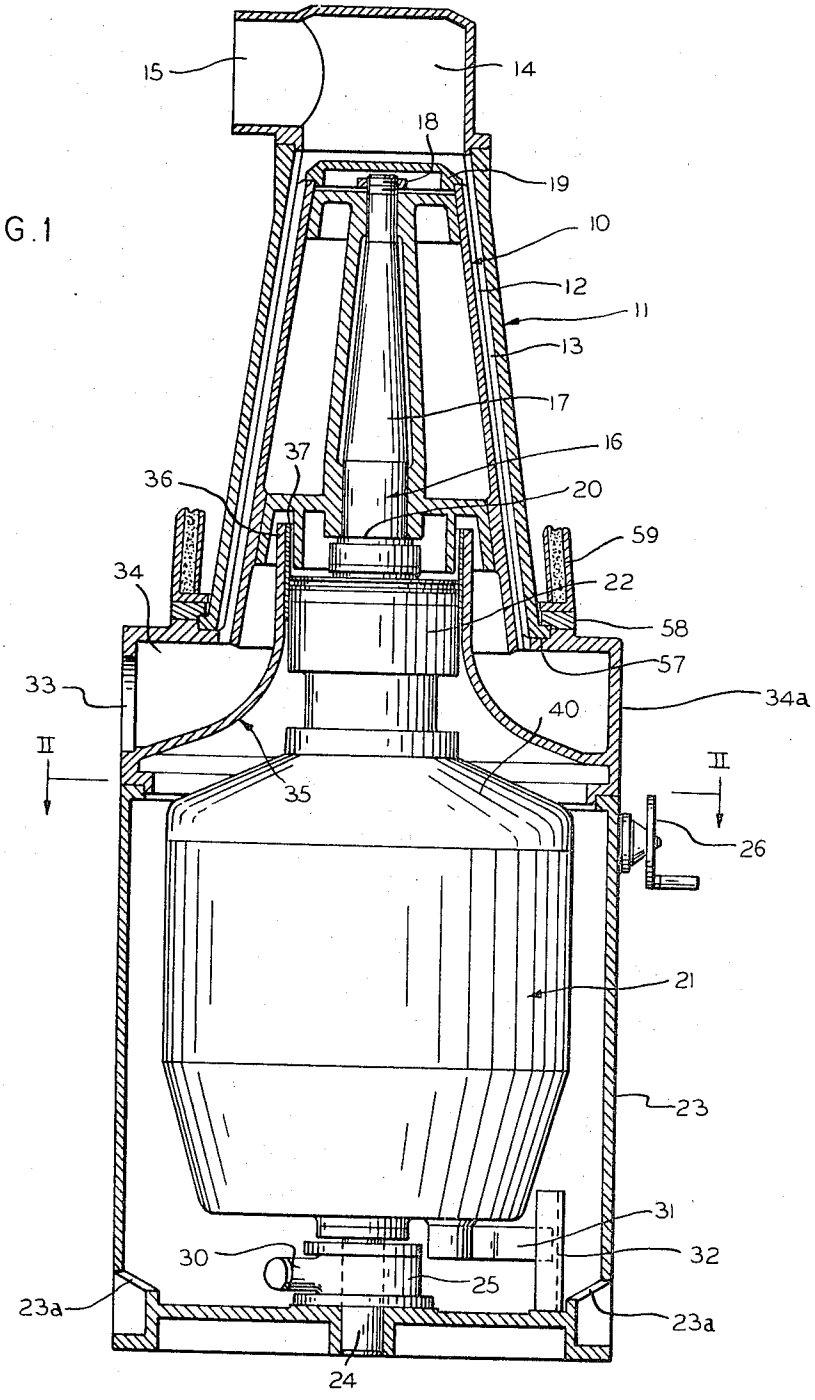
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VERTICAL REFINER

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FIG. 1



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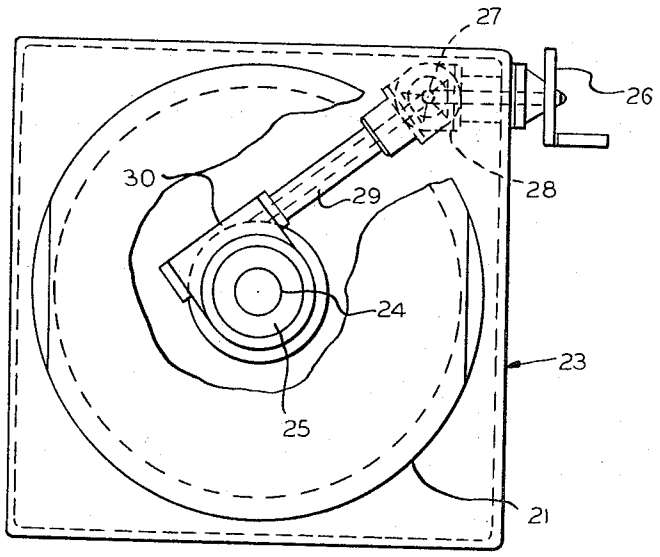


FIG. 2

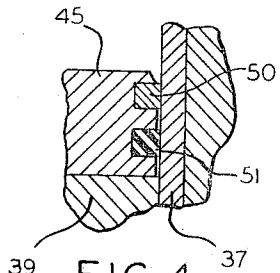


FIG. 4

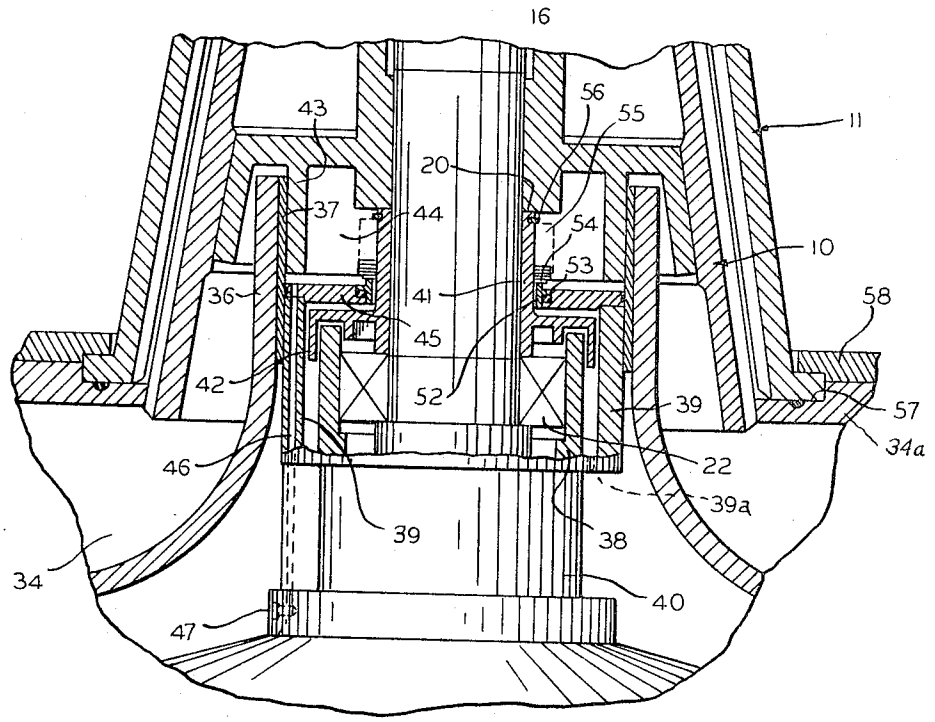


FIG. 3

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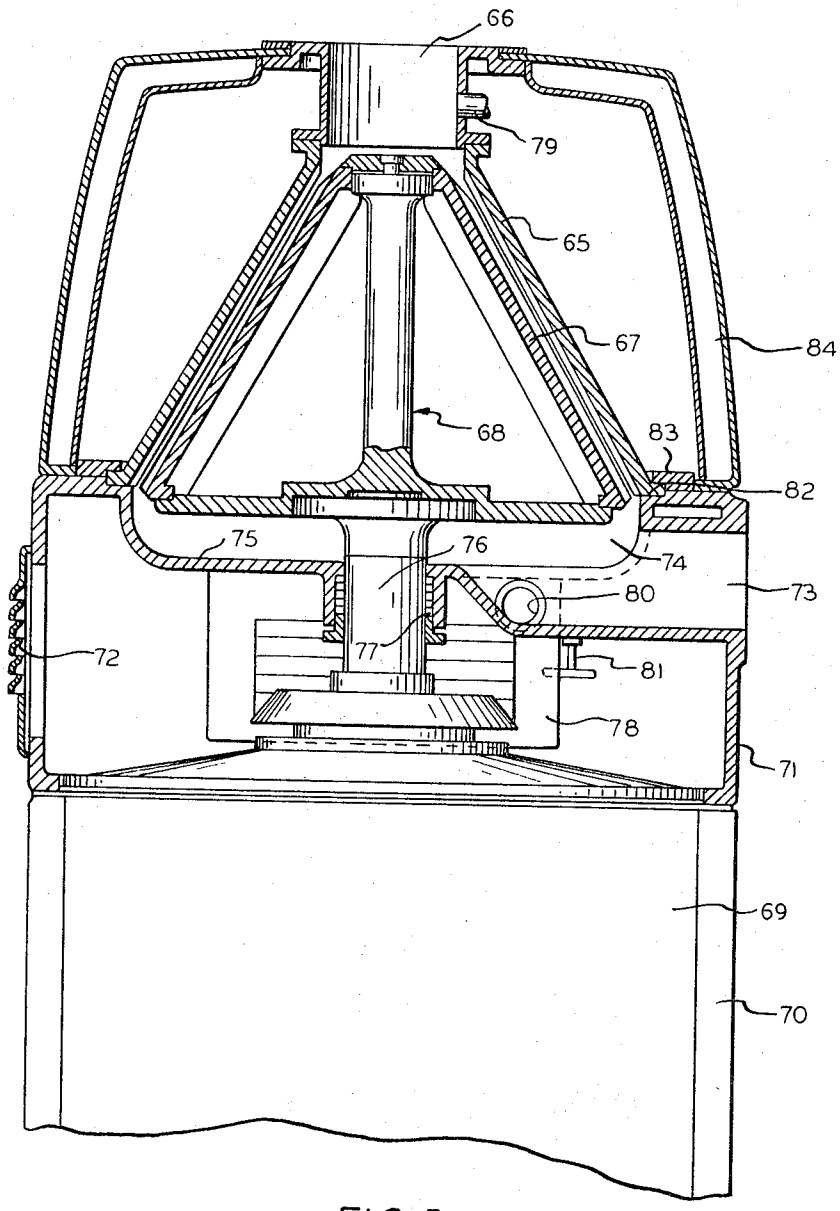


FIG. 5

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VERTICAL REFINER

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5 Claims. (Cl. 241—259)

The present invention relates to improvements in refiners for fiber preparation in papermaking machines.

In a papermaking machine the quality of the paper and the type of paper produced is largely dependent upon the fiber preparation, and a continually operating refiner is commonly used in refining the stock as it flows to the papermaking machine. The present invention relates in particular to conical high speed refiners having an outer shell with an inner rotary conical plug wherein refiner bars are positioned on the facing surfaces of the plug and shell and the spacing between the plug and shell is controlled to regulate the effect of the refiner. Consistent and satisfactory operation of the refiner is essential in developing optimum strength characteristics of the paper web and stock freeness. The necessity for obtaining uniform stock characteristics and controlled stock characteristics with changes in the stock flow and other conditions is important. It is also important to the objective of uniformity and control to maintain the bars in optimum condition so that the shell and plug are changed periodically.

It is accordingly an object of the present invention to provide a conical refiner having improved features for adjusting the plug of the refiner in or out to set and maintain a predetermined power setting or a predetermined plug pressure.

A further object of the invention is to provide an improved conical refiner which operates on a vertical axis thereby improving the balance and centering effects and enhancing uniformity of output, and providing improved sealing and support features for the vertical refiner which prevent leakage of stock and provide for a longer bearing and motor life to avoid the necessity of repair and shut-downs.

A further object of the invention is to provide an improved vertical conical refiner wherein the shell and plug can be easily and rapidly changed with a minimum of effort and a minimum of shut-down time.

A still further object of the invention is to provide a conical refiner of generally improved operating design, having low space requirements and being compact in arrangement for installation and handling and for improved operation and long wearing life.

Other objects, advantages and features will become more apparent with the teaching of the principles of the invention in connection with the disclosure of the preferred embodiments thereof in the specification, claims and drawings, in which:

FIGURE 1 is a vertical sectional view taken through a refiner embodying the principles of the present invention;

FIGURE 2 is a horizontal sectional view taken substantially along line II—II of FIGURE 1;

FIGURE 3 is an enlarged detailed sectional view taken through the base of the plug and shell and showing the relationship of the sealing and bearing parts accommodating rotation and axial adjustment of the mechanism;

FIGURE 4 is an enlarged fragmentary detailed view of a seal of the structure; and

FIGURE 5 is a vertical sectional view illustrating a modified form.

As shown on the drawings:

FIGURES 1 and 4 show a rotary conical plug **10** coaxially mounted within a conical shell **11**. On the surfaces of the plug and shell are bars or blades **12** and **13** which perform the refining operation as the plug **10** is rotated. The effect of refining is varied by controlling the axial position of the plug **10** relative to the shell **11**. The shell **11** has a port **15** at the upper end thereof in communication with a chamber **14** for the stock, at the top of the conical plug **10**.

The plug is mounted on a shaft means **16** having a tapered upper support end **17** with the plug being removably mounted on the end **17** by a nut **18**, with the nut covered over by plug cap **19**. The plug seats down against a shoulder **20**. For removal of the plug, the cap **19** is removed and the nut **18** is removed. The shell is also easily removed for replacement of the plug and shell as will later be described.

The shaft means **17** is a motor shaft driven by a motor **21** within a cylindrically shaped hollow housing **23**. The motor is enclosed by its own water-proof casing **40**.

The motor **21** its shaft means **16** and the plug **10** are vertically mounted and are supported for vertical movement on a support shaft **24** which has a threaded portion receiving a nut **25**. Rotation of the nut **25** will adjustably raise or lower the shaft **24** and thus move the plug **10** vertically relative to the shell **11** to control the refining operation.

For rotation of the nut **25**, FIGURES 1 and 2, a hand wheel **26** is mounted near the top of the housing **23** and through a beveled gearing **28** rotates a vertical shaft **27** leading down to the bottom of the housing and through additional gearing this rotates a horizontal shaft **29** connected to a worm gearing **30** which rotates the nut **25**. The nut is rotatably mounted on the floor of the housing **23** for supporting the motor, shaft means and the plug.

Leakage past seals between the shaft means and the stationary parts is accommodated by drain openings **23***a* at the base of the housing **23**. The motor **21** is permitted to be vertically adjusted without rotating by an arm **31** which slides vertically in a groove in a stationary guide **32** on the housing **23**.

A port **33** leads into an upper end cap **34***a* of the motor shell **23** and has communication with an annular chamber **34**. The annular chamber **34** is formed within an end cap **34***a* of the housing **23**, which is annular in shape and suitably mounts at the top of the housing. The chamber **34** has an annular inner wall **35** which is shaped to curve inwardly and upwardly to form a vertical annular wall **36**. Mounted within the vertical chamber wall **36** is a tubular sleeve **37** which has an inner sealing and bearing surface that supports the bearing **22** for the shaft means and provides a seal with the plug **10**.

For providing a seal with the plug, the plug has a downwardly extending annular skirt or flange **43**, FIGURE 3. The flange **43** has a close clearance relative to the sleeve **37** to prevent leakage of the stock through the space therebetween, and to permit relative vertical movement of the plug **10** when it is adjusted in position relative to the shell **11**.

Radially within the flange 43 is a water chamber 44 which is preferably supplied with fresh water so that the fresh water meets the stock in the space between the flange 43 and the sleeve 37 thereby preventing stock from leaking downwardly into the housing and preventing the stock from contacting the bearing 22, FIGURE 3.

The bearing 22 surrounds the shaft means 16 and is supported in a bearing support 38 on the motor casing 40. Also supported on the motor casing is an annular collar 39 which supports at its upper end a plate means 45 which forms the lower boundary for the water chamber 44. A fresh water passage 46 leads upwardly from a fresh water inlet 47 to the water chamber 44.

The inner boundary of the water chamber 44, which surrounds the shaft means 16, is in part formed by a collar 41 which is tight on the shaft means 16 and rotates therewith. The collar has an outwardly and downwardly extending flange 42 which prevents any water leaking past the seal 53 from leaking downwardly into the bearing 22. The space below the flange 42, which is between the bearing support 38 and the collar 39 will have openings at its lower edge such as at 39*a* so that water can drip downwardly into the housing.

The plate means 45 has a seal at its outer edge which is shown in detail in FIGURE 4. The seal includes an upper scraper ring 50 which is rigid and axially maintains the rigid collar 39 centered within the wall 36 to maintain the axial position of the motor and shaft means 16. Below the scraper ring 50 is an O-ring seal 51, and the O-ring seal and scraper ring 50 slide within the inner surface of the sleeve 37.

At the inner circumference of the plate means 45 is another seal formed of an annular rotatable sealing ring 52 mounted on a rubber support ring 53. The sealing ring has an upwardly smooth annular sealing face which rotatably engages a rotating sealing ring 54 carried on the collar 41 on the shaft means. A sealing ring 54 is vertically slidable and is urged against the ring 52 by expansible bellows 55. These bellows are internally gas pressurized to continue to urge the ring 54 in sealing engagement with the ring 52. A light-weight helical spring may also be used and the bellows 55 is backed against a split locking ring 56 seated in a groove in the collar 41. The top of the collar provides the shoulder 20 against which the plug 10 is clamped.

The shell 11 is mounted on an annular seat 57 at the top of the housing portion 34*a*, and is held in place by an annular shell holding ring 58 which may be secured to the housing such as by bolts not shown. Supported on top of the ring 58 is an insulating dome 59 which is shown only in part, and which is provided with sound insulation and extends up over the top of the shell 11.

During operation of the refiner, the stock is prevented from leaking into the bearing area by the back pressure of water in the water chamber 44 formed between the rotating shaft means 16 and the axially extending flange 43 of the plug 10 spaced radially outwardly of the collar 41 on the shaft 16, and the stationary plate means 45 and sleeve 37. Water is supplied through a passage 46, from a supply line 47.

In the arrangement of FIGURE 5, a conical plug 67 is located within a shell 65 having an axial port 66 at the top of said shell and opening thereinto. The plug is supported on a vertical shaft means 68 which is the shaft of a motor 69 and mounted in a housing 70.

At the top of the housing is an annular housing part 71 having a hollow space therein ventilated through vents 72 and containing a bearing support assembly 78 for supporting the shaft means 76.

Below the plug is a stock chamber 74 having a chamber wall 75 and having a port 73 leading therefrom. The wall 75 supports a rotary seal 77 preventing leakage of the stock downwardly along the shaft portion 76 of the shaft means 78.

A portion of the stock is recirculated through a recirculation inlet 79 leading down to a recirculation outlet 80 feeding into the stock inlet 66. A control valve shown schematically at 81 controls the quantity of stock recirculated.

The shell 65 is removably mounted at the top of the housing portion 71 on an annular seat 82, held in place by clamping ring 83. Also mounted on the housing is an insulating dome 84.

Thus it will be seen that we have provided an improved refiner which meets the objectives, advantages and features above set forth. The mechanism is capable of high speed operation and provides a refiner which requires a minimum of shutdown time permitting easy adjustment while running and preventing contamination and fouling of parts with stock leakage. The plug and shell are easily and quickly changed.

The drawings and specification present a detailed disclosure of the preferred embodiments of the invention, and it is to be understood that the invention is not limited to the specific forms disclosed, but covers all modification, changes and alternative constructions and methods falling within the scope of the principles taught by the invention.

We claim as our invention:

1. In a paper stock refiner having a
vertically extending housing,
a motor mounted within said housing and having a vertical motor shaft extending upwardly therefrom,
an end cap for said housing having an exterior wall conforming generally to the wall of said housing,
an annular flange extending inwardly from the top thereof, and
an annular interior wall, which with said exterior wall forms an annular chamber for stock,
said annular interior wall also having a bearing mounted inwardly thereof and within the limits thereof and forming a bearing for said vertical motor shaft,
a port having communication with said annular chamber,
a vertical shell mounted on and sealed to said end cap and extending upwardly therefrom and having a frusto-conical interior wall,
a port at the top of said shell in communication with the interior thereof,
a conical plug mounted on said motor shaft and extending therealong and rotatably driven therefrom and having a frusto-conical surface spaced inwardly of said frusto-conical interior wall of said shell and adapted to have stock passed therealong during rotation of said plug to effect a refining operation, and
means preventing the stock passing between said ports and in the space between said plug and hollow interior wall of said shell from contaminating said bearing including said interior annular wall and plug, forming an annular pressure chamber within said interior annular wall, and a water inlet to said pressure chamber supplying water to said chamber to provide a back pressure of water in said chamber, preventing the passage of stock into said chamber.

2. A paper stock refiner according to claim 1 wherein the pressure chamber includes
an annular plate extending about said shaft and forming a bottom wall of said pressure chamber,
means sealing said plate to the interior portion of said annular wall extending upwardly along said motor shaft above said bearing,
and means sealing said plate to said shaft, and said inlet to said pressure chamber leading through said plate.

3. A paper stock refiner in accordance with claim 2 wherein the means sealing said plate to the interior portion of said inner annular wall comprises

an upper scraper ring centering said plate within said interior annular wall,

an O-ring seal beneath said scraper ring and a collar spaced outwardly of said bearing and abutting the bottom of said plate and forming an annular drain passage for water leaking past said means sealing said plate to the interior portion of said inner wall.

4. A paper stock refiner in accordance with claim 3 wherein the water inlet passageway extends along the wall of said collar into communication with said passageway through said plate, and

wherein drain passageways are provided to drain water leaking past said inner sealing means to the interior of said housing.

5. A stock refiner according to claim 1

wherein said shell abuts and is sealed to said top wall of said end cap and

wherein means are provided for removably securing said shell to said end cap whereby said shell may be removed from the top of said housing.

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