Feb. 23, 1971 E. R. BURLING 3,564,631

PULP TREATING APPARATUS AND METHOD

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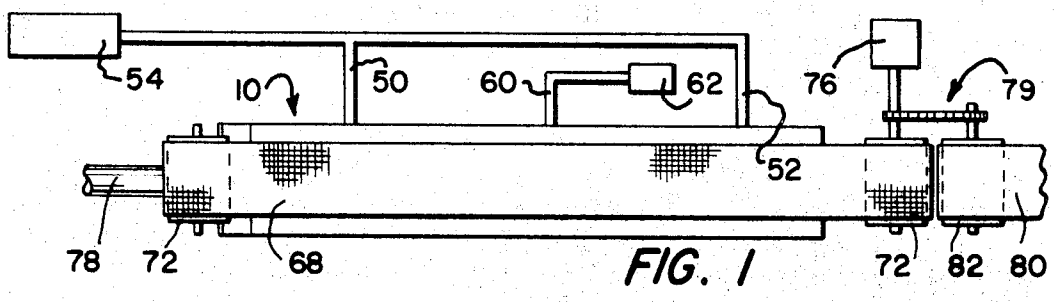

FIG. 1

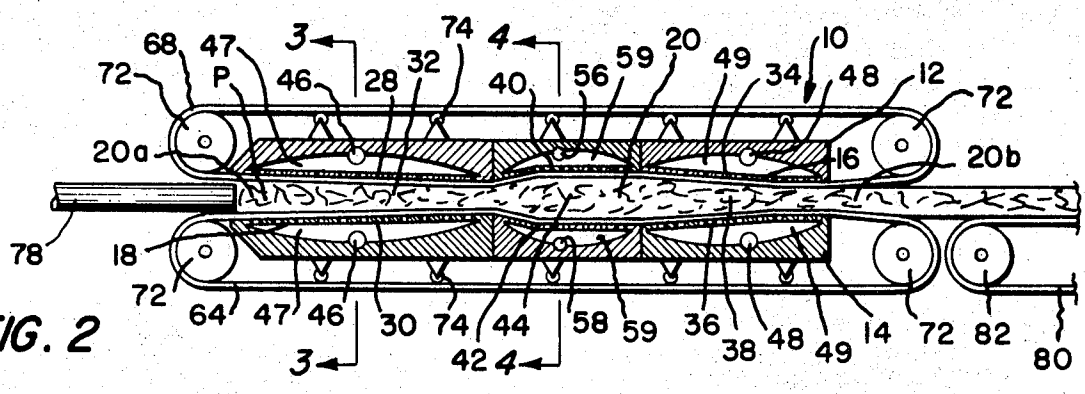

FIG. 2

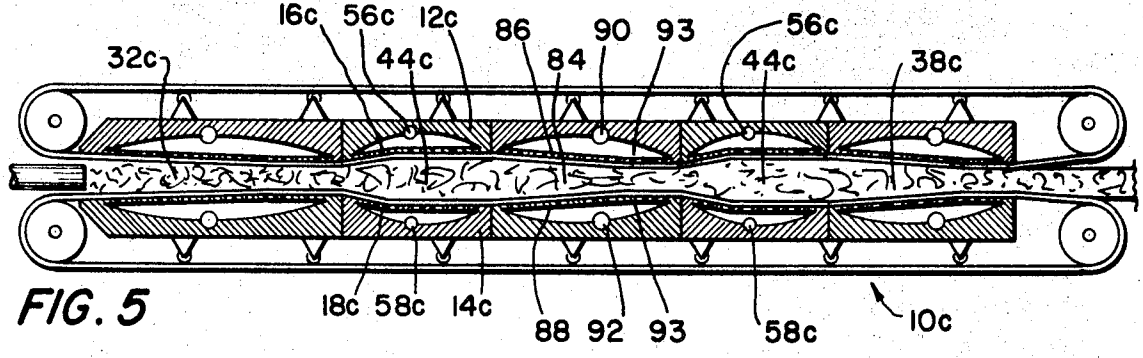

FIG. 5

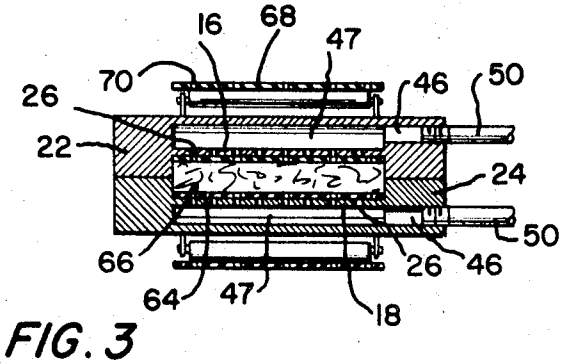

FIG. 3

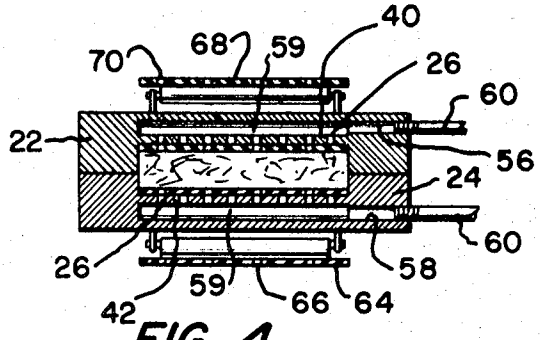

FIG. 4

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PULP TREATING APPARATUS AND METHOD

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U.S. Cl. 8—156 7 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for treating pulp, comprising a pair of platens having adjacent perforate walls spaced to form opposing sides of an elongated processing chamber and constructed to cause the chamber to include at least a pair of narrowing pressing zones interconnected by an intermediate widening expanding zone. A pair of perforate conveying belts are longitudinally driven through the chamber adjacent the perforate walls for transporting pulp therethrough; and conduits are connected to the pressing and expanding zones for, respectively, draining liquid therefrom and supplying dilution liquid thereto. Also a method for treating pulp through the employment of this apparatus.

BACKGROUND OF THE INVENTION

The present invention relates to pulp and paper making machinery and more specifically to the provision of a new and improved apparatus and method particularly adapted for treating pulp to replace a liquid in the pulp with another liquid.

During the manufacture of cellulose pulp, there are numerous instances in which a liquid in the pulp must be replaced with another liquid. The most common of these instances, of course, arises when liquor and contained spent chemicals must be removed from the pulp and replaced by cleaner dilution water. Conventionally, this replacement operation is generally performed by agitating the pulp in a slurry diluted to extremely low pulp consistency and then screening the pulp on a wire screen while it is being washed by additional dilution water. This conventional replacement operation, however, requires the employment of vast quantities of dilution liquid and is, for this reason, inefficient and disadvantageous.

SUMMARY OF THE INVENTION

The principal object of the present invention is to provide a new and improved apparatus which is particularly constructed and arranged to efficiently perform such a replacement operation without the necessity for the aforementioned vast quantities of dilution liquid.

Another object of the invention is to provide a new and improved method for performing such a replacement operation through the employment of this apparatus.

These objects, and those other objects and advantages of the invention which will become apparent from the following description taken in connection with the accompanying drawings, are attained by the provision of a new and improved pulp treating apparatus which generally considered may comprise a plurality of opposed platens cooperating to provide an elongated processing chamber which includes a pluarilty of narrowing pressing zones interconnected by an intermediate widening expanding zone. A conveying means is provided in the processing chamber for directing pulp longitudinally therethrough such that pulp is conveyed successively through a first of the pressing zones, the expanding zone, and the other of pressing zones. In addition, a means communicates with each of the pressing zones for draining liquid therefrom; and a means communicates with the expanding zone for injecting dilution liquid thereto.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the drawings:

FIG. 1 is a schematic view illustrating a pulp treating apparatus constructed in accordance with one embodiment of the invention;

FIG. 2 is an elevational sectional view of the pulp treating apparatus illustrated in FIG. 1;

FIG. 3 is an elevational sectional view taken on line 3—3 in FIG. 2, looking in the direction of the arrows;

FIG. 4 is an elevational sectional view taken on line 4—4 in FIG. 2, looking in the direction of the arrows; and

FIG. 5 is an elevational sectional view generally similar to FIG. 2, but illustrating a pulp treating apparatus constructed in accordance with a modified embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout the several views, FIGS. 1 through 5 illustrate apparatuses constructed in accordance with two embodiments of the invention which, although particularly adapted for pulp washing use, may be alternatively employed in many other situations in which a liquid in the pulp is to be replaced with another liquid. More specifically, FIGS. 1 through 4 illustrate a pulp treating apparatus, designated generally as **10**, comprising a pair of elongated press platens **12, 14** which are disposed in opposing relationship. The platens **12, 14** include adjacent spaced walls **16, 18**, respectively, which cooperate to form opposing sides of an elongated processing chamber **20** between the platens **12, 14**. The opposing lateral sides of this processing chamber **20** are, as illustrated in FIGS. 3 and 4, closed by abutting extensions **22, 24** of the platens **12, 14**.

The walls **16, 18** are perforated by apertures **26** throughout their lengths and are particularly constructed to cause the processinf chamber **20** to include a plurality of narrowing cross-section pressing zones interconnected by at least one intermediate widening cross-section expanding zone. More particularly, adjacent the inlet end **20***a* of the processing chamber **20**, the walls **16, 18** include opposing wall sections **28, 30** which converge as they extend longitudinally from such inlet end **20***a*. This convergence of the wall sections **28, 30**, as will be seen, forms the portion of the processing chamber **20** therebetween into a first vertically tapering pressing zone **32**. Similarly, adjacent the discharge or outlet end **20***b* of the processing chamber **20**, the walls **16, 18** include opposing wall sections **34, 36** which converge as they extend longitudinally towards the discharge end **20***b*. This convergence of the wall sections **34, 36**, again as will be seen, forms the portion of the processing chamber **20** therebetween into a second vertically tapering pressing zone **38**.

Intermediate the pressing zones **32, 38**, and immediately downstream from the pressing zone **32**, the walls **16, 18** include opposing wall sections **40, 42** which diverge as they extend longitudinally from the pressing chamber **32** and thence extend substantially parallel for a short distance before their junctures with the wall sections **34, 36**. This construction of the wall sections **40, 42** forms the portion of the processing chamber **20** therebetween into a vertically widening expanding zone **44** which, after attaining its maximum width, retains such width for a short distance prior to the commencement of the second pressing zone **38**. It will be seen that, due to this construction of the walls **16, 18**, pulp conveyed longitudinally through the processing chamber **20** from the inlet end **20***a* to the

discharge end **20***b* is directed successively through the first pressing zone **32**, an expanding zone **44**, and the second pressing zone **38** before its discharge from the processing chamber **20**.

The platens **12**, **14** each contain passage means **46** which communicate with the first pressing zone **32** through cavities **47** and the apertures **26** in the wall sections **28**, **30**. The platens **12**, **14** also each contain passage means **48** which communicates with the second pressing zone **38** through cavities **49** and the apertures **26** in the wall sections **34**, **36**. The passage means **46**, **48**, as illustrated in FIG. 1, each are connected by suitable conduits or pipes **50**, **52** to a conventional vacuum pump **54** which serves to create sufficient vacuum in the conduits **50**, **52** and cavities **47**, **49** to draw liquid expressed from pulp by the pressing zones **32**, **38** from the processing chamber **20**. Alternatively, however, the passage means **46**, **48** could be otherwise suitably connected to discharge the liquid expressed from the pulp in the pressing zones **32**, **38**.

The platens **12**, **14**, in addition, contain passage means **56**, **58**, respectively, which communicate with the expanding zone **44** through cavities **59** and the apertures **26** in the wall sections **40**, **42**. These passage means **56**, **58**, as illustrated in FIG. 1, are connected by suitable conduit means **60** to a source **62** of pressurized dilution liquid such that, during the operation of the apparatus **10**, pressurized dilution liquid is continuously supplied to the expanding zone **44** through the passage means **56**, **58**. The dilution liquid thus supplied to the expanding zone **44** will, of course, be washing water in those instances in which the apparatus **10** is employed as a pulp washer but in other applications of the apparatus **10** may be other suitable liquids such as, for example, water containing bleaching chemicals or organic liquids. Furthermore, although both of the passage means **56**, **58** are illustrated as supplying dilution liquid to the expanding zone **44**, it will be understood that alternatively only one of such passage means **56**, **58** could be so employed in which event the other thereof could be used for draining excess liquid from the expanding zone **44**.

A conveying apparatus is provided for conveying pulp longitudinally through the processing chamber **20** and hence successively through the first pressing zone **32**, the expanding zone **44**, and the second pressing zone **38**. As illustrated in FIGS. 1 through 4, this conveying apparatus comprises a first or lower endless conveying belt or web **64**, perforated throughout its length by apertures **66**, which is disposed longitudinally through the processing chamber **20** and entrained around the platen **14**. In addition, this conveying apparatus also includes, in the embodiment of the invention illustrated in FIGS. 1 through 4, a second or upper endless conveying belt or web **68**, perforated throughout its length by apertures **70**, which is disposed longitudinally through the processing chamber **20** and entrained around the platen **12**. The conveying belts **64**, **68** are supported at their end turns by end rollers **72** and intermediate their end turns are supported and guided by idler rollers **74** carried by their respective surrounded ones of the platens **12**, **14**. The conveying belts **64**, **68** are suitably tensioned such that during the operation of the apparatus **10**, as shown in FIG. 2, they engage the one of the walls **16**, **18** of the platen they surround and assume the relative converging, diverging, and reconverging configuration of the walls **16**, **18** which was aforedescribed. The conveying belts **64**, **68** are longitudinally driven to transport pulp supplied to the processing chamber **20** at the inlet end **20***a* through the processing chamber **20** and out the discharge end **20***b* thereof by a conventional driving means such as the electric motor **76**. The motor **76**, as illustrated in FIG. 1, is connected by suitable gearing, designated generally as **79**, to the end rollers **72** to rotate the latter at a controlled speed whereby the end rollers **72** serve as driving rollers for the conveying belts **64**, **68**.

In the operation of the pulp treating apparatus **10**, pulp having a fiber content preferably within the range of 1 to 5% is continuously supplied to the inlet end **20***a* of the processing chamber **20** by a suitable feed apparatus; and treated pulp discharged at the discharge end **20***b* of the processing chamber **20** is removed by a suitable discharge apparatus. As illustrated in FIGS. 1 and 2, the feed apparatus for the apparatus **10** comprises a feed conduit **78**, suitably connected to receive pulp from a source (not shown), which projects intermediate the conveying belts **64**, **68**. The discharge apparatus comprises a conventional endless conveying belt or web **80**, driven by the motor **76** through a driving roller **82**, disposed in horizontal alignment with the endless conveying belt **64**. It will be understood, however, that other feed and discharge apparatus could be alternatively employed for these purposes.

During the operation of the aforedescribed pulp treating apparatus **10**, the pulp supplied by the feed conduit **78** to the inlet end **20***a* of the processing chamber **20** forms a pulp mat which horizontally extends the width of the processing chamber **20** and vertically the distance between the conveying belts **64**, **68** at the location P it is fed thereto. The conveying belts **64**, **68** convey this pulp mat through the first pressing zone **32** where, due to the converging construction of the wall sections **28**, **30**, the mat is pressed between the platens **12**, **14** to extract liquid from the mat. The conveying belts **64**, **68** then convey the pressed mat to the expanding zone **44** where, due to the enlarged cross-section of the zone **44**, the mat quickly expands and attains a relatively porous condition which enables it to rapidly absorb dilution liquid supplied by the passage means **56**, **58**. The mat and its contained dilution liquid are thence transported by the conveying belts **64**, **68** to the second pressing zone **38** where the mat is repressed to extract a portion of its carried dilution liquid and thereafter discharged onto the conveying belt **80** which transports it to the succeeding stage of the paper making operation.

FIG. 5, wherein parts similar to those previously described with reference to the pulp treating apparatus **10** are designated by the reference character for their similar previously described part followed by the suffix *c*, illustrates a pulp treating apparatus **10***c* constructed in accordance with a modified embodiment of the invention. The pulp treating apparatus **10***c* differs from the aforedescribed pulp treating apparatus **10** only in that the pressing zones **32***c*, **38***c*, rather than being interconnected by only a single intermediate expanding zone, are interconnected by a pair of intermediate expanding zones **44***c* which are spaced by a pressing zone **84**. The pressing zone **84** is identical in construction to the aforedescribed pressing zones **32**, **38** and, hence, is vertically bounded by converging wall sections **86**, **88** of the walls **16***c*, **18***c*. The platens **12***c*, **14***c* include passage means **90**, **92** communicating through cavities **93** with the pressing zone **84** and connected in the manner shown in FIG. 1 to a suitable vacuum pump (not shown). The passage means **56***c*, **58***c* moreover, in this embodiment of the invention, may either be connected such that the same dilution liquid is supplied to the pulp mat in both expanding zones **44***c* or, alternatively, such that different dilution liquids are supplied in the expanding zones **44***c*.

The operation of this embodiment of the invention is believed to be apparent from the aforegoing description taken in connection with the accompanying drawings.

From the aforegoing it will be seen that I have provided a new and improved apparatus which, due to relatively high consistency of the pulp it treats and the manner in which the pulp is pressed and then released to absorb liquid, operates in a highly efficient manner. It will moreover be seen that this apparatus performs its pressing and releasing actions on the mat without either disrupting the mat or dislodging the component fibers from their relative positions.

From the aforegoing it will also be seen that I have provided a new and improved pulp treating method basically comprising the steps of introducing the pulp into

an elongated processing chamber having a plurality of narrowing pressing zones interconnected by an intermediate widening expanding zone, conveying the pulp longitudinally through this processing chamber to cause the pulp to pass alternately through the pressing and expanding zones, and introducing diluent liquid into the pulp during its passage through the expanding zone.

From the aforegoing it will be seen that I have provided new and improved means for accomplishing all of the objects and advantages of my invention. It will be understood, however, that, although I have illustrated and hereinbefore specifically described only two embodiments of my invention, the invention is not limited merely to these two embodiments but rather contemplates other embodiments and variations within the scope of the following claims.

Having thus described my invention, I claim:

1. An apparatus for treating pulp, comprising a plurality of platens having adjacent walls opposed in spaced relationship to bound opposite sides of a processing chamber therebetween; said processing chamber having an inlet end and a discharge end; said walls successively relatively converging, diverging and reconverging as they extend from the chamber inlet end towards the chamber discharge end whereby said processing chamber has portion defining successively a first transversely narrowing pressing zone, a transversely widening expanding zone and a second transversely narrowing pressing zone as it extends from its inlet end towards its discharge end; an endless porous conveying web extending longitudinally through said processing chamber adjacent each of said walls for directing pulp through said processing chamber whereby the pulp is conveyed successively through said first pressing zone, said expanding zone and said second pressing zone; said conveying webs being tensioned to have the relatively converging, diverging and reconverging relationship of said walls; first drainage conduit means connected to said processing chamber at said first pressing zone for discharging liquid pressed from pulp in said first pressing zone from said processing chamber; second drainage conduit means connected to said processing chamber at said second pressing zone for discharging liquid pressed from pulp in said second pressing zone from said processing chamber; and supply conduit means connected to said processing chamber for supplying dilution liquid to said processing chamber at said expanding zone said porous conveying webs permitting said discharge of liquid pressed from the pulp.

2. A pulp treating apparatus according to claim 1, further comprising the conduit means connected to said processing chamber at said expanding zone being connected to said expanding zone through at least one of said walls of said platens.

3. A pulp treating apparatus according to claim 1, further comprising the conduit means connected to said processing chamber at least at one of said pressing zones being connected to the pressing zone through at least one of said walls of said platens.

4. A pulp treating apparatus according to claim 1, further comprising said platen walls being perforate, and the conduit means connected to said processing chamber at said pressing and expanding zones being connected to said pressing and expanding zones, respectively, through said walls and said porous conveying webs.

5. A pulp treating apparatus according to claim 1, further comprising said platen walls relatively rediverging and again reconverging whereby said processing chamber includes a plurality of expanding zones, each intermediate and interconnecting a pair of pressing zones, and has a pressing zone at each of its inlet and discharge ends, and wherein conduit means is connected to said processing chamber at each of said pressing and expanding zones for draining liquid therefrom and supplying liquid thereto, respectively.

6. A pulp treating apparatus according to claim 1, further comprising said platen walls having perforate portions bounding said expanding zone, said supply conduit means being connected to said expanding zone through one of said walls and the thereadjacent porous conveying web, and means connected to said expanding zone through the other of said platen walls and the thereadjacent conveying web for draining liquid from said expanding zone.

7. A method of treating pulp containing liquid, comprising the steps of introducing the pulp to one end of a processing chamber bounded along opposite sides by platen walls which successively relatively converge, diverge and reconverge as they extend from said one end of the processing chamber towards the other end thereof; directing the introduced pulp through said processing chamber towards its said other end by endless porous conveying webs which extend adjacent each of said platen walls and which are tensioned to have the aforesaid relative converging, diverging and reconverging relationship of said platen walls, discharging the liquid pressed from the pulp by the relatively converging portions of said platen walls from the processing chamber through perforations in said platen walls separately from the liquid pressed from the pulp by the relatively reconverging portions of said platen walls whereby the first mentioned liquid is removed from the processing chamber prior to the pulp being directed along the relatively diverging portions of the platen walls; supplying dilution liquid to the pulp while the pulp is directed along the relatively diverging portions of the platen walls; and discharging the pulp from said other end of said processing chamber.

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U.S. Cl. X.R.

68—44, 204; 162—56, 60; 210—400