

Feb. 28, 1961

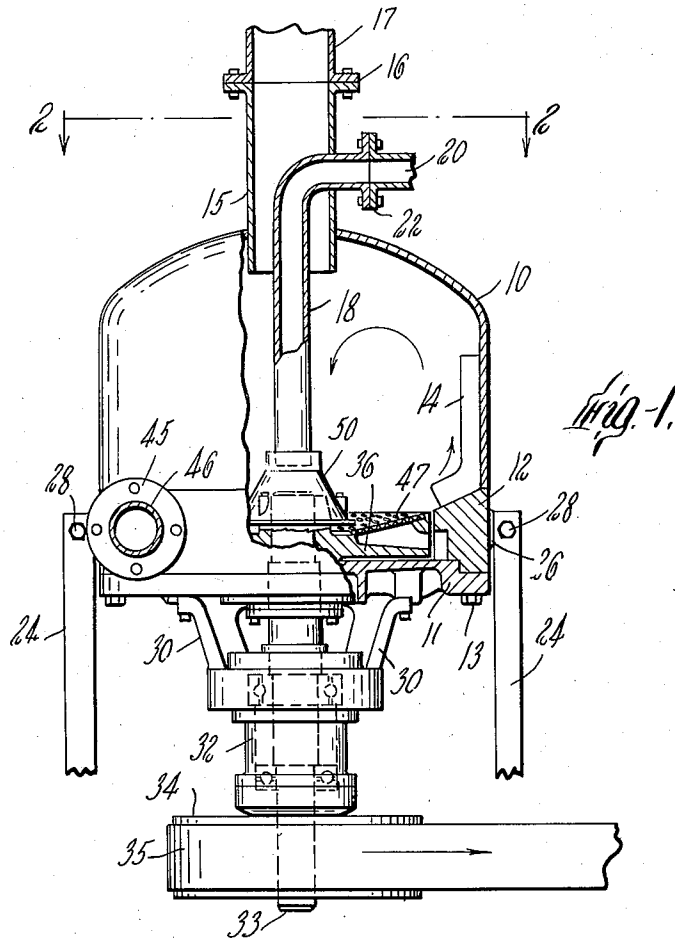
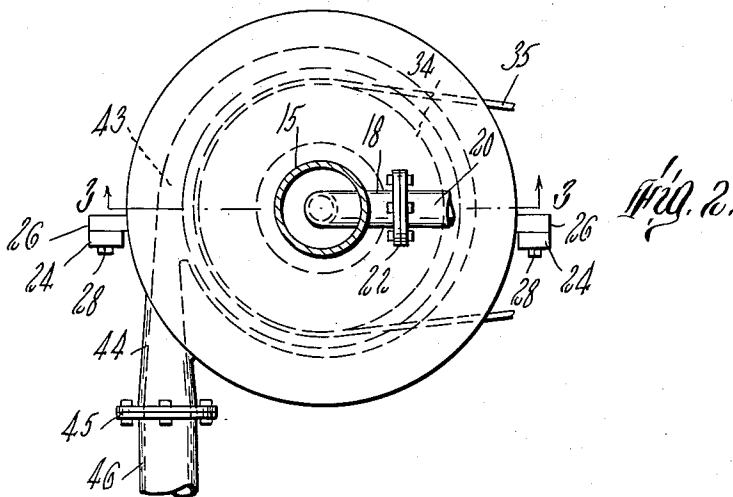
J. P. RICH

2,973,153

PULPER

Filed May 16, 1958

2 Sheets-Sheet 1



**Feb. 28, 1961**

J. P. RICH

**2,973,153**

PULPER

Filed May 16, 1958

2 Sheets-Sheet 2

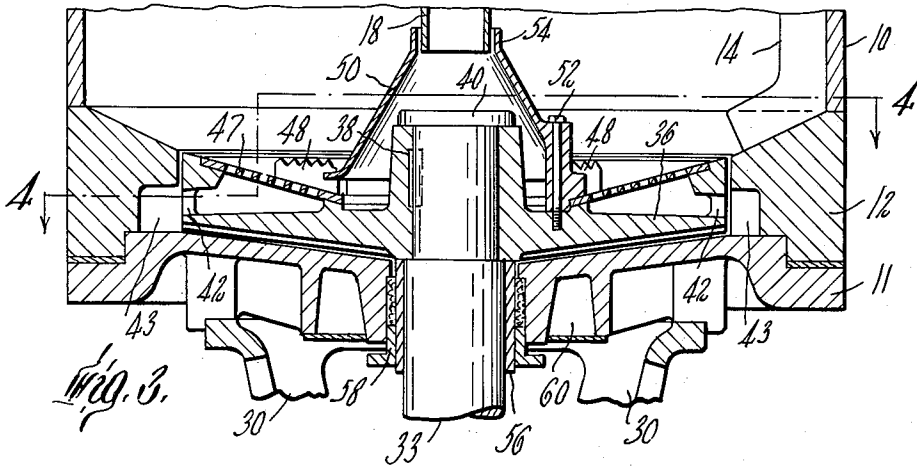
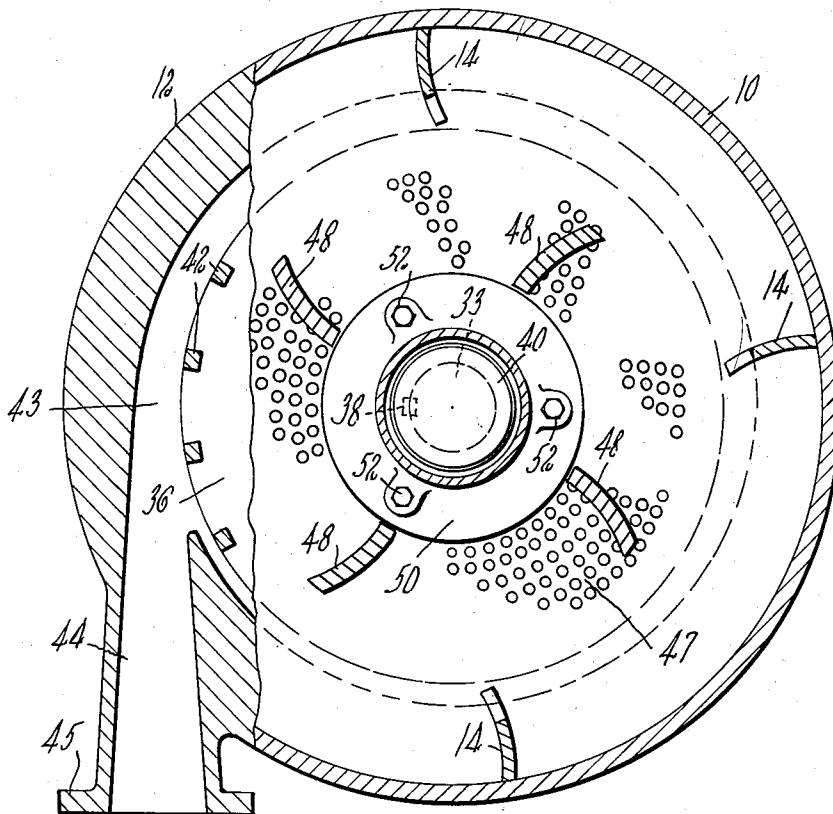


Fig. 4.

1

2,973,153

PULPER

John P. Rich, Nashua, N.H., assignor to Improved Machinery Inc., Nashua, N.H., a corporation of Maine

Filed May 16, 1958, Ser. No. 735,752

4 Claims. (Cl. 241—46)

The present invention relates to apparatus for disintegrating and fiberizing paper pulp stock materials and more particularly to apparatus, of a type commonly called pulp beaters, which include a rotor structure adapted to act upon the pulp stock in a refining process.

There is considerable current interest in continuous pulping systems which are utilized to obtain a higher yield of fiber. In such systems, it is frequently desirable that the complete removal of lignin in the high temperature, pressurized chemical pulping stage be compromised to a certain extent in order to achieve a higher quantity of usable fiber, mechanical processes being thereafter employed to complete the pulping process. However, there arises a problem in such treatments in that the stock requires careful subsequent treatment because of the presence of partially reacted but unextracted lignin which tends to rebind the fibers if the temperature of the pulp be allowed to drop significantly. Under such circumstances it is hence essential to maintain the stock at high temperatures and pressure until the completion of the mechanical pulping step.

Conventionally, the beater stage wherein the stock is mechanically pulped follows the chemical pulping stage. In the beater unit the pulp is operated on by mechanical equipment and when the pulp is sufficiently refined the resulting fibers are passed through a screening medium to the next stage of the paper manufacture. As set forth above, where the beater is operated in conjunction with a continuous pulping system it is necessary that it be capable of operating under pressure and that the process be carefully controlled where maximum fiber yield is desired so that the detrimental effects due to the presence of lignin in the mechanical pulping stage are minimized.

In conventional beating structures a rotatable element is provided which is equipped with vanes or ribs which work against the pulp stock contained in the apparatus. The resulting mechanical action and violent agitation acts to disintegrate the pulp stock and produces a sufficient defiberization for subsequent screening and bleaching.

In the manufacture of most papers it is further necessary to reduce the fibers at least in part to fibrils, as by a refiner such as a beater. Fibrating or beating serves to rupture the thin outer wall of the pulp fiber and to fray the thin thread like elements exposed, thus producing fibrils. The fibrils, being of much smaller diameter than the untreated fibers, are more flexible and capable of matting together. This permits the establishment of more points of contact between fibers which makes for paper of greater strength. As the beating proceeds the mat of fibrils formed is much more dense than one formed from unbeaten pulp, and water passes at a much slower rate therethrough. This property is of importance in controlling properties of paper, such as tensile and bursting strength, folding endurance, density, stiffness and transparency. However, the increased tendency of refined stock to mat is particularly troublesome under the conditions of the pressure beating process where a screen-

2

ing medium is utilized to properly filter the treated stock and this tendency is accentuated when lignin is present in the stock being beaten.

Accordingly, a principal object of the present invention is to provide an improved type of beater suitable for use in a continuous pulping system.

Another object of the invention is to provide an improved beater structure including novel means for introduction of the dilution water.

Still another object of the invention is to provide an improved type of defibering apparatus capable of operating under substantial pressures.

The preferred embodiment includes a tank which is suitable to be operated under relatively high pressures, say in the order of 200 p.s.i. Pulp stock and dilution water at appropriate temperatures are introduced into the tank through centrally located conduits. The water is deposited on a rotating screen structure in a preferential manner, and is discharged radially outward so as to clear the screen and to prevent plugging such that the screening of the desired fibers is accelerated. Also mounted on the rotating structure are a plurality of beater elements such as toothed breaker members which act to disintegrate and refine the stock which is forced against them. When sufficiently refined, the material is passed through the screen and is moved by a rotating vane structure into a discharge conduit.

Preferably, the bottom of the pressure vessel is conical. Baffles on the walls of the container are utilized to deflect the pulp sufficiently to prevent rotation of a mass of stock adjacent the periphery of the vessel. Thus, the pulp enters downwardly and is moved outwardly across the breaker members such that a violent disintegrating action results. This movement of stock is in the same direction generally as the flow of the dilution water across the screen. The beater structure is suitable for use in a high flow rate system and enables a reduction of the power requirements of the system. Due to the ability to operate under elevated temperature and pressure and with the provision of improved screen cleaning means the beater is especially well adapted for a variety of uses.

Other features, objects and advantages of the invention will be apparent as the following description of the preferred embodiment, in conjunction with the drawings, progresses.

In the drawings:

Fig. 1 is a view, in partial section, of the defibering apparatus of the preferred embodiment of the invention;

Fig. 2 is a sectional view along the line 2—2 of Fig. 1 showing a top view of the apparatus;

Fig. 3 is a sectional view along the line 3—3 of Fig. 2; and

Fig. 4 is a sectional view along the line 4—4 of Fig. 3.

With reference to Fig. 1, the apparatus includes a tank which is constructed to withstand pressures in excess of 200 p.s.i. The tank includes an upper pressure vessel shell 10, a base plate 11 and a discharge casing 12 which is interposed between the shell and the base plate. The shell is welded to the discharge casing and the base plate is secured to the casing by means of bolts 13. Positioned within the shell 10 are a plurality of baffles 14 which are adapted to deflect stock inward, thus improving the circulation therein.

Pulp stock is introduced to the tank through the connection 15 which is connected by means of bolted flanges 16 to a pulp stock line 17. The pulp entering the beater in a continuous pulping system is maintained under pressures in the order of 200 p.s.i. and at a temperature of approximately 400° F. Appropriately heated dilution water is introduced into the tank through conduit 18 which is connected to water line 20 by means of similar bolted flanges 22. Both of these lines preferably enter

the tank in the upper portion thereof. The dilution water inlet 18 is brought through the wall of the stock inlet 15 and turns a 90° angle such that it extends down into the tank concentrically with the stock inlet.

The tank itself is supported by a plurality of struts 24 which are secured to flanges 26 on the discharge casing 12 by means of bolts 28.

Secured to the base 11 of the tank by means of arms 30 is a thrust bearing housing 32 which supports a vertically mounted rotatable shaft 33. The shaft is driven by any suitable means, such as a pulley 34 and a belt 35 connected to a suitable source of power (not shown). The shaft extends into the tank and a plurality of elements are mounted on the shaft within the tank. These elements and their interrelationship may be best understood with reference to Figs. 3 and 4. These elements include a vane structure 36 which is secured to the shaft 34 at the upper end thereof by means of key 38 and cooperating keyways. A cap 40 is secured to the top of the shaft and is positioned over the joint between the shaft and vane structure as a protective medium. The vane structure has a plurality of radially extending vane members 42 which are adapted to move refined stock outwardly into the passageway 43 formed in the discharge casing 12. The passageway 43 is formed about the vane structure and provides a conduit for the removal of refined fibers. It gradually enlarges to a terminal portion 44 which has a flange 45 suitable for connection to a discharge line 46.

Mounted on the vane structure in a position above the clearing vanes 42 is a screen 47 having a mesh sized to pass suitably refined fibers. This screen member is preferably a disc shaped plate, formed into a cone such that the screen surface slopes upward from the central portion outward towards its periphery. The screen is secured at its inner and outer edges on the vane structure by appropriate means, such as screws.

Mounted on the screen structure 47 are plurality of breaker members 48 which include jagged tooth-like upper surfaces. These surfaces are designed to be rotatably driven in a manner to work and otherwise agitate the fibers of the stock contained in the tank such that they may be refined to a condition suitable for the subsequent stage in the paper making operation.

In addition to the breaker members 48, a diffuser cone 50 is positioned centrally of the rotating structure and is secured to the vane structure by means of three bolts 52. The cone has an open top portion which is adapted to receive the lower end of the dilution water inlet pipe 18. The top portion has a cylindrical portion 54 having an inside diameter slightly greater than the outside diameter of the inlet pipe 18. The two members are located coaxially and positioned such that a running clearance is assured. However, the magnitude of the clearance is such as to exclude stock from the interior of the cone. (Alternatively, if desired, the cone structure may be an integral portion of the water inlet conduit where the application of the beater apparatus permits.) These elements, the vane structure, the screen, the breaker members and the diffuser cone thus are all secured to the shaft 33 in the preferred embodiment and rotate as a unit.

The shaft has conventional bearing surfaces 56 with associated sealing gland members 58 and water chambers 60 associated therewith to provide adequate cooling and thus assure proper operation.

In operation the pulp stock is introduced into the pressure vessel through pipe 15. Dilution water is introduced through line 18 concurrently. The stock moves downward through the tank and is acted upon by the rotating elements and particularly by the breaker members 48. Circulation of the charge in the upper portions of the tank, as indicated generally by the arrows, is assured by the baffles 14 which deflect the stock and prevent rotation of it within the vessel. When the stock

has been sufficiently disintegrated the resulting fibers and fibrils pass through the holes in the screen 47 into the discharge chamber. In this chamber the stock is forced outwardly by the vanes 36 into the discharge channel 43 and eventually into the discharge conduit for transportation to the next stage of the manufacturing operation. The dilution water, introduced through pipe 18, is discharged on to the protective end cap 40 inside of the cone 50. The water is then discharged radially outwardly and is deflected downward by the cone structure onto the screen plate 47 in a manner such that the screen is always preferentially swept with water and any tendency for it to clog due to the pressure involved, the presence of lignin in the stock or the degree of refining undertaken is minimized.

It will thus be seen that the invention provides an improved pulp refining apparatus in which pulp may be introduced into the refining chamber under substantial pressure and acted thereon by mechanical pressure such that an excellent defiberizing process results. Dilution water is introduced in a direction coaxial with the rotating elements and is discharged in a radially outward direction up an inclined screen surface in the same direction as the pulp flow such that it sweeps across the screen plate in a preferential manner and maintains that structure clear of impediments.

Although a preferred embodiment of the invention has been shown and described, certain modifications thereof will be obvious to those skilled in the art, and it is not intended that the invention be limited to the preferred embodiment or to details thereof and deviations may be made therefrom within the spirit and scope of the invention as defined in the following claims.

I claim:

1. Apparatus for defibering paper pulp comprising a tank adapted to receive fluid pulp stock for defibering, a beater structure rotatably mounted for rotation in the bottom of said tank, said beater structure including a plurality of beater elements mounted thereon and a disc-shaped screen mounted adjacent the periphery of said beater structure for rotation therewith through which stock as refined by the beater elements is adapted to pass, a dilution water conduit for introducing dilution water into said tank onto the center of said beater structure such that said dilution water is discharged onto said screen for movement radially outward thereon on the upper surface thereof to clean said screen, and a deflector structure disposed adjacent said dilution water outlet in spaced relationship from said beater structure, said dilution water being discharged within said deflector structure and said deflector structure acting to deflect pulp outwardly onto said screen such that the dilution water may be directed onto said screen in a radially outward direction in preference to the pulp for maintaining the screen in suitably cleared condition.

2. Apparatus for defibering paper pulp adapted for association with a continuous pulping system comprising a substantially enclosed tank adapted to withstand pressures on the order of 200 p.s.i., conduit means for introducing fluid pulp stock in the upper portion of said tank, a horizontally disposed involute-shaped casing portion in the base of said tank and a defibered stock discharge conduit connected to said casing portion, a beater and screen structure mounted for rotation in a substantially horizontal plane in the base of said tank, said beater structure including a vane structure positioned within said casing portion and adapted to co-act therewith for assisting the discharge of refined fibers from said tank, a disc-shaped screen plate mounted above the vane structure and adjacent the periphery of said beater structure and a plurality of beater elements mounted on said screen plate for refining the pulp in a defibering action to a size sufficiently small to pass through said screen, through said volute casing and out said discharge conduit, dilution water conduit means mounted coaxially with said stock conduit

5

means for introducing dilution water into said tank onto the center of said beater structure such that said dilution water is discharged onto said screen plate for movement radially outward thereon on the upper surface thereof to clean said screen plate, and a hollow cone-shaped structure disposed adjacent the dilution water conduit in spaced relationship from said beater structure, such that said dilution water is discharged within said cone structure and said cone structure being adapted to deflect pulp outwardly from the center of said beater structure such that the dilution of water may be directed onto said screen plate in a radially outward direction in preference to the pulp for maintaining the screen plate in suitably cleared condition.

3. Apparatus for defibering paper pulp adapted for association with a continuous pulping system comprising a substantially enclosed tank adapted to withstand pressures on the order of 200 p.s.i., an involute-shaped casing portion in the base of said tank and a defibered stock conduit connected to said casing portion for introducing fluid pulp stock, a beater and screen structure mounted for rotation in a substantially horizontal plane adjacent the base of said tank, said beater structure including a vane structure positioned within said casing portion and adapted to coact therewith for assisting the discharge of refined fibers from said tank, a disc-shaped screening medium mounted above the vane structure and adjacent the periphery of said beater structure and a plurality of beater elements mounted on the screening medium interiorly of the periphery thereof, means for introducing pulp stock into said tank, means for introducing dilution water into said tank onto the center portion of said beater structure such that said dilution water is

6

discharged onto said screening medium for movement radially outward thereon to clean said screening medium and a cone-shaped structure disposed adjacent the dilution water outlet and in spaced relationship from said beater structure such that said dilution water is discharged within said cone structure, and said cone structure being adapted to deflect pulp outwardly from the center of said beater structure such that the dilution water may be directed onto said screening medium in a radially outward direction in preference to the pulp for clearing the screening medium, said beating elements adapted to refine said pulp in a defibering action so that the defibered pulp may be passed through said screen into said casing for discharge from said tank.

4. The pulp beater as claimed in claim 1 wherein said deflector structure is mounted on said beater structure for rotation therewith and said dilution water conduit extends into said deflector structure, a running clearance being provided between said conduit and said deflector structure.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|           |          |                |
|-----------|----------|----------------|
| 1,207,069 | Park     | Dec. 5, 1916   |
| 1,675,612 | Laird    | July 3, 1928   |
| 2,506,882 | Lipscomb | May 9, 1950    |
| 2,592,215 | Wandel   | Apr. 8, 1952   |
| 2,641,453 | Teale    | June 9, 1953   |
| 2,648,261 | Chaplin  | Aug. 11, 1953  |
| 2,674,927 | Wicksell | Apr. 13, 1954  |
| 2,824,702 | Lee      | Feb. 25, 1958  |
| 2,852,199 | Holzer   | Sept. 16, 1958 |