Nov. 16, 1965 J. C. F. C. RICHTER 3,218,040

MIXING APPARATUS FOR THE MIXING OF A BLEACHING AGENT INTO CELLULOSIC PULP

Filed Aug. 10, 1964 2 Sheets-Sheet 1

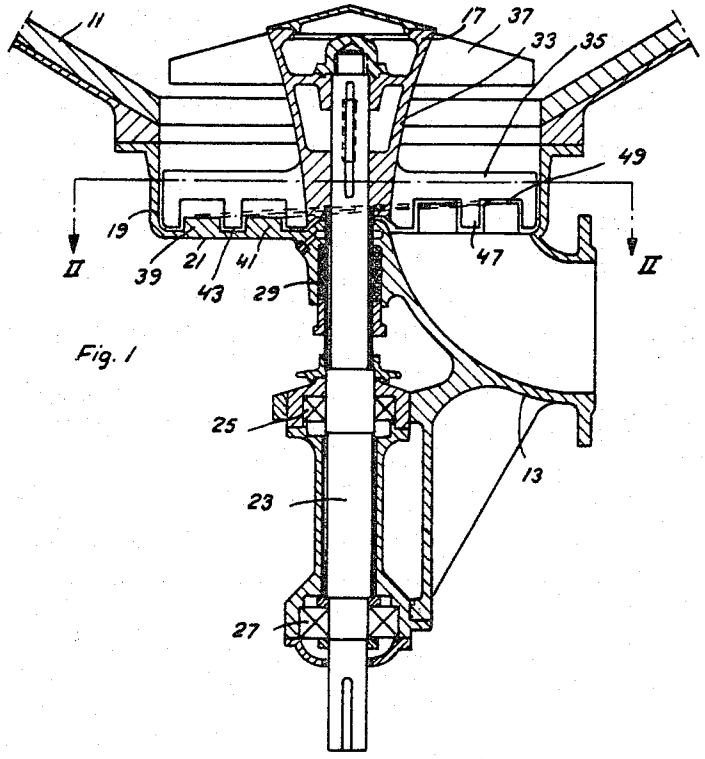


Fig. 1

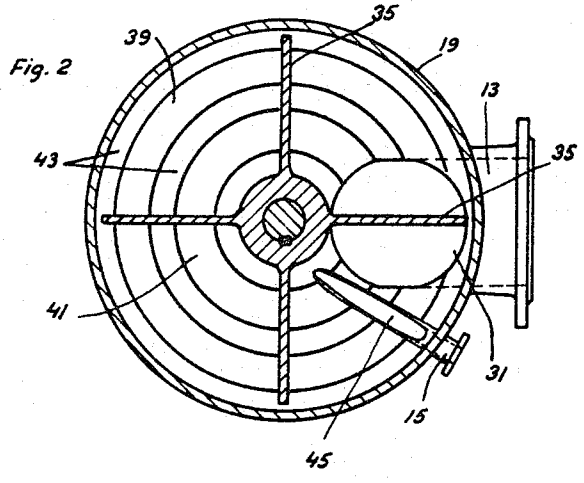


Fig. 2

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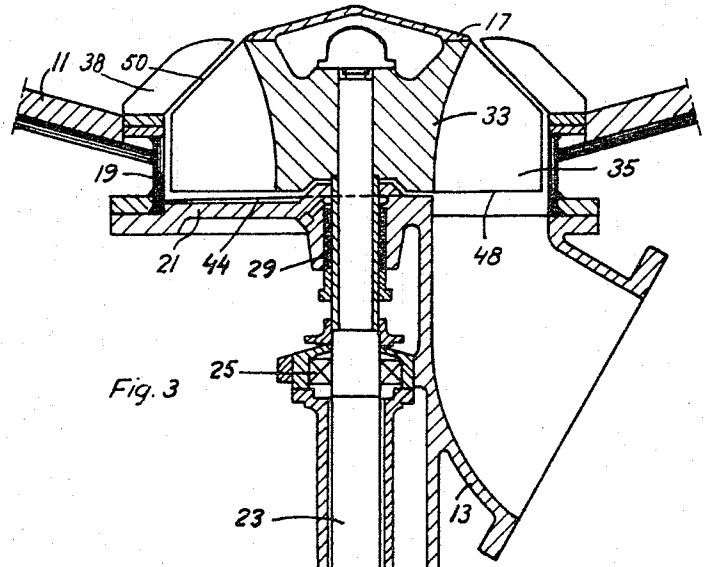


Fig. 3

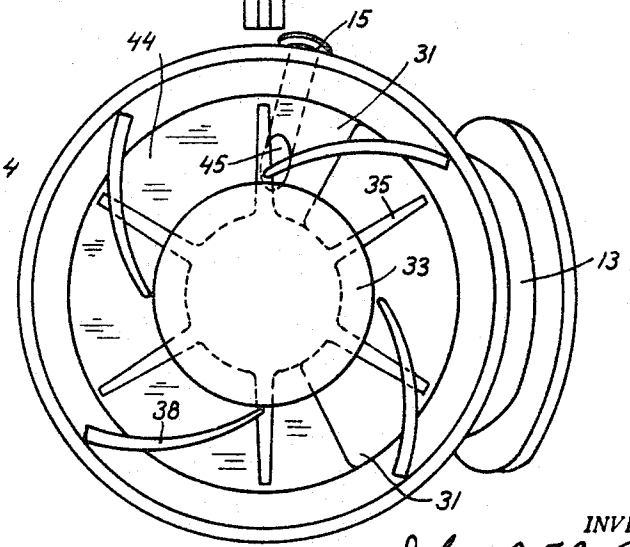


Fig. 4

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# MIXING APPARATUS FOR THE MIXING OF A BLEACHING AGENT INTO CELLULOSIC PULP

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8 Claims. (Cl. 259—23)

The present invention relates to an apparatus for mixing a bleaching agent into cellulosic pulp, particularly high-consistency pulp having a dry content of, e.g., 8 to 20%. The mixing apparatus of the invention is of the type comprising a casing with an agitating member enclosed therein and provided with vanes or the like, a stationary, radially distributed inlet for the bleaching agent being located near the agitating member.

The principal object of the invention is to provide an apparatus for obtaining a uniform mixture of bleaching agent and pulp. A more specific object of the invention is to provide means for mixing by distributing the bleaching agent in a column of pulp fed through the casing, along a continuous helical surface or path. Other objects will also be hereinafter apparent.

Broadly stated, the objects of the invention are realized by the provision of an apparatus which comprises a casing, agitating means including a rotatable shaft with mixing vanes mounted thereon and positioned within the casing, a stationary, radially positioned inlet for supplying bleaching agent to the casing located adjacent the agitating means, the casing including an end wall transverse to the shaft and having an opening therein for supply of pulp to the casing, the end wall forming a helical surface which extends substantially a complete revolution around the shaft of the agitating means, and a supply conduit connected to the end wall eccentrically to the shaft and communicating with the end wall opening, the mixing vanes being positioned to sweep over the opening and carry pulp supplied therethrough in a circular path along the helical surface formed by the end wall whereby bleaching agent from the inlet is distributed into the pulp and the latter is advanced axially.

The invention is more fully described below with reference to the accompanying drawings wherein:

FIGURE 1 is a vertical cross-sectional view of a preferred embodiment of the mixing apparatus;

FIGURE 2 is a horizontal cross-sectional view taken along the line II—II in FIGURE 1; and

FIGURES 3 and 4 are corresponding sectional views of a modified embodiment.

Referring to FIGURES 1 and 2, the mixing apparatus of the invention is placed at the bottom **11** of a bleach tower (shown in part only) to which cellulosic pulp is supplied through a conduit **13**. A conventional bleaching agent meant to react with the pulp in the tower is supplied through a conduit **15** (FIGURE 2). In order to obtain uniform bleaching, it is important that the bleaching agent be evenly distributed into the pulp before it enters the tower, because usually no further mixing takes place in the tower.

The mixing apparatus comprises a rotary agitating member **17** and a casing enclosing the same and constituting a cylindrical shell **19** which at its upper part merges into the conical bottom part **11** of the bleach tower. An end wall **21** forms the bottom of the casing. In the upward direction, the casing is in completely open communication with the bleach tower.

The agitating member **17** is attached to a vertical shaft **23** coaxial to the cylindrical shell **19** of the casing and



journalled in bearings **25**, **27**. The shaft extends through the end wall **21** of the casing and is sealed thereto by means of a stuffing box **29**. The pulp supply conduit **13** forms a 90° tube bend which directs the supplied pulp in an essentially straight upward direction, i.e. parallel to the shaft **23** of the agitating member. The tube connection **13** is located laterally of shaft **23** and forms an orifice **31** of approximately circular configuration which in the radial direction takes up essentially the entire space available between the cylindrical shell **19** and the stuffing box **29**.

The agitating members **17** comprises a hub **33** attached to the upper end of the shaft **23**, a lower series of vanes or blades **35** and an upper series of vanes or blades **37**. Preferably, the vanes **35** are set vertically and in radial planes, whereas the vanes **37** may be inclined or twisted so that they have a certain advancing action upon the pulp in addition to agitating the same.

At its upper side, the end wall **21** is provided with concentric annular ledges **39**, **41** of a rectangular cross-section rising above the plane bottom surface **43** of the end wall. These ledges have their minimum height at one side of the orifice **31** and rise gradually so that they reach their maximum height at their open ends near the opposite side of the orifice **31**. Thus, they form inclined planes constituting somewhat less than one complete revolution of a helical surface having the shaft of the agitating member as its axis and a horizontal line at right angles thereto as its generatrix.

The conduit **15** for the supply of the bleaching agent is connected to an outlet nozzle **45** which is approximately radially directed and which is located in the end wall **21** near that edge of the orifice **31** where the ledges **39**, **41** have their minimum height. The nozzle **45** extends from the cylindrical shell **19** as far as possiible towards the center and its orifice or outlet aperture is arranged to discharge the bleaching agent in a proportion increasing with the distance from the shaft in order thereby to distribute the bleaching agent evenly over the cross-sectional area of the pulp column moving upwardly in the bleach tower.

The vanes of the agitating member are provided in their lower edges with square projections or dents **47** and intermediate recesses **49**. The projections **47** extend between the ledges **39**, **41** of the end wall of the casing and move closely to its plane surface **43**. The recesses **49** run at a varying distance from and above the upper helical surfaces of the ledges.

In operation, the pulp rising through the orifice **31** is deviated into a circular path by the vanes **35** of the rotary member, the bleaching agent being added to the pulp as the same passes the nozzle **45**. During its continued circular movement, the pulp slides upon the evenly rising ledges **39**, **41** and is thereby advanced axially upwards, so that when the vanes **35** move above the orifice **31** anew, they will catch a new batch of the pulp. During each revolution of the agitating member, a portion of the pulp will be circulated in sliding contact with the plane parts **43** of the end wall of the casing and will not be advanced axially. Therefore, a displacement in the axial direction will take place between different portions of pulp supplied simultaneously through the orifice **31**. However, due to mingling above the orifice **31**, such pulp as has not been axially advanced during its first circular run, will sooner or later be brought above the inclined planes of the ledges and advanced upwardly, too.

The modification shown in FIGURES 3 and 4 corresponds closely to the embodiment just described, the same reference numerals being used for corresponding details. The end wall **21** of the casing is made plane and without ledges and, therefore, forms almost a complete turn of a helical surface **44** extending between the sides

of the inlet orifice 31, which in this case takes the shape of a sector of an annulus. The lower edges 48 of the vanes 35 are straight and reach down to the helical surface 44 of the end wall merely at the highest part thereof, i.e., immediately before the vanes sweep over the orifice 31. The bleaching agent supplied through the nozzle 45 (here located in advance of the pulp inlet 31, counted in the direction of rotation) will be distributed over a continuous helical surface in the pulp column rising vertically upwards through the casing 19. The mixing between layers on opposite sides of the helical surface is effected by a series of curved blades 38 which are attached to the bottom 11 of the bleach tower and which extend tangentially and radially inwards, their lower edge being located closely to the surface described by the upper edges 50 of the rotary vanes 35.

It will be appreciated that various modifications may be made in the invention described above. For example, the mixing apparatus of the invention may also be designed as a separate unit connected to the bleach tower by a tube conduit. Additionally, if desired, the mixing apparatus may be arranged with its shaft extending horizontally. Other modifications are also contemplated as coming within the scope of the invention as defined in the claims appended hereto wherein:

I claim:

1. Apparatus for mixing bleaching agent into cellulosic pulp, particularly pulp of high consistency, which comprises a casing, agitating means including a rotatable shaft with mixing vanes mounted thereon and positioned within said casing, a stationary, radially positioned inlet for supplying bleaching agent to said casing located adjacent said agitating means, said casing including an end wall transverse to said shaft and having an opening therein for supply of pulp to said casing, said end wall having upon it a helical surface which extends substantially a complete revolution around the shaft of the agitating means, and a supply conduit connected to said end wall eccentrically to said shaft and communicating with said end wall opening, said mixing vanes being positioned to sweep over said opening and carry pulp supplied therethrough in a circular path along the helical surface formed upon the end wall whereby bleaching agent from said inlet is diestributed into said pulp and the latter is advanced axially.

2. Mixing apparatus according to claim 1, wherein said end wall is provided with a plane bottom surface portion with at least one concentric annular ledge having a helical upper surface projecting above said bottom surface portion.

3. Mixing apparatus according to claim 2, wherein said plane bottom surface portion has at least two concentric annular ledges and said vanes include projections which extend down between said ledges and run close to said plane bottom surface portion.

4. Mixing apparatus according to claim 1 including stationary blades fixed to said casing, wherein said stationary blades are arcuate and extend tangentially and radially toward the center of the casing.

5. In combination with a bleaching tower, a casing fixed to the bottom of said tower and in open communication therewith, said casing comprising (1) a vertical cylindrical shell which defines the lateral extent of said casing and is fixed at its upper end to the bottom of said tower, and (2) an end wall constituting the bottom of said casing and including an opening therein for the supply of pulp to said casing, said end wall having a plane surface with a series of annular ledges thereon of essentially rectangular cross-section projecting into said casing at a height varying from a minimum adjacent one side of said end wall opening to a maximum on the other side of said opening thereby forming inclined planes constituting almost a complete revolution of a helical surface having the shaft of the agitating member as its axis and a horizontal line at right angles thereto as its generatrix; mixing means within said casing, said means including a vertical rotatable shaft extending centrally through said end wall with mixing vanes fixed thereto and rotatable therewith within said casing; the bottom edges of said mixing vanes being provided with alternating recesses and projections, the latter extending between the ledges in said end wall and terminating close to the plane surface of said end wall; and means for adding bleaching agent to said casing and radially thereof at a point just beyond the opening in said end wall adjacent said vanes.

6. Apparatus according to claim 5 wherein said opening in the end wall for supply of pulp extends radially from a point adjacent said cylindrical shell to a point close to the center of said end wall.

7. Mixing apparatus according to claim 5 wherein said mixing means includes an upper and lower series of vanes, the lower vanes being mounted vertically in radial planes and the upper vanes being inclined so as to simultaneously advance and agitate the pulp.

8. In combination with a bleaching tower, a casing fixed to the bottom of said tower and in open communication therewith, said casing comprising (1) a vertical shell which defines the lateral extent of said casing and is joined at its upper edge to the bottom of said tower and (2) an end wall constituting the bottom of said casing and having an opening therein for the supply of pulp to said casing, said end wall having a plane surface so inclined as to form substantially one turn of a helical surface from one side of said opening to the other; mixing means within said casing, said means including a vertical rotatable shaft extending centrally through said end wall with mixing vanes fixed to said shaft and rotatable therewith within said casing, the lower edges of said vanes being straight and reaching down to said helical surface of the end wall only at the highest part thereof just prior to said opening; and means for adding bleaching agent to said casing and radially thereof at a point adjacent said vanes and just beyond the opening in said end wall.


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