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METHOD AND APPARATUS FOR PRESSING MOLDED PULP ARTICLES ON THE MOLD

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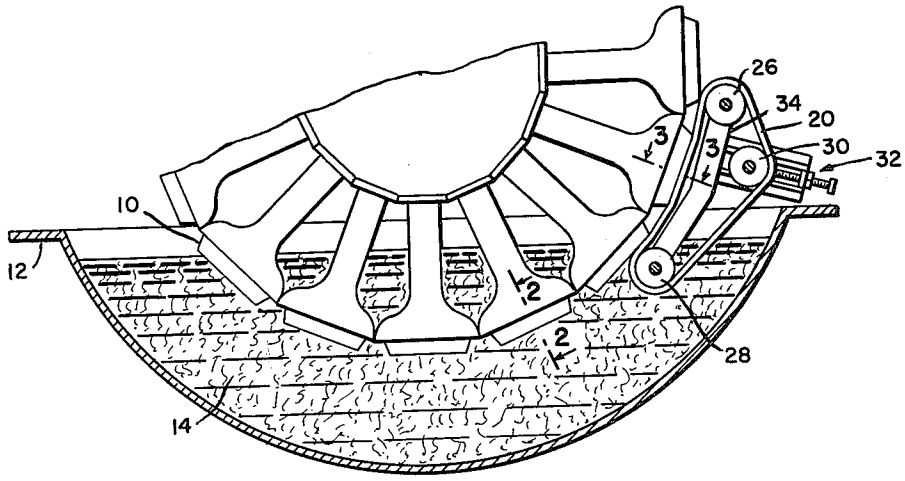

FIG. 1.

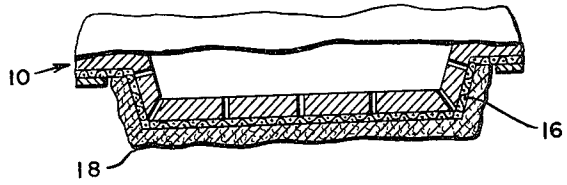

FIG. 2.

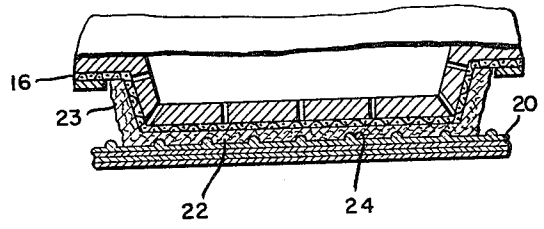

FIG. 3.

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METHOD AND APPARATUS FOR PRESSING MOLDED PULP ARTICLES ON THE MOLD

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This invention relates to a pulp molding method and apparatus and more particularly to a device for rapidly molding, upon suction dies, compacted pulp articles having a smooth outer surface without the necessity of employing mating dies.

When suction molded pulp articles are formed, the surface of the article not in contact with the die is produced with a rough and uneven configuration; these characteristic bumps are made by bundles of fibers and are due to evacuation of water from between the pulp fibers. It is desirable to obtain a smooth surface rather than the rough and uneven surface in order to provide a more attractive product. In the past this has been accomplished by the use of accurately formed mating dies for the suction dies, which mating dies have a smooth surface in the form of the desired surface on the molded pulp article and which mating dies come in contact with the rough surface of the deposited pulp article while said article is still on the suction die. Such mating dies have been made of metal or flexible material, such as rubber. Such dies are expensive and necessitate a reduction in output. In addition such mating dies generally require the use of complex registry apparatus. It has also been conventional to remove the molded pulp article from the suction die and press it between hot matching dies. This suffers from the same problems as the preceding practice. It has also been proposed to use a stretchable belt adjacent the uneven surface of the molded pulp article while the article remains on the suction die; in this manner vacuum is applied through the pulp article to the stretchable belt which is then sucked against the rough and uneven surface to effect a smoothing action. This practice, although reducing the cost of equipment, has failed to produce as satisfactory a product as is desired. All of these known methods of smoothing molded pulp articles start with a comparatively rough surface which is characteristic of the texture of molded pulp.

The present invention contemplates obviating the aforementioned problems by eliminating the characteristic bumps before they are formed; this is accomplished by providing a hard, flexible, continuous belt which applies pressure to pulp in contact with the suction die while the pulp is still in a gelatinous stage. The continuous surface contemplated is to be distinguished from the surface of mating dies which require registry.

It is therefore an object of this invention to provide an improved method and apparatus for producing smooth surfaces on molded pulp articles.

It is another object to provide a method and apparatus for producing molded pulp articles having greater strength, hardness, density and uniformity.

It is yet another object to provide apparatus which is simple and economical to produce.

It is another object to provide apparatus which operates simply and quickly without the need for ancillary registry equipment.

It is another object to provide a method and apparatus which improves the rate and uniformity of drying of molded pulp articles thereby increasing the production rate and reducing the warpage of articles on drying.

It is still another object to provide means for producing an article having a differential thickness.

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

FIG. 1 is a fragmentary view showing the apparatus of the present invention.

FIG. 2 is a schematic-section taken along line 2—2 in FIG. 1 showing deposition of the pulp upon a suction die.

FIG. 3 is a schematic-section taken along line 3—3 of FIG. 1 showing the belt exerting pressure upon the deposited pulp.

Referring more particularly to the drawing, the pulp articles are formed on suction dies 10 by passing said dies through vat 12 containing a pulp slurry 14. The suction dies may be rotatably mounted about a central hub and during operation may rotate through a series of stations including a pulp depositing station, a pressure applying station, a drying station and an article removing station. This invention relates to the pulp depositing and pressure applying stations.

Each die 10 is formed of porous material or screen 16 as is well known in the art. As a die 10 passes through slurry 14, vacuum is applied through the die causing pulp 18 to deposit upon the die. Conventionally as pulp forms on the die and water drains out of the pulp, the wood fibers tend to aggregate into bundles of the water draining through passageways of least resistance formed between bundles. During the formation of the article under the surface of the slurry, the water acts as a carrier for the even distribution of the fibers since conventionally there is about 99 parts of water for each part of fiber; i.e. due to the high proportion of water to fiber, distribution of fiber and draining of water will be essentially uniform while in the vat. The instant the die comes out of the slurry, the gelatinous pulp held to the die by vacuum still has so much water in it that the fibers are still well dispersed. It is only after the bulk of the water is drained out that the fibers tend to aggregate together and form characteristic bumps.

To prevent the fibers from aggregating together to form the characteristic bumps, the flat continuous surface 20, here shown in the form of an endless belt, is pressed against the pulp 18 while it is still in the very wet or gelatinous stage and has enough water left associated with the fibers to keep them dispersed. This forms section 22 of the pulp product which is very dense, strong and smooth and which when removed from the die is much drier than the articles of the prior art. This pressure is preferably initiated while the deposited pulp is still under the surface of the slurry although in normal operation, it may be applied immediately after leaving the slurry, i.e., within ½ second and preferably less than ¼ second after leaving the slurry. By applying pressure while the deposited pulp is still in the gelatinous and water draining stage, the fibers stay dispersed and form uniformly over the suction die. This gives an exceptionally smooth surface in the area of contact of the pressure means. In addition, pressure means 20 serves to mask or shield pulp deposit 22 from further pulp deposition wherever means 22 contacts the deposit when the pressure means is applied beneath the surface of the slurry stock. This provides a product having differential thickness since pulp continues to deposit at 23.

The pressure applying means is preferably an endless belt of stiff rubber such as one comprising a laminate of 4-layer canvass duck and rubber which is greater than ¼" in thickness, although a two-layer canvass duck and rubber laminate 1/16" belt has also proven successful. However, any smooth-surfaced hard material such as rigid plates, plastic sheets or rubber rolls might be used.

If desired the pressure applying means may have a design on its surface in order to squeeze a complementary design on the surface of the deposit. The design 24 may be to impart ribs or corrugations to the article to increase its strength or may be merely for decorative purposes.

The endless belt 20 is allowed to turn freely on the end rollers 26 and 28 and is driven by the movement of the dies in frictional engagement therewith. It is necessary for belt 20 to be tightly stretched against dies 10 to provide a tight wrap so that the belt fully contacts the gelatinous surface without trapping any air therebetween. The belt 20 is tightly stretched against the dies to exert necessary pressure and enable the belt to move by its frictional engagement; this is accomplished by moving adjustable roll 30 and adjusting means 32. The rolls 26, 28 and 30 and adjusting means 32 are supported by T-shaped member 34.

As the die rotates away from the vat, the pressure means moves along with the die and continues to exert force which tends to squeeze water out of the pulp. This squeezing action, along with the vacuum applied from the other side of the pulp article substantially removes the remaining water. About 2 or 3 seconds after the belt has left the slurry the suction behind the die becomes effective on the belt, but by this time the water has been squeezed out of the pulp. The article then passes on to the subsequent stations and, if desired, upon completion of this pressing operation, any other conventional pressing operation as referred to above, may be carried out.

It may be once again reiterated that it is essential to this invention that pressure be applied to the pulp while it is in its gelatinous stage. If the pressure application is held up until vacuum is drawn entirely through the deposit and the water is displaced by air, the deposit will have already obtained its characteristic bumps.

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

What is claimed is:

1. In the method of suction molding pulp articles wherein a series of suction dies is passed in an endless path of travel through a vat containing a slurry of pulp lying along a portion of said endless path and vacuum is applied to the dies to cause pulp to be deposited thereon, the improvement comprising applying pressure to the pulp deposited on a die while said dies pass along a segment of said path of travel and while said pulp is still in the gelatinous stage and before said die leaves said slurry to compact the pulp deposit and provide a pressed outer surface on the pulp article.

2. In suction molding pulp apparatus including a pulp slurry vat having a normal operating level, a series of suction dies adapted to pass in an endless path of travel through said vat and beneath said normal operating level and a vacuum means for applying suction through said dies, the improvement comprising means immediately adjacent said vat and extending into said vat and beneath said normal operating level for applying pressure to the exposed surfaces of pulp articles deposited upon said dies while said pulp is still in the gelatinous stage and while said dies pass along a segment of said endless path of travel.

3. In the method of suction molding pulp articles having a differential thickness along the surface wherein a series of suction dies is passed through a vat containing a slurry of pulp and vacuum is applied to the dies, the step of applying pressure to a portion of said surface by an impervious continuously moving surface, said impervious continuously moving surface being applied first at one edge of said portion of the pulp article surface on the moving die and then gradually moving over and masking the entire portion whereby the remainder of the surface is not masked and thereby receives a greater deposition than said masked portion.

4. In suction molding pulp apparatus including a pulp slurry vat, a series of suction dies adapted to pass through said vat and a vacuum means for applying suction through said dies, the improvement comprising means for applying pressure to the pulp deposited on a die while said pulp is still in the gelatinous stage, said pressure applying means comprising a continuous stiff surface adapted to continuously move during operation.

5. In suction molding pulp apparatus including a pulp slurry vat, a series of suction dies adapted to pass through said vat, a vacuum means for applying suction through said dies, and means immediately adjacent said vat for applying pressure to the exposed surfaces of pulp articles deposited upon said dies, the improvement wherein said pressure applying means comprises a relatively stiff rubber and canvas endless belt which extends into said vat to contact the exposed surfaces of the pulp articles while said pulp is still in the gelatinous stage, said endless belt being adapted to continuously move during operation.

6. Apparatus in accordance with claim 5 wherein said endless belt has a pattern in its article facing surface to impart a complementary pattern to the pulp deposit.

7. In the method of suction molding pulp articles wherein a series of suction dies is passed in an endless path of travel through a vat containing a slurry of pulp lying along a portion of said endless path and vacuum is applied to the dies to cause pulp to be deposited thereon, the improvement comprising applying pressure to the pulp deposited on a die continuously while said pulp is still in the gelatinous stage and before and after said die leaves said slurry while passing along a segment of said path of travel to compact the pulp deposit and provide a pressed outer surface on the pulp article.

8. In the method of suction molding pulp articles wherein a series of suction dies is passed through a vat containing a slurry of pulp and vacuum is applied to the dies to cause pulp to be deposited thereon, the improvement comprising applying pressure to the pulp deposited on a die by an impervious moving surface, said surface contacting first one edge of said pulp deposit on the moving die and then gradually moving over and contacting the portions adjacent said one edge to the opposite edge while said pulp is still in the gelatinous stage.

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