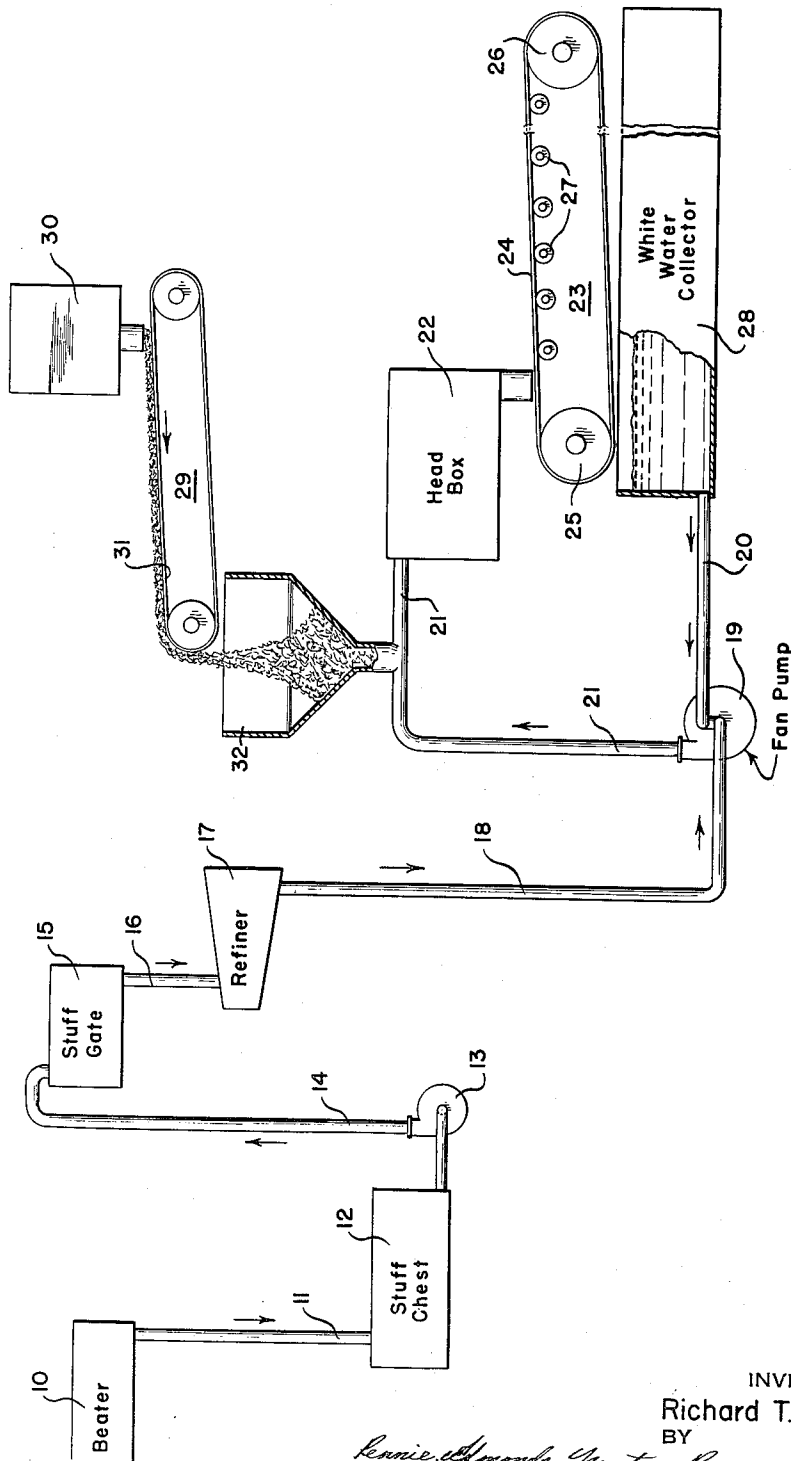


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METHOD OF MAKING PAPER PRODUCT WITH GLASS
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METHOD OF MAKING PAPER PRODUCT WITH GLASS AND OTHER SPECIAL FIBERS

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This invention relates to the art of paper making, and more particularly to a new and improved method of making paper which is composed of a substantial portion of long fibers, or fibers of glass or materials having similar characteristics, and to an improved paper product including such fibers.

In the manufacture of paper which includes quantities of special fibers, such as glass, substantial difficulties have been encountered in connection with the control of the special fibers, rendering it difficult to manufacture paper of the quality desired by conventional paper making procedures. Thus, in some glass fiber papers, for example, it is desirable to utilize fibers of relatively great length (not substantially less than one-fourth inch). The glass fibers are of a multi-filament structure, that is, each fiber comprises a plurality or "bundle" of individual filaments. In order to make paper of the desired quality, using such fibers, it is important to maintain the integrity of the fibers (i.e., prevent the filaments from separating), and to prevent the long fibers from becoming entangled and forming clots.

In conventional paper making practices, a slurry of fibers is formed in a beater and transferred to a stuff chest. The slurry is pumped from the stuff chest to a stuff gate, having a flow metering means, such as an orifice, which delivers the slurry at a controlled rate to a refiner, such as a conventional Jordan machine. After refining, the slurry is delivered to a fan pump, together with a large volume of "white water," which greatly increases the dilution of the slurry. The dilute stock is delivered by the fan pump to the head box of a paper making machine, such as a Fourdrinier, where the stock is flowed onto a moving wire to form a web. The water drained from the wire is collected and returned to the white water system, at the intake side of the fan pump, for further use.

My experience has shown that if special fibers, such as glass or other long or multi-filament fibers are subjected to conventional treatment the fibers will become tangled and clotted, and the integrity of the individual fibers cannot be maintained. Accordingly, the improved method of this invention involves adding the special fibers, in a substantially dry state, directly into the white water system of the paper machine advantageously at a point close to the head box and down-stream from the fan pump of the white water system. The arrangement is such that the fibers are dispersed in copious quantities of water, to avoid tangling, and are not subjected to sufficient agitation of any kind or other severe treatment to cause a loss of fiber integrity.

In the manufacture of paper incorporating glass fibers, for example, it is advantageous to utilize a stock including the glass fibers, together with cellulosic fibers. Thus, the relative percentages by weight of glass and cellulosic fibers may be 75 percent glass fibers, 25 percent wood or other cellulosic fibers. In such cases, the cellulosic fibers may be processed in the usual way, and added to the white water system at the fan pump for delivery to the head box. The glass fibers are, in accordance with the invention, handled separately, and are added directly into the white water system, advantageously as close as practicable to the head box. In the white water system, the glass fibers are distributed throughout the copious quan-

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ties of water, so that tangling and clotting of the fibers is unlikely, and the special fibers are not subject to treatment such as will destroy the integrity of the fiber bundles.

The invention also includes the provision of an improved paper product which incorporates, in its completed form, glass or other special fibers characterized by their relatively great length and/or multi-filament structure. In one of its preferred forms, the new paper product includes approximately 75 percent glass fiber and 25 percent cellulosic fiber, the glass fiber being of a length not substantially less than one-quarter inch.

For a better understanding of the invention, reference should be made to the following more specific description and to the accompanying drawing, which is a simplified schematic representation of a paper making system for carrying out the method of the invention and making the new product.

In the drawing, the numeral 10 designates a conventional beater employed in a paper making system for preparing a slurry of fibers, such as wood fibers, for example. The slurry formed in the beater is transferred through a duct 11 to a stuff chest 12, for temporary storage, after which the slurry is forced, by means of a pump 13, through a duct 14 to a stuff gate 15. The stuff gate 15 may be of a conventional type, and includes a flow metering device, such as a suitable orifice, not specifically indicated, for delivering a metered flow of the slurry through a duct 16 to a refiner 17.

In the refiner 17, which may be a Jordan type for example, the fibers of the slurry are subjected to such further processing as may be necessary or desirable to render the stock suitable for making paper having desired characteristics. The slurry is delivered from the refiner 17 through a duct 18, to the intake of a fan pump 19.

Also connected to the intake of the fan pump 19 is a duct 20, forming part of the white water system of the paper machine. Large quantities of water are delivered to the fan pump 19, through the duct 20, so that the prepared slurry is greatly diluted to the desired consistency for forming a web.

The diluted paper stock is delivered by the fan pump 19, through a duct 21, to the head box 22 of a paper making machine 23. The paper making machine may be a so-called triangular wire Fourdrinier, for example, or may be a standard or inclined Fourdrinier, including an endless wire screen 24 entrained about spaced rolls 25, 26, respectively, and supported by intermediate rolls 27. The wire 24 may slope upwardly somewhat, as indicated.

Stock is flowed onto the wire 24 from the head box 22, and water is withdrawn from the stock and is collected in a white water collector 28. The collector 28 is connected to the white water duct 20, so that white water of the system is used over and over, with such excesses thereof as may accumulate being drained off from the collector, filtered, if desired, and discharged.

Although this invention is not limited to any specific ranges of stock dilution, as a general rule the stock leaving the refiner 17 is at a consistency of about 3-5 percent fiber, by dry weight, while the stock entering the head box 22 may be at a consistency of 1.5 percent to as little as 0.05 percent fiber by dry weight. Thus, large quantities of white water are added to the stock at the intake side of the fan pump in order to obtain the proper stock dilution.

The paper making process, as thus described is substantially conventional, and is suitable for the making of papers utilizing conventional fiber types, where the fibers are of short length and where fiber integrity is not an important consideration. However, where special fibers, such as glass fibers, are incorporated in the paper stock,

or where long multi-filament fibers are desired in the finished product, the described system is not entirely satisfactory. Thus, the submission of such special fibers to beating and refining results in a shortening of the fibers and/or loss of fiber integrity, and the surviving long fibers tend to tangle and clot and do not flow freely through the stuff gate, for example. Accordingly, in the improved method of the invention, the special fiber is added directly into the white water system, where it is quickly dispersed in large quantities of water, sufficient to maintain the individual fibers in separated relation and to permit the free flow of the fibers onto the screen 24, in desired orientations and without forming lumps, etc., in the web.

It is contemplated that the new paper product will include cellulosic and glass or other special fibers in proportions of about 25 percent and 75 percent, respectively, the finished product also including such additives as may be necessary or desirable. In the making of this product, the cellulosic fibers may be processed in the usual manner and delivered to the intake of the fan pump 19. The glass or other special fibers are, however, added directly into the white water system, as by means of a feeder system 29 arranged to discharge fibers into the duct 21. In the illustrated process, the highly dispersed special fibers are mixed with the prepared slurry, to form a diluted stock. Advantageously, the feeder system 29 is arranged to discharge special fibers into the white water duct 21 at a point about three or four feet upstream from the head box 22. For best results, the discharge of special fibers into the white water system should take place no earlier than is necessary to effect proper dispersion of the special fibers. Accordingly, in some cases, it may be possible to discharge the special fibers directly into the head box, providing, of course, the design of the head box is such that proper dispersion of the special fibers is effected. It is also contemplated by the present invention that the feeder system 29 for special fibers may be placed at other points in the white water system where it is advantageous to do so.

Advantageously, the feeder system 29 includes a glass roving cutter 30, which may be a conventional type, such as manufactured by I. G. Brenner, of Newark, Ohio. The cutter 30 may have as many as eight sets of cutters, of which about three to six may be in use at any one time, while others are being readied for use to maintain continuity of operation. The sets of cutters are arranged to receive glass roving from separate rolls of roving, not specifically indicated, each roll having as much as four and one-half miles of roving.

Glass fibers passing through the cutter 30 are chopped into fibers of predetermined length, advantageously not substantially less than one-fourth inch, and are discharged onto a moving belt 31. The belt 31 carries the cut fibers to a hopper 32, which discharges the fibers directly into the white water system, at a point sufficiently ahead of the point of discharge of the stock onto the Fourdrinier wire 24 to permit adequate dispersion of the added fibers.

Accurate control over the quantity of special fibers added to the white water system is afforded by controlling the speed of operation of the cutter 30, as well as the number of cutter sets thereof in operation at any time.

It should be understood that the term "special fibers" as used herein is not restricted to glass or other synthetic fibers, but includes cellulosic and other natural fibers.

Where the product incorporates any fibers of relatively great length and/or of a multi-filament structure, it may be of advantage to employ the improved method of this invention by adding such fibers directly into the white water system, without subjecting the fibers to the conventional processing, such as beating and refining. Moreover, in some cases it may be possible to form the paper stock entirely by the addition of dry "special" fibers into the white water system, without mixing the special fibers with a quantity of prepared slurry. In such cases it may be possible to eliminate many of the conventional components of the paper making system, such as the beater, stuff chest, stuff gate, and refiner.

Accordingly, reference should be made to the following appended claims in determining the full scope of the invention.

I claim:

1. The method of making a paper product in a paper making system comprised of a paper making machine, a circulating white water system, and a pump for conveying white water through the white water system, which method comprises preparing a slurry of processed paper making fibers, introducing the slurry into the circulating white water system to effect a substantial dilution of the slurry, thereafter introducing directly into the white water system a substantial quantity, relative to the paper making fibers, of multi-filament synthetic fibers not substantially less than about 1/4 inch in length and in substantially dry form, said synthetic fibers being introduced into the white water system downstream of the white water pump and not substantially further upstream of the web-forming portion of the paper machine than is necessary to effect dispersal of the synthetic fibers, providing for the dispersal of said synthetic fibers in the relatively large quantities of white water between the point of introduction thereof into the white water system and the web-forming portion of the paper machine, and flowing the dispersed synthetic fibers together with the mixed slurry and white water onto the web-forming portion of the paper machine.

2. The method of claim 1, in which the synthetic fibers are glass, the paper making fibers are cellulosic, and the proportions of glass and cellulosic fibers are about 75% and 25% respectively.

3. The method of claim 1, in which the synthetic fibers are introduced into the white water system upstream of the head box of the paper making machine.

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