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PULP STOCK THICKENER

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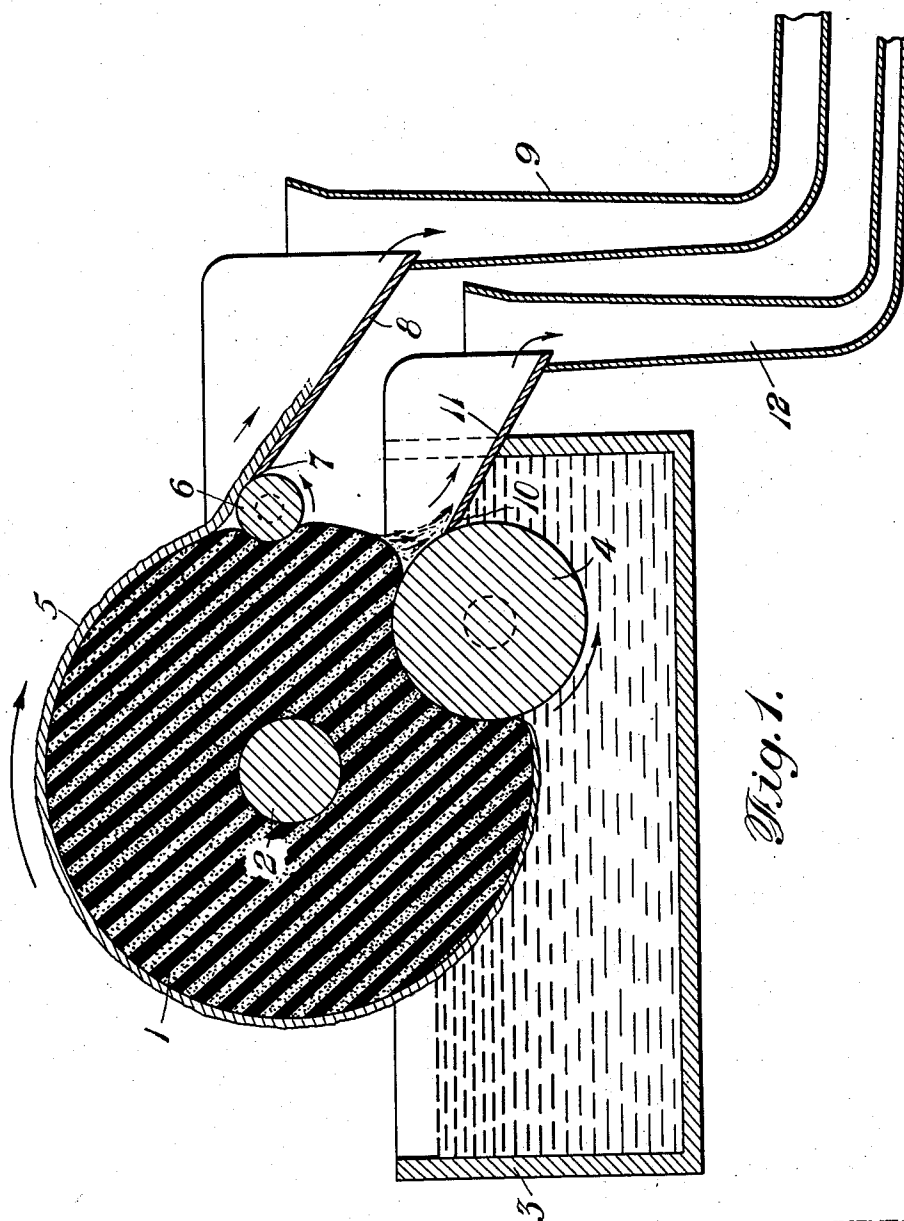


Fig. 1.

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PULP STOCK THICKENER

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This invention relates to apparatus for separating excess liquid from fibrous suspensions, and more particularly to apparatus for thickening liquid slurries of pulp stock.

In the manufacture of paper and many molded pulp articles, such as egg cartons, pie plates, and the like, it is customary to employ a pulp slurry comprising a dilute liquid suspension of pulp fibers as the pulp stock in suction molding operations to produce the pulp articles desired. Frequently, it is necessary to thicken the pulp slurry, by separating excess liquid from the pulp fibers, incident to various washing operations and changes in chemical treating agents, during the preparatory treatment of the pulp stock. A thickening treatment may also be employed in the recovery of waste pulp from the so-called "white liquor" or mill effluent.

Heretofore, the type of apparatus employed most frequently for thickening the pulp stock has been a foraminous suction roll mounted rotatably partially submerged in a pulp slurry tank and connected by suitable pipes to a suction pump. The application of suction to the roll causes wet pulp fibers to be extracted from the pulp slurry and deposits these fibers in a layer on the surface of the roll. This layer of pulp fibers is advanced continuously during rotation of the roll to a doctor blade or a brush type take-off roll mounted adjacent to an apron where the fibers are washed into a container by a suitable spray of water. The thickening apparatus known heretofore required complicated equipment which was expensive to install and operate.

An object of the present invention is to provide new and improved apparatus for thickening pulp stock.

Another object of the invention is to provide a simplified vacuumless apparatus for separating excess liquid from fibrous suspensions.

Still another object of the invention is to provide a simplified apparatus for thickening pulp stock and washing the pulp fibers therefrom without employing auxiliary spraying equipment.

Other objects and the nature and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawing, wherein:

The single figure is a schematic showing in vertical sectional view of a pulp stock thickening apparatus embodying the invention.

The apparatus illustrated includes a massive, cylindrical, spongy type roll 1 having a solid metallic core 2 journaled for rotation in the side walls of an open tank 3 containing pulp slurry. This pulp slurry may contain, for example, from about 1% to about 3% by weight of pulp fibers suspended in water. The roll 1 is mounted partially submerged in the pulp slurry, and during rotation of the roll successive portions thereof are advanced through the slurry for the purpose of absorbing the liquid therefrom.

The spongy roll 1 is composed of a suitable absorbent

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resilient material, such as sponge rubber. Either natural rubber in cellular form, or synthetic foamed rubbery materials may be used, such as polyurethane foam. In any event, the roll 1 must be durable, resilient, tough, and capable of absorbing a relatively large quantity of liquid. The roll 1 may be built around the core 2 by inserting the core into a large cylindrical body of sponge rubber, or by wrapping a thick sheet of sponge rubber around the core, or by securing a series of spongy pads to the periphery of the core.

A compression or squeeze roll 4 is journaled for rotation in the side walls of the tank 3, at approximately the upper level of the pulp slurry contained therein, and in compressing engagement with the spongy roll 1 along the entire length thereof. During rotation of the spongy roll 1 the squeeze roll 4 is rotated therewith, due to the frictional contact between these rolls. As the result of this motion, successive portions of the periphery of the spongy roll 1 are compressed as they enter the pulp slurry, and these portions are allowed to re-expand beneath the surface of the slurry, thereby sucking liquid from the slurry by a sponging action. The cellular structure of the spongy roll 1 should be sufficiently fine to cause the pulp fibers to be deposited in a thick layer 5 on the periphery of the roll 1, while the liquid extracted therefrom is sucked into the interior of this roll during re-expansion of the compressed portions thereof.

After the re-expanded portions of the periphery of the spongy roll 1 have advanced through an arc of about 270° beyond the squeeze roll 4, they are again compressed by a take-off roll 6 mounted rotatably in compressing contact with the roll 1 along the entire length thereof. The take-off roll 6 indents the spongy roll 1 sufficiently to squeeze a small portion of the water therefrom. The water expressed by the take-off roll 6 washes off the layer 5 of pulp fibers deposited on the periphery of the roll 1. A doctor blade 7 scrapes the wet pulp fibers from the take-off roll 6, from whence the pulp fibers slide down an inclined apron 8 into a suitable chest 9. The wet pulp stock discharged into the chest 9 may contain from about 50% to about 80% by weight of pulp fibers.

The successively compressed portions of the periphery of the spongy roll 1 are allowed to re-expand after they advance past the take-off roll 6, until they again reach the squeeze roll 4, which then compresses these portions to a much greater extent than did the roll 6, thereby expressing the remainder of the water from these portions of the roll 1. The water expressed by the squeeze roll 4 is removed therefrom by a doctor blade 10, and allowed to flow down an inclined apron 11 into a drain trough 12. At this point in the rotation of the roll 1 the sponging cycle of compression and expansion starts again.

The squeeze roll 4 and the take-off roll 6 are both made of a corrosion resistant, wear resistant, hard material, such as bronze or steel. The squeeze roll 4 is made considerably larger in diameter than is the take-off roll 6, in order to compress the spongy roll 1 to a greater extent. Driving means (not shown) may be operatively connected to the take-off roll 6 to impart rotation to the three rolls 1, 4 and 6.

It is evident that apparatus embodying the invention provides a very simple and effective means for thickening pulp stock. This apparatus eliminates the requirement of an investment in a vacuum pump, or the piping usually associated with a vacuum filter. Furthermore, the suction force which can be created by compression and expansion of the spongy roll is greater than can normally be obtained from a conventional screen covered cylinder roll, which is dependent upon a difference in the levels of the stock. Another important advantage of apparatus embodying

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the invention is the elimination of a water spray to wash the pulp fibers from the take-off roll. It is also contemplated that the simple construction of this apparatus may enable it to be made portable, thereby providing other practical advantages.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention, and therefore the invention is not limited to what is shown in the drawing and described in the specification, but only as indicated in the appended claims.

What is claimed is:

1. Apparatus for extracting excess liquid from dilute liquid suspensions of fibers, comprising a massive spongy roll composed of an absorbent resilient material mounted rotatably partially submerged in such a suspension, means for compressing successive portions of the periphery of the roll as they enter the suspension during rotation of the roll, which portions are allowed to re-expand beneath the surface of the suspension thereby extracting fibers from the liquid and depositing the fibers on the periphery of the roll, and take-off means mounted in partially compressive contact with said periphery for removing the deposited fibers from the roll after they have emerged from the suspension.

2. Apparatus for extracting excess liquid from dilute liquid suspension of fibers, comprising a massive spongy roll composed of an absorbent resilient material mounted rotatably partially submerged in such a suspension, a squeeze roll mounted rotatably in engagement with the spongy roll for compressing successive portions thereof as they enter the suspension, which portions are allowed to re-expand beneath the surface of the suspension thereby extracting fibers from the liquid and depositing the fibers on the periphery of the roll, and take-off means mounted in partially compressive contact with said periphery for removing the deposited fibers from the roll after they have emerged from the suspension.

3. Apparatus for extracting excess liquid from dilute liquid suspensions of fibers, comprising a massive spongy roll composed of an absorbent resilient material mounted rotatably partially submerged in such a suspension, a squeeze roll mounted rotatably in engagement with the spongy roll for compressing successive portions thereof as they enter the suspension during rotation of the roll, which portions are allowed to re-expand beneath the surface of the suspension thereby extracting fibers from the liquid and depositing the fibers on the periphery of the roll, and a take-off roll mounted rotatably in engagement with the spongy roll for removing the deposited fibers from the spongy roll after they have emerged from the suspension.

4. Apparatus for extracting excess liquid from dilute liquid suspensions of fibers, comprising a massive sponge movable through such a suspension, means for compressing successive portions of the sponge as they enter the suspension, which portions are allowed to re-expand beneath the surface of the suspension thereby extracting fibers from the liquid and depositing the fibers on the surface of the sponge, and take-off means mounted in partially compressive contact with said surface for removing the deposited fibers from the sponge after they have emerged from the suspension.

5. Apparatus for extracting excess liquid from dilute liquid suspensions of fibers, comprising a massive sponge movable through such a suspension, a squeeze roll mounted rotatably in engagement with the sponge for compressing successive portions thereof as they enter the suspension, which portions are allowed to re-expand beneath the surface of the suspension thereby extracting fibers from the liquid and depositing the fibers on the surface of the sponge, and take-off means mounted in partially compressive contact with said surface for removing the deposited fibers from the sponge after they have emerged from the suspension.

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6. Apparatus for extracting excess liquid from dilute liquid suspensions of fibers, comprising a massive sponge movable through such a suspension, a squeeze roll mounted rotatably in engagement with the sponge for compressing successive portions thereof as they enter the suspension, which portions are allowed to re-expand beneath the surface of the suspension thereby extracting fibers from the liquid and depositing the fibers on the sponge, and a take-off roll mounted rotatably in compressing engagement with the sponge for removing the deposited fibers from the sponge after they have emerged from the suspension.

7. Apparatus for separating excess liquid from dilute liquid fibrous suspensions, comprising a massive spongy roll composed of an absorbent resilient material mounted rotatably partially submerged in such a suspension, a squeeze roll mounted rotatably in compressing engagement with the spongy roll at approximately the upper level of the suspension for compressing successive portions of the periphery of the spongy roll as they enter the suspension during rotation of the roll, which portions are allowed to re-expand beneath the surface of the suspension thereby extracting fibers from the liquid and depositing the fibers on the spongy roll, and a take-off roll mounted in compressing engagement with the spongy roll above the upper level of the suspension, said take-off roll compressing the spongy roll sufficiently to express a small portion of the liquid absorbed therein to wash the deposited fibers from the periphery of the spongy roll.

8. The apparatus defined by claim 7, wherein the take-off roll is smaller in diameter than the squeeze roll, and these rolls are mounted approximately 270° apart on the periphery of the spongy roll.

9. Apparatus for thickening pulp stock, comprising a massive sponge rubber roll mounted rotatably partially submerged in a dilute water slurry of pulp stock, a squeeze roll mounted rotatably in compressing engagement with the sponge roll at approximately the upper level of the slurry for compressing successive portions of the periphery of the sponge roll as they enter the slurry during rotation of the roll, which portions are allowed to re-expand beneath the surface of the slurry thereby extracting pulp fibers from the water and depositing the fibers on the sponge roll, a take-off roll mounted in compressing engagement with the sponge roll above the upper level of the slurry, said take-off roll compressing the sponge roll sufficiently to express a small portion of the water absorbed therein to wash the deposited fibers from the periphery of the sponge roll, and a pair of doctor blades mounted adjacent to the squeeze roll and the take-off roll for removing excess water and wet pulp fibers, respectively, from these rolls.

10. The apparatus defined by claim 9, wherein the take-off roll is smaller in diameter than the squeeze roll, and these rolls are mounted approximately 270° apart on the periphery of the sponge roll.

11. A method of thickening a thin liquid slurry of fibrous pulp stock, comprising the steps of continuously advancing a massive sponge into such a slurry to immerse successive portions of the sponge therein, continuously compressing said portions of the sponge as they enter the slurry while permitting said portions to re-expand within the slurry, thereby soaking up liquid from the slurry in the interior of the sponge and depositing extracted pulp fibers on the surface of the sponge, advancing said portions of the sponge out of the slurry, and then removing the deposited fibers from the surface of the sponge.

12. A method of thickening a thin liquid slurry of fibrous pulp stock, comprising the steps of continuously advancing a massive sponge into such a slurry to immerse successive portions of the sponge therein, continuously compressing said portions of the sponge as they enter the slurry while permitting said portions to

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re-expand within the slurry, thereby soaking up liquid from the slurry in the interior of the sponge and depositing extracted pulp fibers on the surface of the sponge, advancing said portions of the sponge out of the slurry, and then partially compressing said portions of the sponge to express sufficient liquid from its interior to wash off the deposited fibers from its surface.

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