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METHOD AND APPARATUS FOR REFINING PAPER STOCK

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Fig. 1.

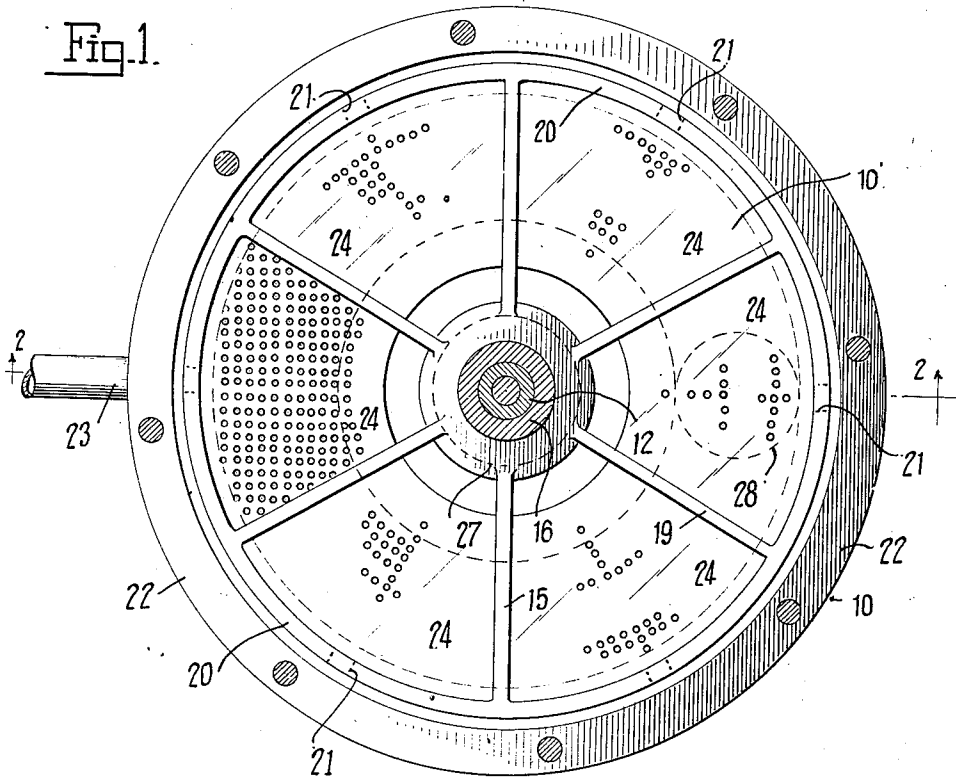
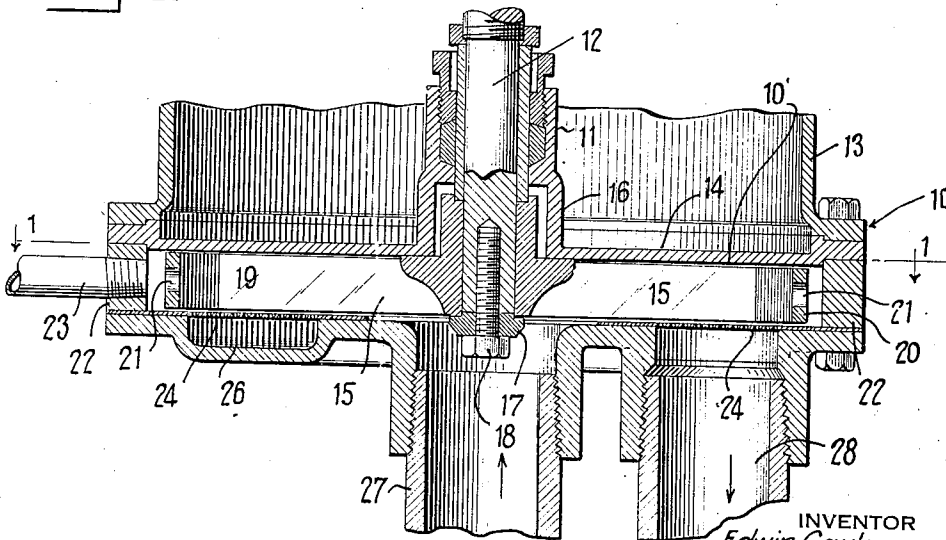


Fig. 2.



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METHOD AND APPARATUS FOR REFINING PAPER STOCK

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7 Claims. (Cl. 92—20)

This invention relates to methods and apparatus for refining paper stock.

This application is, as to all common subject matter, a continuation of my copending application, Serial No. 498,297, filed November 26, 1930.

In the preparation of paper stock for use in paper making machines it is necessary to de-fiber the solid material and to subject it to a severe rubbing action in order to obtain a fibrous stock which is satisfactory for paper manufacture. Various methods and machines are used in the paper making industry to accomplish these purposes, including beaters, Jordan engines, tube and ball mills and the like.

Crude and partially prepared paper stock usually contains heavy particles which may be of a metallic or granular nature, which, if allowed to remain in the stock, will form spots or blemishes of an objectionable nature in the paper or board which is subsequently prepared therefrom. The paper stock may also contain particles of pulp which are too large to be advantageously incorporated in the paper or board.

It is an object of the invention to provide a method and apparatus for treating paper stock which will accomplish an efficient de-fibering and refining operation, and at the same time will separate out heavy particles and large particles to an extent such that the finished stock will be in suitable condition for the manufacture of paper and board in the ordinary manner.

Varying conditions are encountered in the manufacture of different kinds and grades of paper, and while in some instances the method and machine to be described herein are suitable for performing a complete refining and separating action, in other instances, it may be desirable to use the said method and machine for a partial refining and separating action either subsequent to previous treatment, or prior to subsequent treatment. It is a further object of the invention, therefore, to provide a method and operation which may be easily and readily adjusted to varying conditions so that the desired qualities may be imparted to the stock being treated.

A preferred embodiment of the apparatus suitable for carrying out the invention is illustrated in the accompanying drawing, in which,

Figure 1 is a horizontal section on the line 1—1 of Figure 2, and

Figure 2 is a vertical section taken on the line 2—2 of Figure 1.

One of the features of my invention is the pro-

vision of a closed treating chamber having an intake opening through which the stock to be treated may be introduced, and having an outlet opening through which treated stock may be removed, but having a screen interposed between the inlet and outlet openings, the said screen having openings of restricted area such as to prevent the passage of material beyond a predetermined size. I also provide means to agitate the material within the closed chamber in order to secure the desired rubbing effect which is the essence of the refining action. Since the openings in the screen are of restricted size, there is a tendency for solid material to accumulate in the closed chamber, and consequently the proportion of solid material to liquid is higher in the said chamber than it is in the mixture entering the chamber or in the mixture leaving the chamber. This is of decided advantage, for the greater the concentration of the solid which is being subjected to agitation, the greater is the effectiveness of the rubbing action which takes place.

Referring to the drawing, the apparatus comprises a casing or frame 10 having a treating chamber 10' therein. On one side of the casing is a sleeve 11 for an impeller shaft 12 driven by any suitable means and supported in any suitable bearings. The casing may include an upper portion 13 (shown partly broken away) which may provide anchorage for bearing support for the impeller shaft as well as for a motive device. The sleeve 11 just referred to is formed on a solid plate 14.

The impeller 15 is secured through its hub 16 and by a washer 17 and cap bolt 18 to the lower end of the shaft. The impeller also includes the radial vanes 19 and an outer rim 20 provided with a plurality of perforations 21.

The casing 10 is provided with an outer circumferential wall 22 furnished with an outlet conduit 23 of restricted size, the size of the conduit being determined by its initial dimensions or by such regulatory devices as may be found desirable.

Disposed closely adjacent the impeller there is an annular foraminous plate or screen 24 having openings of such limited size as to exclude coarse particles which it is desired shall not pass the screen. The head 25 of the casing provides an annular trough 26 beneath the screen. An intake conduit 27 is provided at the center of the head for the inflow of stock to be treated and an outlet conduit 28 is provided in the outer part of the head along the trough 26 for the outflow of the refined material.

In operation, the stock to be treated, which is in the form of solid material in liquid suspension is introduced into the treating chamber through the intake opening 27, and is withdrawn through the screen 24, the trough 26 and the outlet 28. Due to the fact that the screen is interposed between the intake and outlet openings, solid material tends to accumulate in the treating chamber thus increasing the concentration of solid material therein. Except for the fact that the impeller is so arranged with respect to the screen that the entire area of the screen is being constantly swept by the impeller the screen would soon become clogged, but the arrangement is such that the screen perforations are constantly cleared.

The impeller, which is operated at a relatively rapid rate, as for example, at a rate such as to provide lineal velocities at the rim of the impeller in excess of 2,000 feet per minute, not only serves to clear the screen, but also produces a violent agitation of the concentrated material contained within the treating chamber. This induces a rubbing action between the individual fibers or particles of solid material, and also produces a rubbing action between the particles of solid material and the screen which, being perforated, has the effect of a roughened surface. Because of the relatively high concentration of solid material in the treating chamber, the refining and de-fibering action is very effective. If desired, the other interior surfaces of the treating chamber may also be roughened.

The relatively rapid rotation of the impeller also produces a centrifugal action in the treating chamber of the apparatus disclosed in the drawing, which causes the heavier particles, such as metal, earth, and the like, to be thrown outward with greater force than the remainder of the material, thus causing them to move toward the impeller rim 20 so that they can escape through the openings 21 and be removed from the apparatus through the conduit 23 which is of a size such as to withdraw only a small proportion of the material being treated.

Obviously, some fine material will pass out with the heavy materials but the flow of liquid through the conduit 23 for bearing away these rejected materials is so restricted relative to the outlet 28 that only a negligible quantity of fine material is wasted. Even this may be recovered by subsequent separation, preferably after further disintegration of the large particles traveling therewith.

It will be understood that the invention may be variously modified and embodied within the scope of the subjoined claims.

I claim as my invention.

1. Apparatus for refining paper stock, comprising, in combination, an impeller casing provided with a central axial inlet for the entering fluid mass, a rotatable impeller in said casing completely enclosed thereby and provided with vanes and a rim having openings of limited size for the outflow of heavy particles thrown outward by centrifugal force, an outer circumferential wall of said casing provided with a restricted opening, an end wall of said casing provided with an annular outflow trough intermediate the axis and the circumference, said trough having a relatively large outlet opening leading therefrom, and a screen plate disposed over said trough and closely adjacent the impeller vanes, for the purposes set forth.

2. Apparatus for refining paper stock, compris-

ing, in combination, a casing, an impeller having vanes rotatable within said casing, a rim on said impeller provided with restricted openings for escape of heavy particles under centrifugal action, and a screen plate disposed closely adjacent said impeller vanes for passing the liquid and smaller particles but retaining the larger particles, said impeller vanes sweeping said surface to disintegrate said large particles in part and move the remainder off said screen plate.

3. Apparatus for refining paper stock, comprising, in combination, a casing having substantially parallel upper and lower walls, one of said walls being provided with a screen, an inlet opening to said casing on one side of said screen, and an outlet opening from said casing on the other side of said screen, an impeller rotatable between said walls and having vanes to impart rotative movement to the liquid, said vanes extending substantially from said unscreened wall to said screened wall and arranged in close proximity to said screen and sweeping said screen in order to work the fibers lodged on said screen and at the same time to clear the openings in said screen.

4. Apparatus for refining paper stock, comprising, in combination, means providing a closed treating chamber having inlet and outlet openings through which stock is flowed continuously, a screen therebetween having openings of such restricted size as to cause an increase in concentration of solid material in said chamber over that of the stock flowing into and out of said chamber, and means moving in close proximity to said screen for agitating the contents of said chamber and for clearing the openings of said screen to permit treated material to pass through.

5. Apparatus for refining paper stock, comprising, in combination, means providing a closed treating chamber having inlet and outlet openings through which stock is flowed continuously, a screen therebetween having openings of such restricted size as to cause an increase in concentration of solid material in said chamber over that of the stock flowing into and out of said chamber, means moving in close proximity to said screen for agitating the contents of said chamber and for clearing the openings of said screen to permit treated material to pass through, and means to withdraw a restricted quantity of unscreened material from said chamber.

6. Method of refining paper stock which comprises, flowing stock consisting of fiber suspended in water into a treating chamber having a plurality of outlet openings of such restricted size as to cause said openings to become plugged with fibers and also to cause an increase in the concentration of fiber contained in said chamber, and agitating the contents of said chamber by impelling a substantially rigid member at high speed in such manner that an edge of said rigid member moves across said openings in close proximity thereto, thereby crushing and bruising the fibers lodged in said openings while at the same time clearing said outlet openings so as to permit treated stock to pass through.

7. Method of refining paper stock which comprises depositing fibers on a perforated plate in which the perforations are of such restricted size that the fibers tend to accumulate and plug the said perforations, and impelling a substantially rigid member at high speed across said plate in close proximity thereto, whereby said rigid member crushes and grinds said accumulated fibers against said plate.

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