Sept. 4, 1962 D. G. MAGILL, JR 3,052,295

METHOD AND APPARATUS FOR MAKING SYNTHETIC FIBER PAPER

Filed June 21, 1957

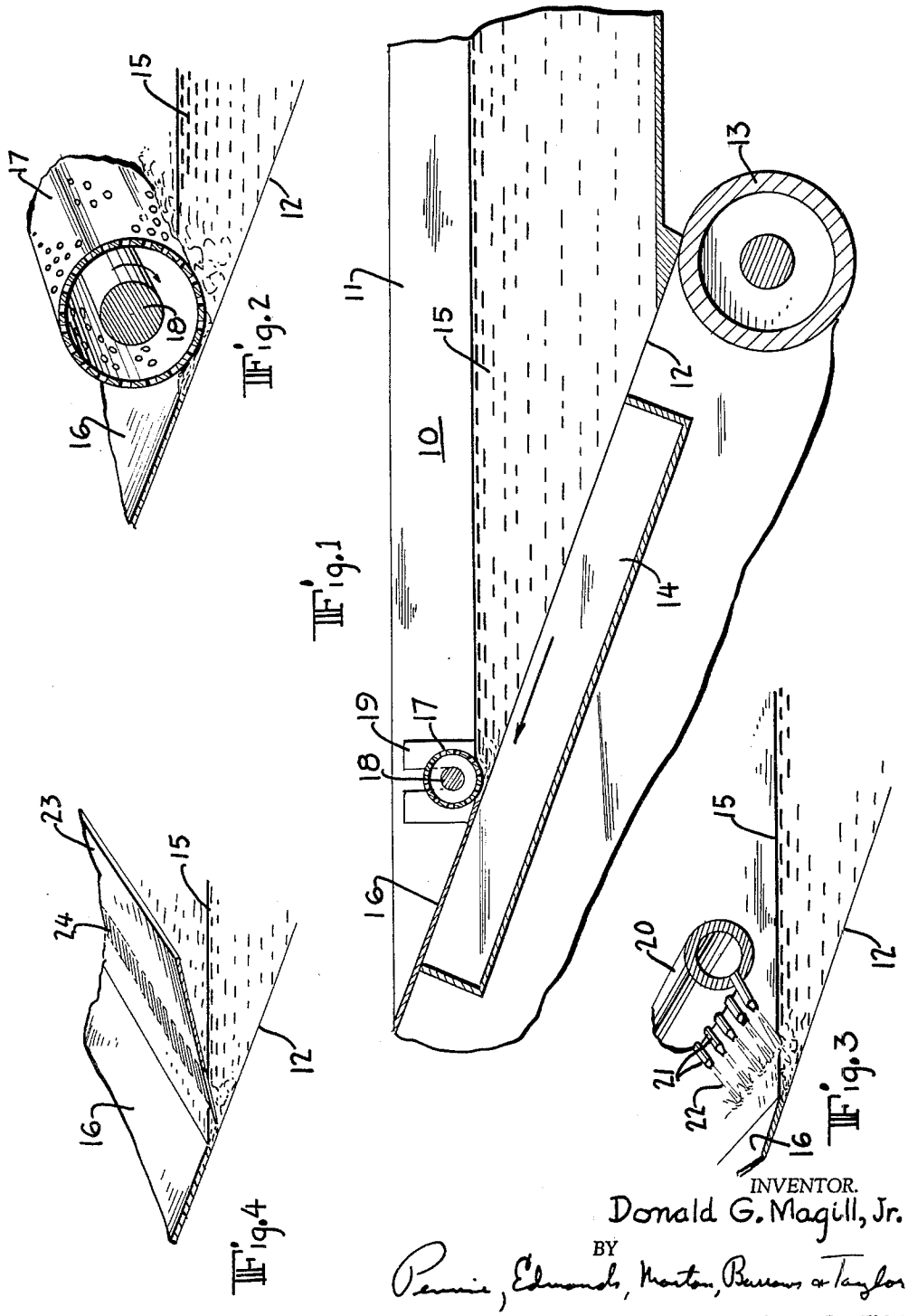

FIG. 2

FIG. 1

FIG. 3

FIG. 4

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United States Patent Office 3,052,295 Patented Sept. 4, 1962

3,052,295

METHOD AND APPARATUS FOR MAKING SYNTHETIC FIBER PAPER

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Filed June 21, 1957, Ser. No. 667,084
2 Claims. (Cl. 162—314)

The present invention relates to the art of paper making, and more particularly to novel and improved arrangements for making papers including a substantial proportion of synthetic or other special fibers.

In the manufacture of papers and paper products, it is often desirable to utilize a large percentage of synthetic fibers, such as glass, as nylon, Orlon or the like, or other special fibers, such as fibers of relatively great length. Such papers find advantageous use in the making of various resin or plastic laminates, and in the manufacture of decorative articles, for example. Improved methods and apparatus for making papers of this type are described and claimed in the copending applications of Richard T. Jackson, et al., Serial No. 633,497, filed January 10, 1957, for "Paper Product Formed With Glass and Other Special Fibers and Method of Making Same," and Donald G. Magill, Jr., et al., Serial No. 654,440 filed April 23, 1957, for "Synthetic Fiber Paper and Method of Making Same" both applications being owned by the owner of the within application.

One of the difficulties which has been encountered in connection with the making of synthetic and long fiber papers has been the tendency for the special fibers to form into clumps during the paper making process. While, for many purposes, the presence of clumps or clots does not render the product unusable, the clumps may be somewhat unsightly, and the product is rendered less desirable for decorative uses, such as in lampshades, various specialty papers, etc. Moreover, the larger clumps may prevent adjacent sheets from lying flat upon each other, making saturation of multiple sheet lay-ups more difficult, and making it more difficult to obtain a uniform resin content in laminated end products.

As set forth in the above mentioned Jackson et al. application, the formation of clumps or clots during early stages of the paper making process may be substantially avoided by adding the glass or other special fibers directly into the white water system of the paper making apparatus, whereby the special fibers are carried in a highly diluted stock. The present invention provides a method and apparatus for eliminating clumping in the manufacture of special fiber papers, which may be employed as a supplement to or possibly as an alternative for that described in the Jackson et al. application. To this end, the invention provides improved methods and apparatus affecting the paper making process at or near the instant of formation of the paper web, whereby the formation of clumps or clots is avoided or materially reduced.

Generally, the new method involves the agitation of the paper making stock during the last instants of web formation, when the water is largely removed from the stock, to the end that the glass or other special fibers are prevented from gathering together, or clumping at that critical time. Once the web is formed, the special fibers are held in place by the cellulosic fraction and/or the various binders in the web, so that the end product is of the desired structure and appearance.

One of the specific aspects of the invention resides in the provision, in a paper making machine, of a perforated roll, resting upon and driven by the screen of the machine at a point immediately adjacent the line along which the web emerges from the stock. The roll rests

lightly on the screen and acts, as it rotates, to agitate the then thickening stock and to disturb the special fibers sufficiently during the formation of the web to substantially avoid any clumping or clotting thereof.

Alternatively, the thickening stock, during the last instants of formation of the paper web, may be agitated by a multiplicity of jets of water, directed into the thickening stock, or by a comb-like element projecting into the stock and effecting the desired agitation thereof as the stock moves relative thereto. It is also contemplated that other alternative arrangements may be employed in obtaining the end result of the new method, by effecting the proper agitation of the stock during the last instants of web formation.

For a better understanding of the invention, reference may be made to the following specification and the accompanying drawing, in which:

FIG. 1 is a fragmentary cross sectional view of a paper making machine incorporating improved features of the invention and adapted for carrying out the new method;

FIG. 2 is a fragmentary perspective view of the apparatus of FIG. 1; and

FIGS. 3 and 4 are fragmentary perspective views of alternative forms of apparatus for use in carrying out the new method.

Referring now to the drawing, the numeral **10** designates, generally, a paper making machine, which may be a so-called triangular Fourdrinier, or an inclined Fourdrinier, for example. The illustrated portion of the paper making machine **10** includes a head box **11**, endless wire **12** trained about a roll **13** and forming, at least in effect, the outer end of the head box, and a suction box **14** positioned beneath the wire **12**, at the outlet end of the head box **11**. The foregoing elements are conventional, and the conventional paper making process is carried out thereon by forming a pool or pond **15** of highly dilute paper stock in the head box **11** and causing the Fourdrinier wire **12** to move from right to left, as viewed in FIG. 1. As the wire **12** moves progressively past the stock supply **15**, water is drained through the screen, by the action of gravity and by suction from the box **14**, and a web of paper is formed progressively on the wire. When the wire **12** moves away from the stock supply, a web **16** is completely formed thereon and is carried away by the wire and eventually transferred to suitable dryer apparatus, not shown.

In the making of glass and other special fiber papers, the stock **15** may include a predetermined quantity of cellulosic fibers and a quantity of special fibers, such as glass, nylon, Orlon, etc., or fibers of greater than usual length. By way of example only, the stock may include, in addition to water and additives, glass and cellulosic fibers in proportions of about 75% and 25% respectively. The glass fibers may be in the order of one-half inch in length.

As a general rule, the effective incorporation of glass and other special fibers in paper stock involves substantial problems in connection with the clotting or clumping of the special fibers. The present invention provides a practical and effective arrangement for avoiding clumping of the special fibers during the last instants of web formation, so that the fibers will be more uniformly distributed throughout the web and a product of improved appearance and greater usefulness may be obtained.

In the form of the invention illustrated in FIGS. 1 and 2, there is provided an agitating roll **17**, which is mounted adjacent the outer end of the head box **11**, so as to be partly immersed in the stock **15**. Advantageously, the agitating roll **17** is supported, as by means of a shaft **18** and guide **19**, for free rotation and for free movement toward and away from the Fourdrinier wire **12**. Thus,

the roll **17**, which may have a weight of about 30 pounds, for example, is supported by the wire **12** and is adapted to be rotated by movement of the wire.

In accordance with the invention, the agitating roll **17** is so positioned, relative to the wire **12** and head box **11**, that the roll is partially immersed in the paper stock at a point spaced slightly from the line along which the formed web **16** emerges from the stock. Thus, in the illustrated apparatus, in which the wire **12** may be inclined about 22° from the horizontal and the agitating roll **17** may be about four inches in diameter, the point of tangency of the roll **17** may advantageously be spaced about one inch back from the line of emergence of the web **16** from the stock.

As best shown in FIG. 2, the agitating roll **17** has a perforated or screen-covered outer surface, the lower portion of which is immersed in the stock **15**. Accordingly, as the roll **17** is rotated, by movement of the wire **12** thereunder, the stock surrounding the roll is churned and agitated. This reorients the special fibers and prevents them from clotting or clumping together during the period in which the web formation takes place. It will be understood, in this respect, that the web **16**, is completely formed almost instantaneously after the wire passes under the roll **17**, so that the special fibers cannot reorient sufficiently to form clumps.

Agitation of the stock adjacent the line of emergence of the web **16** therefrom is important for two reasons: first, the stock at that point is believed to be of relatively high consistency, much of the water having drained therefrom, and second, the velocity of the stock slurry relative to the wire decreases progressively as the wire nears the line of emergence so that the stock immediately adjacent the screen, near the line of emergence, normally has relatively little turbulence.

An alternative arrangement for effecting the desired agitation of the stock during the instants of web formation is shown in FIG. 3, wherein, in place of the agitating roll, the paper making machine is provided with means for directing a plurality of jets of water into the stock immediately prior to emergence of the web therefrom. Thus, in the apparatus of FIG. 3, a water supply header **20** is disposed above the stock **15**, near the line of web emergence. Extending from the header are a plurality of tubes **21**, spaced along the header at closely spaced intervals. Advantageously, the tubes **21** are disposed at an acute angle to the Fourdrinier wire **12**, whereby streams of water **22** issuing therefrom are directed generally toward the wire, but have a component of velocity in the direction of movement of the wire.

In the apparatus of FIG. 3, the streams of water **22** serve to agitate the stock and rearrange the special fibers, in the manner desired, to avoid clumping. The location of the header **20** and tubes **21**, and the direction of the streams **22**, is advantageously such that the streams strike the stock **15** approximately one inch back from the line of emergence of the web **16** therefrom, so that web formation is completed almost instantaneously, after the wire passes the streams.

Another alternative arrangement for carrying out the method of the invention is illustrated in FIG. 4, wherein the paper making machine is provided with a comb-like element **23** located adjacent the outer end of the head box **11** and having a plurality of closely spaced teeth **24** projecting into the stock near the line of emergence of the web **16** therefrom. The comb-like element is disposed at an acute angle to the wire **12**, so that the teeth **24** project somewhat in the direction of wire movement, and the location of the element **23** is such that the teeth **24** thereof are spaced about one inch back from the line of emergence of the web from the stock.

The operation of the apparatus of FIG. 4 is similar to that of FIGS. 1–3, in that the stock is agitated during the final instants of web formation, as the wire and stock move relative to the element **23**, so that the special fibers in the stock are prevented from bunching together or clumping. The formed web **16**, emerging from the stock, is therefore characterized by a substantially uniform distribution of the special fibers.

The method and apparatus of the invention are particularly advantageous in connection with the manufacture of papers comprising glass or plastic fibers, or fibers of relatively great length. The instant invention effectively supplements that described in the before mentioned Jackson et al. application; and it is contemplated that it may be possible to employ the present invention as an alternative, either in whole or in part, to the Jackson et al. invention, as well as a supplement thereto.

The paper product manufactured by the new method and apparatus is well suited for use in the preparation of various plastic laminates and as a decorative specialty paper. The finished product, being substantially free of clumps of the special fibers, is easily laminated, and the uniform distribution of special fibers throughout the finished web improves the appearance of the finished paper.

The forms of the new method and apparatus herein illustrated and described are intended to be representative only, since certain changes may be made therein without departing from the clear teachings of the invention. Accordingly, reference should be made to the following appended claims in determining the full scope of the invention.

I claim:

1. In a paper making machine of the type including a head box for holding a supply of paper stock in the form of a pool, said pool being of gradually decreasing depth and having a horizontal surface, and a web-forming wire constituting part of said head box and movable along an upward incline in contact with the pool and emerging upwardly from the surface of the pool to form a web on the wire; the improvement comprising a perforated roll mounted for free rotation about an axis adjacent said wire and near the line of emergence of said wire from the surface of said pool, said perforated roll being supported directly on said wire for rotation by movements thereof, a substantial portion of said roll being exposed above the surface of the pool, said roll being in contact with said wire and said pool substantially at the apex of the intersecting planes formed by the upwardly inclined wire and the horizontal surface of the pool.

2. The machine of claim 1, in which said roll is supported on said wire along a line spaced about one inch from said apex.

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