Aug. 28, 1956 R. P. LEMIEUX 2,760,412

APPARATUS AND METHOD FOR REDUCING EDGE FLASH IN PULP MOLDED ARTICLES

Filed Feb. 23, 1952 2 Sheets-Sheet 1

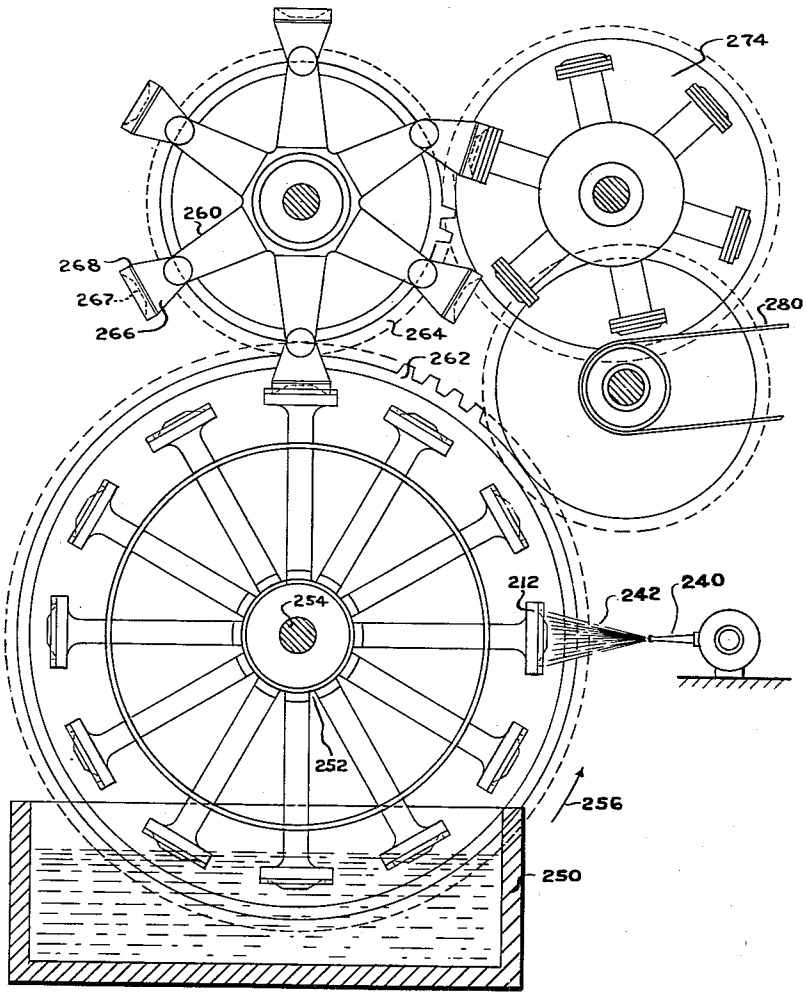


Fig. 1

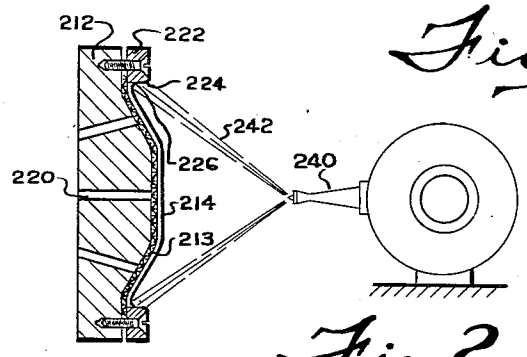


Fig. 2

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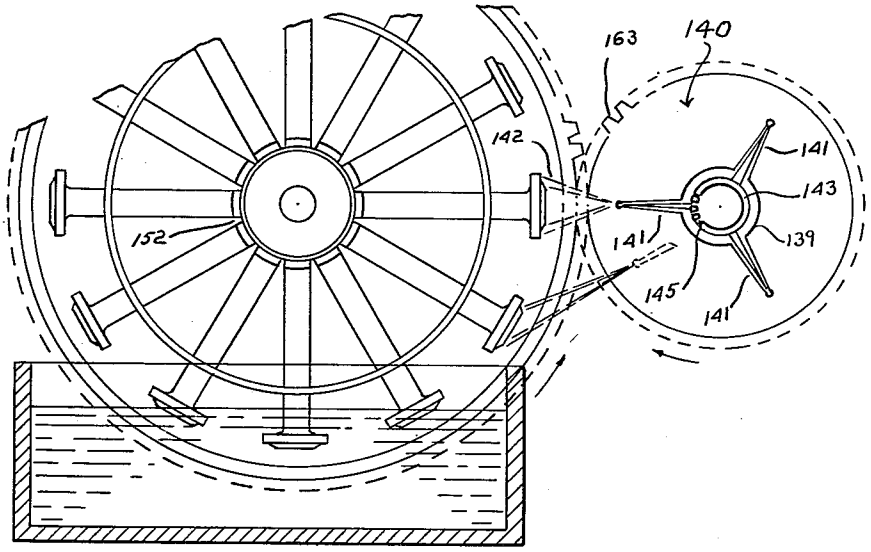


Fig 3

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2,760,412

APPARATUS AND METHOD FOR REDUCING EDGE FLASH IN PULP MOLDED ARTICLES

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8 Claims. (Cl. 92—57)

This invention relates to molding, more particularly to apparatus and methods for molding articles from fibrous pulp.

Edge flashing, or a very thin flange of surplus material, generally forms at the marginal edges on pulp articles molded from dies that have been in use for some time. This flashing is particularly annoying. The normal resiliency of the pulp makes it impossible to remove fibrous flashing by mere flexure, the simple and usual technique for removing flashing from cured resin articles. Any attempt to positively remove flashing generally leaves the edge of the molded article fuzzy and produces loose fibrous particles which annoy any nearby personnel and also constitute an explosion hazard.

Among the objects of the present invention is the provision of novel molding apparatus and methods which avoid this and related difficulties.

The above as well as additional objects of the present invention will be more readily understood from the following description of several of its exemplifications, considered in conjunction with the acompanying drawings wherein:

Fig. 1 is an elevational view showing a pulp molding apparatus of the invention;

Fig. 2 is a detail view with parts in section of a portion of the apparatus of Fig. 1; and

Fig. 3 is a view similar to Fig. 1 of a modified form of molding apparatus exemplifying the invention.

According to the present invention, it is possible to substantially reduce or entirely prevent the formation of edge flashing on articles made from molded pulp by redistributing the marginal portions of the mass of pulp fibers that is initially loosely formed on the usual suction die. By this redistribution these marginal portions are at least partially commingled with the adjacent portions of the fibrous mass so that there is little if any flash formed at the margins.

For the above purposes redistribution is readily effected by impelling a stream of liquid against the marginal portions of the loosely formed pulp from which the article is made, while suction is applied. The liquid stream renders the fibrous portions against which it is impelled more fluid, while the suction carries these fluid portions onto the adjacent portions of the pulp mass.

Referring more specifically to the drawings, Fig. 1 shows a pulp molding apparatus of the general type described in Chaplin Patent No. 2,163,585, granted June 27, 1939, or in Randall et al. Patent No. 2,234,979, granted March 18, 1941. A forming turret **252** is here shown as carrying a plurality of perforated forming dies **212** through a pulp slurry tank **250** while suction is applied through the die perforations to form a layer of pulp on the successive dies. This layer is then subjected to additional suction after it is withdrawn from the slurry to remove free draining liquid, and is then compacted and dried so that it is ready for use.

In the illustrated apparatus the forming turret **252** rotates around shaft **254** in the direction indicated by the arrow **256** and carries the formed pulp layers from tank **250** to transfer turret **260** which holds a multiplicity of pressing dies **266** shaped to mate with the forming dies. By proper control of the suction in dies **212** and the application of suction to dies **266** along with compressed air to dies **212** if desired, the formed pulp layers are transferred to the transfer dies and at the same time compacted between dies **212** and dies **266**.

The transferred layers can now be subjected to additional compacting and/or suction, and can also be heated if desired, as by supplying heat to the dies **266** or by additional dies which coact with the transfer turret **260**. Pressing turret **274** can also be aranged to remove the pressed pulp layer from the transfer turret and drop them on a conveyor belt **280** which carries them through a tunnel drier for example if they are not already sufficiently dry. The various turrets and other components can be driven in suitable synchronism as by gears such as those indicated at **262**, **264**.

The perforated forming dies can be of the types shown in the above Chaplin or Randall et al. patents, or those of Manson Patent No. 2,273,055, granted February 17, 1942, Sheffield Patent No. 1,984,384, granted December 18, 1934, or Louisot Patent No. 2,129,697, granted September 13, 1938. An internal passageway or manifold communicates with perforations shown at **220** in Fig. 2 to suck in liquid from the slurry and trap the fibers of the slurry on a forming surface such as the wire screen **213**. A marginal ring **222** is conveniently used to provide a pulp retaining wall or walls **224** for guiding the engagement of the cooperating pressing dies **266** and confining the formed layer of pulp **214** to the desired poritions of the die.

Cooperating dies **266** are provided with pressing surfaces **267** corresponding to the mating surface of die **212**, so as to accurately compress the loosely formed layer **214** into the desired shape, and at the same time express some of the liquid present in this layer when first formed. In addition, marginal walls **268** on the pressing dies are shaped to coact with the pulp supporting wall **224** of die **212**. For commercial operations some small amount of clearance, usually not more than about 2 to 4 mils (thousandths of an inch), is provided between walls **224** and **268** to limit the escape of pulp during compacting. In normal molding the suction die provides a slight excess of pulp at the periphery, as indicated at **226**. Although this helps to assure that the edges of the finished article art not deficient in thickness and thereby unduly weakened, some of the excess pulp will be forced up along the guide walls **224** during the pressing step, particularly if these walls or their cooperating guide walls on dies **266** are worn, nicked or scratched.

According to the present invention however, a spraying structure **240** is arranged to impel an encircling hollow stream of liquid **242** against the marginal edges **226** of loosely formed mass of pulp fibers **214** on suction-forming mold **212** (see Fig. 2). While the liquid stream is so impelled it is advisable to keep suction applied to the forming die **212**. The impact of the stream on marginal fibers redistributes these fibers and causes them to readily flow by reason of the excessive liquid that is present. Under the influence of the suction these readily flowable fibrous particles are sucked over to the adjacent portions of the interior of the fibrous mass **214**. As a result, when the impelled stream is stopped the margins of the formed mass are of greatly reduced thickness, and when compacted show very little or no flashing, even with die clearances of as much as 15 to 20 thousandths of an inch.

The redistributing stream of liquid is preferably kept

as much as possible from being impelled directly at the central portions of the loosely formed pulp mass **214**. If this is not done, the points at which the stream contacts this intermediate portion will tend to show a displaced fiber structure that gives rise to uneven thicknesses and undue loss of strength. This does not occur at the periphery apparently by reason of the fact that there is initially at least a slight localized excess of pulp fibers. The liquid stream does have a tendency to apply sufficient liquid to the pulp mass to cause it to run slightly, particularly where the formed mass is held in an inclined or vertical position as shown in Fig. 2. However, such running actually assists in the redistribution of the marginal fibers, and the suction prevents the running from causing any sizeable shift or flow of the fibers in the flowable pulp mass.

Practical embodiments of the invention can have the forming dies stationary or moving while being sprayed. The construction of Fig. 1 is of the first mentioned variety. The turret rotations are arranged to take place in discrete steps which carry each die through an arcuate move equal to the distance between these individual dies. Between the steps the turret assembly **252** is held stationary. Suction, which is applied at least while the immersed die **212** is held stationary in the slurry to cause formation of the desired fibrous mass, can be maintained through several succeeding steps so that it is still maintained when the die carrying the formed mass reaches the spray position shown in Fig. 1. In the pause after this step, the spray structure **240** is actuated for a short period of time. About 1 to 4 seconds is all that is needed where the spraying liquid is water and the spray discharge passageways are circular with a diameter of about 10 mils and the spray pressure is about 50 to 60 pounds per square inch. Variations in spray pressure and discharge openings appear to be of substantially no effect so long as the spray is vigorous enough to be directive.

After the spray step is completed the turret assembly **252** advances to the next step where the formed fibrous mass on the next die **212** is sprayed, etc. It is not necessary to maintain the forming suction throughout the entire interval between forming and spraying. The suction can be interrupted for as long as desired.

The position of the formed fibrous mass **214** when it is sprayed is not critical, and can vary from the horizontal to the vertical or can be at any inclination between these two extremes.

The compacting operation by itself may be of long duration to effect a substantially complete drying of the fibrous article. On the other hand, compacting can very advantageously be limited to a period of one or two seconds, or the length of time required for the suction forming of layer **214**. Such short compacting treatments provide all the necessary compactness of the fibrous layer which can then be permitted to complete its drying either in other dies or without the application of any pressure, as for example on a conveyor belt or one of the forming dies. Some warpage may be experienced with this type of free drying, but it is not severe and may be compensated for by a final pressing in accurately dimensioned dies.

The technique of the present invention can be used to reduce edge flashing in articles molded from fibrous or non-fibrous masses that include water or other moistening liquid. In all of these cases the redistributing action is quite similar in effect. The spraying liquid can be any convenient one including water, with or without additions such as sizing or coloring material.

Fig. 3 shows a variant of the above pulp molding apparatus in which the flash-reducing spraying is effected while the forming dies are in motion. Here the spraying unit **140** has a plurality of nozzles **141** mounted on conduit **139** held as by gears **163** to rotate with a forming turret **152**. Instead of having this turret move in steps, it is very simply connected for continuous rotation except when the apparatus is shut down.

The spray drive is timed so that the successive nozzles move across the adjacent portion of the forming turret in synchronism with the successive forming dies. Suitable valve action is provided for actuating the spray discharge during this synchronized movement to effect the desired fiber distribution.

In the form shown in Fig. 3, the spray is controlled by a fixed valve member **143** which cooperates with the internal surface of the conduit **139** in a manner similar to that of a rotatable sleeve valve. Spray liquid is delivered from a suitable source to the interior of member **143** and one or more ports **145** in this member permit discharge of the liquid through a nozzle **141** when the nozzle moves into alignment with the ports.

The resulting stream of liquid **142** effects the desired fiber redistribution as explained above in connection with Fig. 2. It is not necessary to have this stream directed extremely accurately at the thickened marginal portions of the formed fibrous mass. The redistribution appears to extend over an appreciable band of the margin at least about a half inch or more in width. The small amount of stream displacement as for example between the dash-line and full-line positions shown in Fig. 3, is accordingly of no consequence notwithstanding the variable elongation of this stream impingement pattern in some of the positions.

Instead of having a single spray stream, a plurality of spray steps can advantageously be used for each redistribution operation. A single spray step usually does not completely level the thick pulp edge shown in Fig. 2, but by using further steps, any excess pulp left by the preceding step can be further redistributed to further reduce the excess. Best results appear to be obtained where the sequence of steps includes a first step more than one second long, a last step less than ½ second long, and intermediate steps of intermediate duration, with sufficient interruption to permit effective fiber redistribution between steps.

One highly effective example of such a sequence is a combination of four steps the first of which takes 1½ seconds, the next two ½ second each, and the fourth ⅓ second. This sequence produces commercially acceptable margins in the finished article even though the die guides are badly marred and scored with clearance gaps in excess of 25 mils.

As shown in Fig. 3, the ports **145** can be provided in the desired number and varied in size to effect the desired spray steps. The number of nozzles **141** can be equal to, more than or less than the number of forming dies. Provision should be made in the construction of the apparatus of Fig. 3 to assure that the projected stream of spray liquid **142** reaches the proper potions of the forming dies. Inasmuch as these dies in their rotation move toward and away from the plane of closest proximity to the spray structure, it is advisable to have the nozzles rotate with an angular velocity somewhat lower than that indicated by the relation of its rotation radius to that of the forming turret **152**. This permits the projected nozzle stream as it undergoes changes in length by reason of the varying distance to a moving die, to trace a path generally conforming to that of the die. Where the number of dies or nozzles are varied, suitable adjustment of the nozzle rotation should be made.

If desired, the rotating molding turret can be connected with one or more nozzles connected to oscillate about a short arc having the axis of turret **152** as its center of rotation. The oscillation can then be coordinated with the turret rotation to assure that the spray moves along with and is properly directed onto the forming dies as they continually move past the spray zone. If the required oscillation frequency is unduly high, it can be lowered by oscillating a larger number of nozzles simultaneously, on a single holder for example, with

each nozzle directed at a different die. In this way a single oscillation cycle can be arranged to simultaneously redistribute the pulp on several different dies.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope hereof it is to be understood that the invention is not limited to the specific embodiments hereof except as defined in the appended claims. Thus for example, the encircling streams of the present invention can be square, rectangular or of any other shape corresponding to the outlines of the articles being molded.

What is claimed is:

1. In a pulp molding apparatus, a tank for holding a pulp fiber slurry, a forming die mounted for movement through said pulp fiber slurry, said forming die having means thereon for depositing a loosely formed, wet mass of fibers on the die face thereof, and a flash reducing mechanism spaced from said tank and in opposed relation to said die face when said forming die is in a predetermined position outside said slurry, said mechanism comprising a projecting device constructed and arranged to project a continuously extending, hollow, fluid spray against the peripheral portion only of said wet mass while said wet mass is on said forming die.

2. The apparatus of claim 1 wherein said forming die is mounted for intermittent movement during which it is held stationary for a predetermined period when it reaches a predetermined position, said flash reducing mechanism being arranged, in timed relationship with said forming die, to project a spray against said die while it is held stationary at said position during said predetermined period and to halt the projection of said spray after the termination of said predetermined period.

3. The apparatus of claim 1 wherein said forming die is mounted for continuous movement into, through and out of the slurry, and wherein said mechanism is interconnected with said forming die to move said spray in conjunction with said die during at least a portion of the path of movement of said die outside said slurry.

4. The apparatus of Claim 1 wherein means are provided to apply a suction behind the die face of said

forming die while it is being subjected to the action of said spray.

5. A method for reducing the formation of edge flashing on molded pulp articles which includes the steps of forming a mass of wet pulp into a desired shape on an open mold face, and then projecting a hollow, continuously extending fluid spray from a spaced, opposed position relative to said open mold face against the peripheral area of the face of the shaped mass while said mass is held on said open mold face.

6. The method of claim 5 wherein a suction is applied behind the face of the shaped mass while it is being subjected to the action of the spray.

7. The apparatus as defined by claim 1 in which the spray mechanism includes automatic control elements connected to operate the spray in groups of spray steps the first step of which is more than a second long, the last of which is less than ½ second long, and intermediate steps are of intermediate duration.

8. A method as defined by claim 5 in which the fluid is impelled in a group of steps the first of which is at least one second long, the last of which is not more than ½ second long, and intermediate steps are of intermediate duration.

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