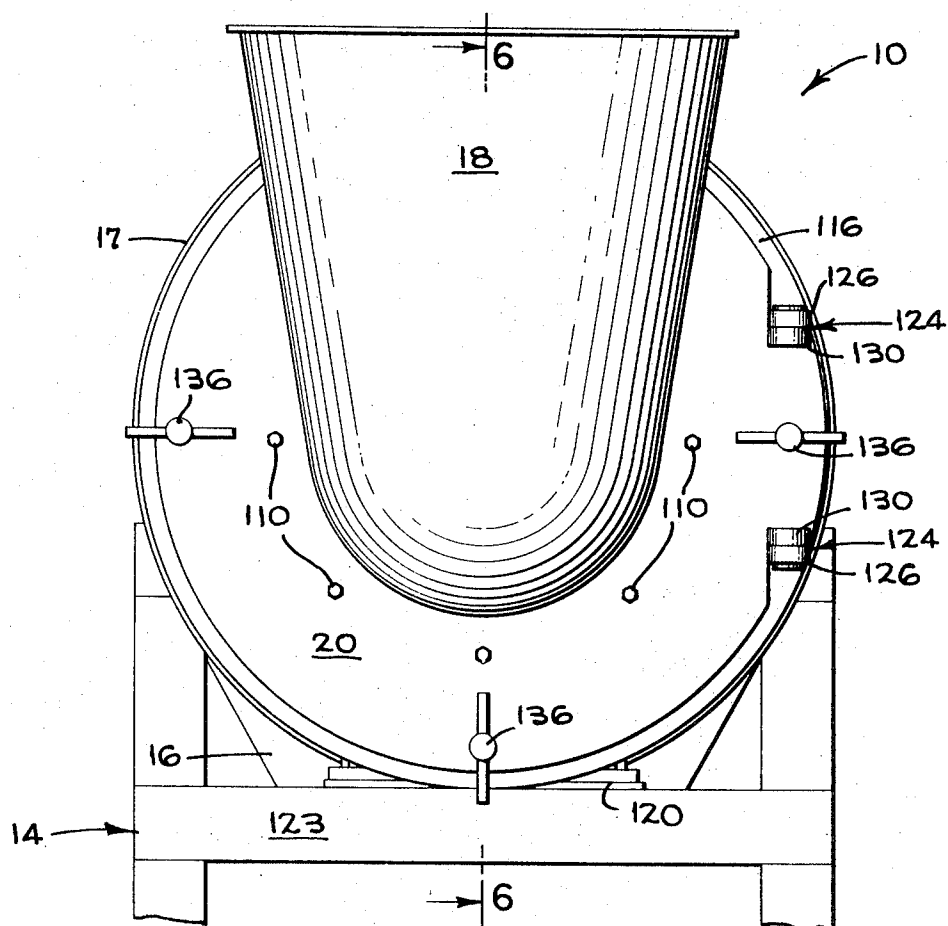


FIG. 2

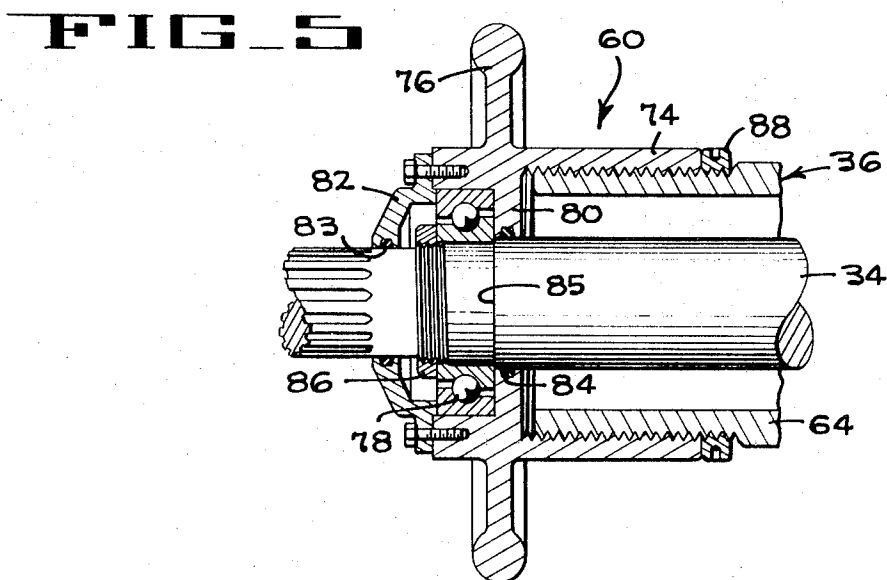


FIG. 5

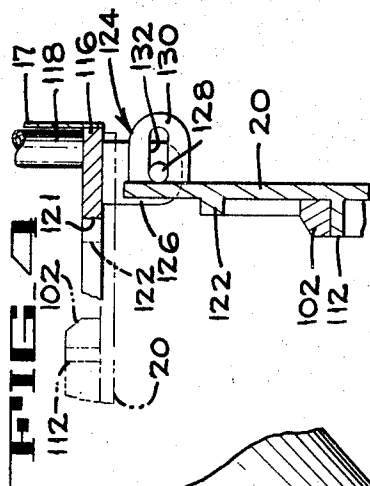


FIG. 1

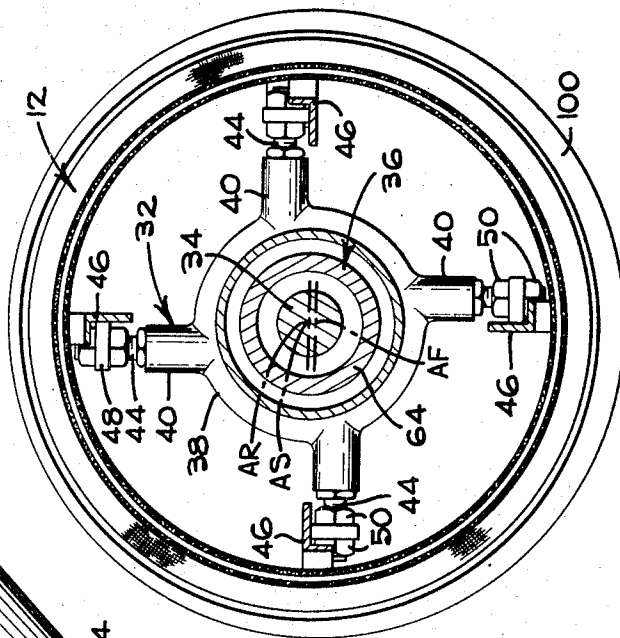
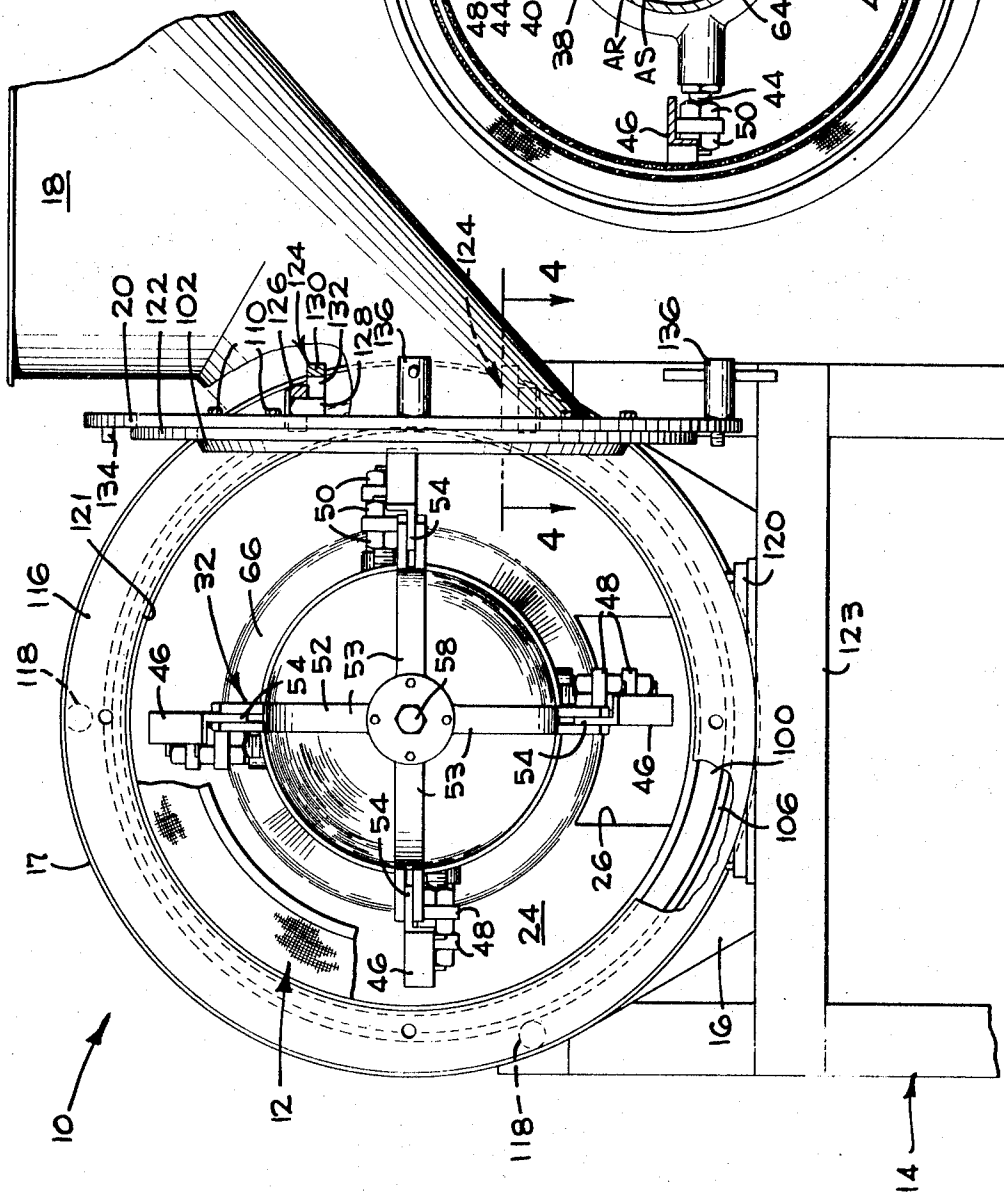


FIG. 3



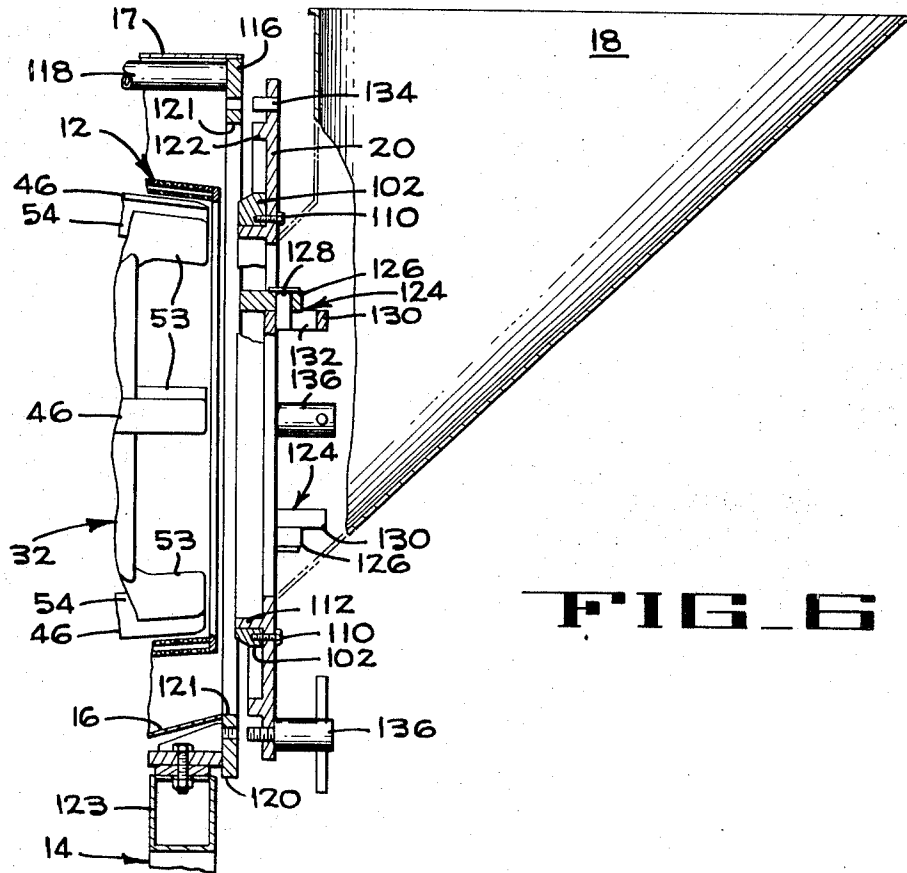


FIG. 6

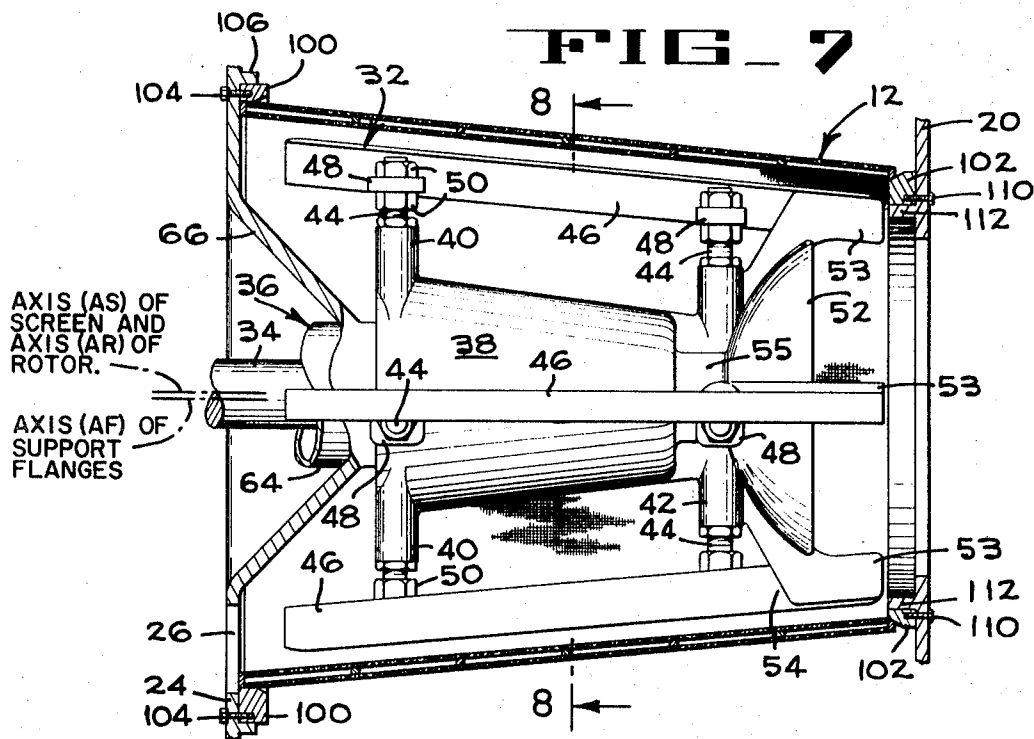
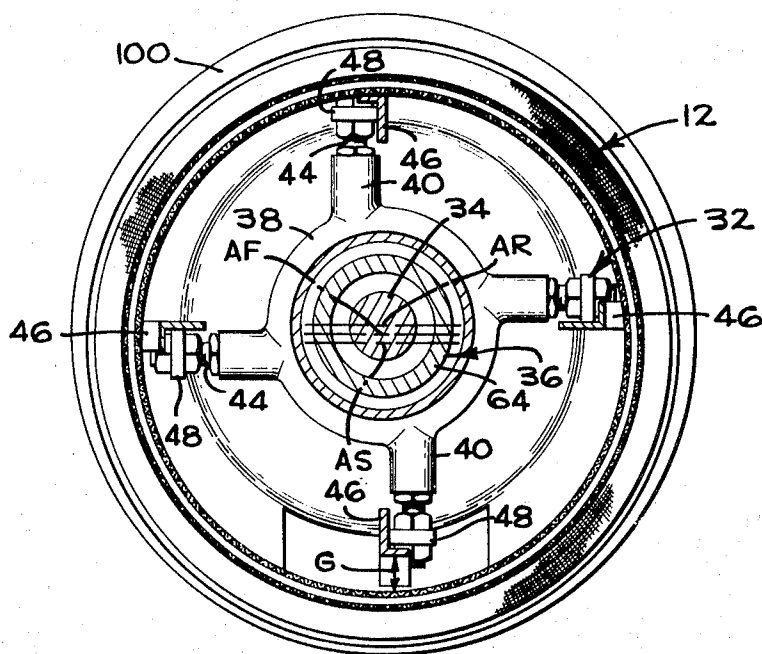
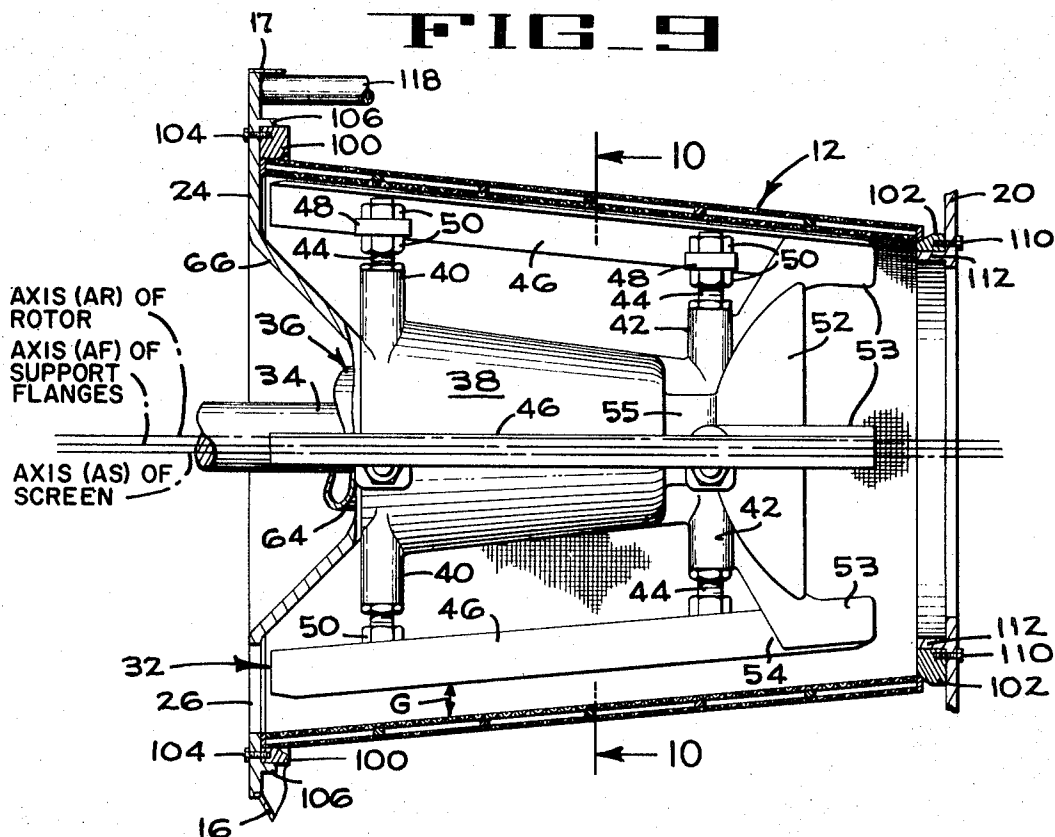


FIG. 7



PULPING AND FINISHING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to an apparatus for pulping products such as fruits or vegetables.

2. Description of the Prior Art

Pulpers and finishers are well known in the art and may be used for pitting fruit such as apricots or freestone peaches. The pulping action of the pulper, when used as a pitter, separates the pits from the fruit meat and reduces the fruit meat to a pulp or juice. If a more refined consistency of the finished product is required, a finisher is used. The finisher is structurally equivalent to the pulper except for the size of the perforations in the housing.

In U.S. Pat. No. 2,101,620 to Lewis a pulping machine is disclosed wherein a rotor is eccentrically journaled within a cylindrical housing having a screen around its lower end. Such eccentricity provides a different gap between the pulping blades of the rotor and the upper and lower surfaces of the screen with the result that pulp will not cling to the pulping blades, and accordingly, a much better pulping action is achieved by the Lewis pulper as compared to other known pulpers having pulping blades which are rotated about an axis that is concentric with the axis of the screen.

However, the pulping blades of the type of pulping apparatus disclosed by Lewis has the recognized disadvantage of being adjustable, to vary the spacing between the pulping blades and screen, only when the pulping machine is not being operated.

Another prior art pulper is disclosed in U.S. Pat. No. 2,142,649 to Lindley which discloses a frusto-conical perforated housing or screen having a driven frusto-conical rotor therein that is concentric with the screen and is axially adjustable relative thereto during operation. Although this type of pulping apparatus may be readily adjusted to vary the distance between the pulping blades and the screen housing, the gap between the blades and the screen is always the same throughout each revolution of the rotor for each axial setting of the rotor relative to the screen. The pulp within the screen, therefore, tends to cling to the pulping blades and accordingly the Lindley device does not provide a pulping operation which is as efficient as that achieved in pulping apparatus using eccentrically mounted rotors.

SUMMARY OF THE INVENTION

The pulping apparatus of the present invention includes a frusto-conical perforated housing or screen having a driven frusto-conical rotor therein. The rotor is mounted on a cantilever bearing assembly which projects into the large end of the screen. An end plate is pivotally mounted on the frame and is movable between a closed position where it provides support for the small end of the screen and an open position where it permits the entire screen to be pulled out of the frame without requiring the removal of bearings or the like. The rotor shaft may be adjusted during operation axially of the screen either when the rotor shaft is positioned concentric with the axis of the screen or is positioned eccentrically relative to the axis of the screen.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical central section of the pulping apparatus of the present invention.

FIG. 2 is an end elevation of the apparatus of FIG. 1 looking in the direction of arrows 2—2 of FIG. 1 and illustrating the end plate in its closed or operative position.

FIG. 3 is an end view similar to FIG. 2 but with the end plate shown pivoted outwardly 90° to its open position, certain parts being broken away and only a fragment of the screen being shown.

FIG. 4 is a horizontal section taken along lines 4—4 of FIG. 3, illustrating one of the hinges with a fragment of the end plate in its open position in solid lines and the end plate in its closed position in dotted lines.

FIG. 5 is an enlarged vertical central section taken through the adjustable bearing assembly for the rotor.

FIG. 6 is a vertical section taken generally along lines 6—6 of FIG. 2 illustrating one of the hinges supporting the end plate in a position parallel to its closed operative position but not yet clamped against the frame in supporting engagement with the small end of the frusto-conical screen.

FIG. 7 is an operational view illustrating the screen centered with the rotor and with the rotor positioned near the infeed or right end of the screen, the size of the gap between the rotor and the screen being exaggerated.

FIG. 8 is a vertical section taken along lines 8—8 of FIG. 7.

FIG. 9 is an operational view illustrating the screen mounted eccentrically of the rotor and with the rotor being shifted to a position near the discharge or left end of the screen, the size of the gaps being exaggerated.

FIG. 10 is a section taken along lines 10—10 of FIG. 9.

DESCRIPTION OF PREFERRED EMBODIMENT

The pulping and finishing apparatus 10 (FIGS. 1 and 2) of the present invention comprises a frusto-conical housing or screen 12 supported by a frame 14. At least the lower portion of the screen 12 is perforated to allow juice and small portions of the pulp being processed to flow therethrough and enter a discharge hopper 16. Preferably, the entire surface of the frusto-conical screen is perforated as illustrated in the drawings and the housing is enclosed by a hood 17 positioned over the upper half of the screen to prevent splashing.

A product such as apricots or peaches to be pitted is directed into the screen 12 through a hopper 18 that is rigidly secured to a vertical front wall or end plate 20 that is loosely pivoted to the frame 14. The end plate 20 provides support for the small end of the screen when it is locked in its operative position. A rear wall 24 is rigidly secured to the other end of the frame 14, provides support for the large end of the screen 12, and has a discharge opening 26 in the lower end thereof.

A rotor 32 is provided in order to pulverize the product within the screen 12 so that the juice and small pulp particles will flow through the perforations in the screen and be collected in the hopper 16, and so that the solids will be discharged through the opening 26. The rotor 32 includes a shaft 34 which is journaled in a cantilever bearing assembly 36 that is rigidly secured to the frame and has said rear wall 24 formed integrally therewith.

The rotor 32 comprises a cast body 38 (FIGS. 1, 3 and 7) which includes two series of bosses 40 and 42 that project radially outward and are internally threaded to receive adjustment bolts 44. As shown in FIG. 8, four rotor blades 46 are provided and each blade is in the shape of an angle bar. Two tabs 48 are welded to each rotor blade 46 and are slidably received on the associated bolts 44 and locked in place by locknuts 50. As best shown in FIGS. 1 and 3, a spider 52 is formed integrally with the rotor 32 and includes four legs 53 which slidably receive the radial flanges 54 of the associated rotor blades 46 to more rigidly support the same. The body 38 includes a hub 55 (FIG. 1) which is rigidly secured to one end of the shaft 34 by splines 56 and a cap screw 58.

It will be understood that the rotor blades 46 are initially adjusted to the desired spacing from the screen by means of the adjustment bolts 44 and lock nuts 50, and that subsequent desired changes and spacing from the initial setting may be accomplished during operation by moving the shaft axially.

In this regard, the cantilever bearing assembly 36 includes a shaft adjusting device 60 (FIGS. 1 and 5) which may be used to adjust the rotor axially during operation. The bearing assembly 36 comprises a tubular housing 64 which is formed integrally with the end wall 24 and connected thereto by a frusto-conical flange 66. The shaft 34 projects out both ends of the housing 64 and has the inner race of a bearing 68 held in place against a shoulder formed on the shaft 34 by a snap ring 70. The outer race of the bearing 68 is mounted for axial sliding movement within the tubular housing 64, and the bearing is protected from contamination by a seal 72.

The shaft adjusting device 60 (FIG. 5) is screwed onto the other end of the housing 64 which is threaded as indicated in FIG. 5. The shaft adjusting device 60 comprises an internally threaded body 74 which is screwed onto the housing 64 with the aid of hand wheel 76. The outer race of a bearing 78 is clamped against an inwardly projecting flange 80 of the body 74 by a cap 82. The cap 82 is apertured to allow the shaft to project therethrough, and seal rings 83 and 84 are provided in the cap 82 and in the flange 80 to preclude contamination of the bearing 78. The inner race of the bearing 78 is mounted on a reduced diameter portion of the shaft 34 and is locked against a shoulder 85 by a locknut 86 screwed onto the shaft. It is apparent, therefore, that rotation of the body 74 relative to the tubular housing 64 by means of the hand wheel 76 will cause the shaft to move axially and thus move the rotor 32 relative to the screen 12 between the positions shown in FIGS. 7 and 9. In this way, the spacing between the rotor blades 46 and the screen 12 may be varied during operation to provide the most desirable pulping operation. The body 74 may be locked in adjusted position by a lock nut 88.

As indicated in FIG. 1, the rotor 32 is driven by a motor 90 which is connected to the splined end 92 of the shaft 34 by a flexible coupling 94 having a splined connecting flange 96 that is sufficiently long to accommodate movement of the splined end of the shaft within the connecting flange 96.

In order to adjust the screen 12 from a position concentric with the axis of the shaft 34 as shown in FIGS. 1, 7 and 8 to a position that is eccentric relative to the axis of the shaft 34 as shown in FIGS. 9 and 10, eccentric mounting rings 100 and 102 are provided to support the large and small ends, respectively, of the frusto-conical screen 12. The large mounting ring 100 is connected to the wall 24 by a series of equally spaced capscrews 104 and has a cylindrical outer peripheral surface which is supported by an annular support flange 106 that projects inwardly from the wall 24. Similarly, the small mounting ring 102 is connected to the pivotal end plate 20 by a series of equally spaced capscrews 110 and has a cylindrical inner surface which is supported by an annular support flange 112 that projects inwardly from the wall 20. The axis AF of the support flanges 106 and 112 are eccentric relative to the axis AR of the rotor 32 and shaft 34 as clearly indicated in FIGS. 1 and 7. The axis AS of the screen and of the inner cylindrical surface of the ring 100 and outer cylindrical surface of the ring 102 are eccentric relative to the axis AF of the flanges 106 and 112.

As indicated in FIGS. 1, 7 and 8, the eccentricity between the outer surfaces and inner surfaces of each of the rings 100 and 102 is such that when the thickest portion of the large ring 100 is lowermost and the thickest portion of the small ring 102 is uppermost, the axis AS of the screen will coincide with the axis of the rotor AR. Conversely, if the eccentric rings 100 and 102 are both rotated 180° to the position illustrated in FIGS. 9 and 10, the axis AS of the screen 12 will be eccentric relative to the axis AR of the rotor 32. It will be recognized that other amounts of eccentricity between the rotor and the screen may be achieved by placing the widest portion of the rings at selected points between their uppermost and lowermost positions.

An important feature of the invention is that the frusto-conical screen 12 may be readily removed from the pulping and finishing apparatus 10 by merely pivoting the end plate 20 from its operative position shown in FIG. 1 to its open position shown in FIG. 3. In order to support the end plate 20, the frame 14 includes a ring 116 which is rigidly supported by three tubes 118 (FIGS. 1, 3 and 4) and by a bracket 120 (FIG. 1) welded to its lower end and bolted to a box beam 123 of the frame. The ring 116 has an opening 121 therein which is slightly larger in diameter than the largest diameter of the screen 12, and which receives an annular flange 122 of the end plate 20 when the end plate is in operative position. A pair of hinges 124 are provided for loosely pivoting the end plate 20 to the frame ring 116. Each hinge 124 includes an ear 126 (FIGS. 1 to 5) welded to the ring 116 and having a hole

therein through which a pivot pin 128 projects. As best shown in FIG. 2, the end wall 20 is cut away to accommodate the ears 126. A mating pair of ears 130 are welded to the end wall 20 and are disposed immediately adjacent the associated ears 126 so as to receive the pins 128 in slots 132 (FIGS. 1, 3 and 4).

The end plate 20 is normally entered and locked in operative position against the frame ring 116 by a centering pin 134 (FIG. 3), the annular flange 122, and by three wing bolts 136 (FIG. 2) which are supported by the end wall 20 and are received in threaded holes in ring 116. When it is desired to remove one screen for repair, cleaning, or replacement by another screen, the end plate 20 is unlocked from the ring 116 and is pulled outwardly and then pivoted to the open position illustrated in FIGS. 3 and 4. The old screen is then pulled out through the opening 121 in the ring 116 and the new screen 12 is pushed axially over the rotor 32 and is guided into the eccentric ring 100 by a chamfered edge on the ring.

The end plate 20 is then pivoted into planar alignment with the ring 116 as illustrated in FIG. 6 and is thereafter moved axially inward. Chamfered edges of the eccentric ring 102 move into the small end of the screen 12 to support the same. The annular flange 122 and the centering pin 134 centers the end plate 20 relative to the frame 14, and the wing bolts 136 are then tightened to lock the end plate 20 firmly against the ring 116 in its operative position.

In operation, the rotor blades 46 are first locked into a desired operating position for the particular type of product being handled by means of the lock nuts 50 (FIG. 1). The pulping apparatus 10 is then placed in operation by starting the motor 90 and directing the product being processed into the hopper 18. The rotating blades 46 then pulverize the product, and if the product is apricots, for example, causes the juice and small particules of pulp to flow through the perforations of the screen 12 and into the discharge hopper 16 for subsequent collection. The pits and the solid portions of the product that are too large to pass through the perforations in the screen 12 are discharge through the discharge opening 26 and are disposed of in the usual manner. Since it has been determined that a better pulping action takes place for most fruits and vegetables when the screen 12 is eccentrically mounted relative to the rotor 32, prior to operation the eccentric rings 100 and 102 are usually positioned as illustrated in FIGS. 9 and 10 but with the rotor positioned to the far right. With the screen positioned in this manner, the axis AS of the screen will be eccentric relative to the axis AR of the rotor and will permit widening of a gap G (FIGS. 9 and 10) during operation if such additional spacing is desired. The initial adjustment is performed prior to commencement of operation, as above mentioned, with the axis AS of the screen being placed about three thirty-seconds to three-eighths of an inch below the axis AR of the rotor shaft 34. After detecting the results of the operation with the screen 12 positioned as above indicated and during continuous operation of the apparatus 10 (FIG. 1), the locknut 88 may be loosened and the hand wheel 76 turned to move the rotor 32 axially of the screen 12 thereby positioning the rotor in the optimum position for the particular product being handled. The locknut 88 is then tightened against the body 74 to lock the adjusting device 60 in selected position.

If, for example, freestone peaches are to be handled after the machine has been used and the rotor has been adjusted for apricots, the same eccentricity may be retained and the rotor may be shifted axially toward the large end of the screen 12 to the position indicated in FIGS. 9 and 10 thereby increasing the gap G (FIGS. 9 and 10) between the pulping blades 46 and screen 12. Such axial movement of the rotor is accomplished by first loosening the locknut 88 (FIG. 1) and then rotating the shaft adjusting device 60 by means of a hand wheel 76 until the rotor blades 46 are spaced from the housing a sufficient distance to prevent damage to the larger peach pits.

After the rotor has been placed in the desired position the locknut 88 is again tightened against the body 74 thereby locking the axial adjustment device 60 in desired position.

Although the apparatus of the present invention has been described as a pulping machine, it will be understood that the same principal of operation will apply to a finishing machine. In this regard the pulping screen may be easily removed by pivoting the end plate 20 to the position shown in FIG. 3 as above described, and the pulping screen may be replaced with a finishing screen having smaller apertures therein. It will also be understood that other fruits and vegetables, such as tomatoes, or other products such as paper pulp may be processed by the subject apparatus.

From the foregoing description it will be apparent that the pulping and finishing apparatus of the present invention features a frusto-conical rotor disposed within the frusto-conical perforated housing or screen. The rotor may be adjusted, during operation, in a direction axially of the housing; and the screen may be adjusted, while stationary, between a position concentric with the axis of the rotor and a plurality of positions eccentric relative thereto.

Although the best mode contemplated for carrying out the present invention has been shown and described, it will be apparent that modifications and variation may be made without departing from what is regarded to be the subject matter of the invention.

What I claim is:

1. A pulping apparatus comprising a frame, an end wall on said frame mounting a cantilever bearing assembly, a rotor journaled in said bearing assembly and having an axis of rotation, a plurality of pulping blades carried by said rotor, drive means connected to said rotor for rotating said rotor about said rotor axis, a frusto-conical screen surrounding said rotor in close proximity to said pulping blades and having a large end and a small end and an axis of generation, first screen supporting means secured to said end wall for telescopically engaging and supporting the large end of said screen, a pivotal end plate normally secured to said frame near the small end of the screen, second screen supporting means secured to said plate for telescopically receiving the small end of said screen, and means for releasing said plate from said frame for allowing the screen to be removed from said frame without interference with the rotational support of said rotor.

2. A pulping apparatus comprising a frame, an end wall on said frame mounting a cantilever bearing assembly, a rotor journaled in said bearing assembly and having an axis of rotation, a plurality of pulping blades carried by said rotor, drive means connected to said rotor for rotating said rotor about said rotor axis, a screen surrounding said rotor in close proximity to said pulping blades and having two ends and an axis of generation, first screen supporting means secured to said end wall for telescopically engaging and supporting one end of said screen, a movable end plate secured to said frame near the other end of said screen, and second screen supporting means secured to said plate for telescopically receiving the other end of said screen, said first and second supporting means being first and second eccentric rings, and additionally comprising means for adjustably securing said first ring to said end wall and said second ring to said plate.

3. A pulping apparatus comprising a frame, an end wall on said frame mounting a cantilever bearing assembly, a rotor journaled in said bearing assembly and having an axis of rotation, a plurality of pulping blades carried by said rotor, drive means connected to said rotor for rotating said rotor about said rotor axis, a screen surrounding said rotor in close proximity to said pulping blades and having two ends and an axis of generation, first screen supporting means secured to said end wall for telescopically engaging and supporting one end of said screen, a movable end plate secured to said frame near the other end of said screen, and second screen supporting means secured to said plate for telescopically receiving the other end of said screen, said first and second screen supporting means being radial adjustment means which may be controlled so as to selectively position the axis of said screen concentric with said rotor or eccentric relative thereto.

4. A pulping apparatus comprising a frame, an end wall on said frame mounting a cantilever bearing assembly, a rotor journaled in said bearing assembly and having an axis of rotation, a plurality of pulping blades carried by said rotor, drive means connected to said rotor for rotating said rotor about said rotor axis, a screen surrounding said rotor in close proximity to said pulping blades and having two ends and an axis of generation, first screen supporting means secured to said end wall for telescopically engaging and supporting one end of said screen, a movable end plate secured to said frame near the other end of said screen, second screen supporting means secured to said plate for telescopically receiving the other end of said screen, said first and second screen supporting means being radially adjustable and including a pair of eccentric rings rotatably about a common axis and disposed in supporting engagement with opposite ends of said screen, and means for connecting said eccentric rings to said frame in any one of a plurality of rotated positions for either positioning the screen axis concentric with the rotor axis or for positioning the screen axis eccentric of the rotor axis.

5. A pulping apparatus comprising a frame, an end wall on said frame mounting a cantilever bearing assembly, a rotor journaled in said bearing assembly and having an axis of rotation, a plurality of pulping blades carried by said rotor, drive means connected to said rotor for rotating said rotor about said rotor axis, a screen surrounding said rotor in close proximity to said pulping blades and having two ends and an axis of generation, first screen supporting means secured to said end wall for telescopically engaging and supporting one end of said screen, a movable end plate secured to said frame near the other end of said screen, second screen supporting means secured to said plate for telescopically receiving the other end of said screen, said screen being a frusto-conical screen having its large end supported by said first screen supporting means, said end plate being disposed adjacent and parallel to the small end of said screen, and additionally comprising means for releasably connecting said end plate to said frame for allowing said end plate to first be moved axially outward a short distance from said screen and thereafter be pivoted to a position parallel to the axis of said rotor for allowing said screen to be easily removed from said frame.

6. A pulping apparatus according to claim 5 wherein said releasable connecting means includes a hinge comprising a first ear rigidly secured to said frame and having a pivot pin receiving hole therein, a second ear rigidly secured to said end plate and having an elongated slot therein extending parallel to the rotor axis when the end plate is secured to the frame, and a pivot pin extending through said hole and through said slot.

7. A pulping apparatus comprising a frame, a frusto-conical perforated screen supported by said frame and having an axis of generation, a rotor having an axis of rotation, a plurality of pulping blades carried by said rotor and disposed generally parallel to the adjacent surfaces of said screen, mounting means for supporting said rotor for rotation about said rotor axis and for movement longitudinally of said rotor axis, drive means connected to said rotor for rotating said rotor about said rotor axis, axial adjustment means included in said mounting means for adjusting said rotor axially of said housing during rotation of said rotor, and radial adjustment means supported by said frame for adjusting the position of said screen axis radially relative to the rotor axis.

8. An apparatus according to claim 7 wherein said radial adjustment means may be controlled so as to selectively position the axis of said screen concentric with said rotor axis or eccentric relative thereto.

9. An apparatus according to claim 8 wherein the maximum amount of eccentricity is on the order of about three-eighths of an inch.

10. An apparatus according to claim 8 wherein said axial adjustment means is adapted to move said rotor axially relative to said screen while the machine is in operation and when said screen axis is in any of its positions of transverse adjustment relative to said rotor axis.

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11. An apparatus according to claim 8 wherein said mounting means includes a cylindrical housing, and wherein the rotor includes a drive shaft journaled for rotation and for axial sliding movement in said mounting means, and additionally comprising a tubular body concentric with said shaft and screwed onto said cylindrical housing, means connecting said

tubular body to said shaft for rotation relative thereto and for axial movement therewith, said shaft and rotor being moved axially of said housing upon rotation of said tubular body relative to said cylindrical housing, and means for locking said tubular body to said cylindrical housing in adjusted position.

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