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PAPER MANUFACTURING ROLL CONSTRUCTIONS AND PROCESSES

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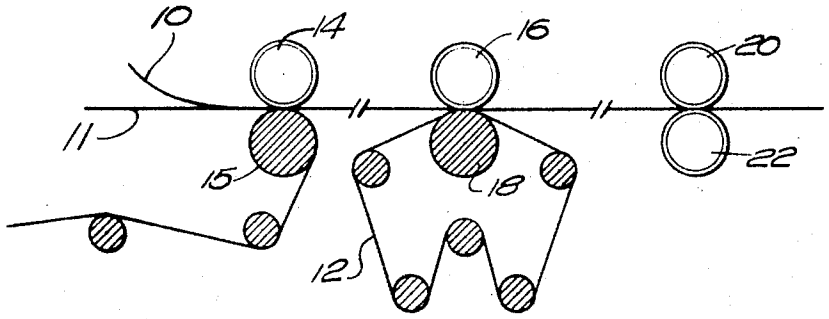


FIG. 1

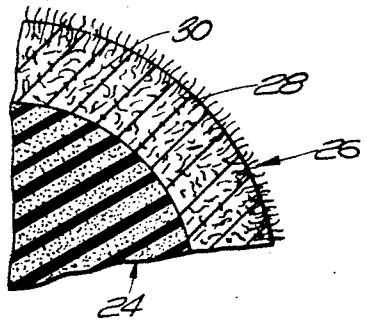


FIG. 2

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PAPER MANUFACTURING ROLL CONSTRUCTIONS AND PROCESSES

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ABSTRACT OF THE DISCLOSURE

In a paper making machine, following casting of the aqueous pulp suspension onto a moving web and partial drainage of water therefrom to form a wet sheet, water is pressed from the wet sheet by rolls that are characterized by a covering composed of an elastomer and a dispersion of hydrophobic fiber strands penetrating through the outer surface of the elastomer. Such rolls have superior release characteristics with respect to the wet sheet.

SUMMARY OF THE DISCLOSURE

The present invention relates to paper making machines and processes and, more particularly to enhancement of the release characteristics of rolls in contact with the advancing wet sheet following casting of the aqueous pulp suspension in any of the several different types of paper forming processes. In a typical paper making process, a dilute aqueous slurry of cellulose fibers, which have been produced by grinding wood pulp or the like, first is cast on an endless wire screen through which water is drained, next is advanced onto an endless felt, with which it passes between a series of so-called press rolls that squeeze and withdraw water therefrom, next is advanced by itself between a series of press rolls and then is advanced over heated drying cylinders. Difficulties have been encountered as a result of a tendency by fibers of the wet sheet to adhere to the press rolls with which they come in contact.

The primary object of the present invention is to provide improve release characteristics in the rubber cover of a press roll for paper sheet formation by the addition of fine fiber strands, ends of which penetrate and protrude through the finished, ground outer surface of the rubber cover. It is believed that, when the fibers are hydrophobic, the surface tension of a water film on the rubber cover surface is interrupted in such a way as to decrease adhesion of the wet paper filaments to the rubber cover surface as a whole. Other objects of the present invention will in part be obvious and will in part appear hereinafter.

DESCRIPTION OF THE DRAWINGS

The invention accordingly comprises the devices and processes possessing the particular components, steps and interrelationships, which are exemplified in the following detailed disclosure, the scope of which will be indicated in the appended claims. For a fuller understanding of the nature and objects of the present invention, reference is to be had to the following description taken in connection with the accompanying drawings, wherein:

FIG. 1 is a distorted cross-sectional, schematic view of a roll construction embodying the present invention; and

FIG. 2 is an exaggerated cross-sectional, broken-away detail view of one of the rolls of the construction of FIG. 1.

SPECIFIC DISCLOSURE

In a paper making process involving the present invention, the initial wet sheet **10**, is formed by casting a dilute aqueous slurry of cellulose fibers onto an endless wire screen **11**, as is shown in FIG. 1. In accordance with the present invention a so-called lumpbreaker roll **14**, which is a press roll embodying the present invention, serves to contact the advancing paper sheet in such a way as to flatten uneven agglomerations of fibers in various portions of the advancing sheet. The sheet next advances onto an endless felt **12**. The wet sheet and the felt advance into engagement between a series of press rolls, two of which are shown at **16, 18**, after the sheet is separated from screen **11** at **15**. Then the wet sheet advances between the nips of a series of press rolls, two of which are shown at **20, 22**. When advancing over wire screen **11**, on felt **12** and in contact with the various press rolls, generally the moisture content by total weight of the sheet is in excess of 35%. The rolls in direct contact with the wet sheet, during this time, are characterized by exceptional release properties in accordance with the present invention. It will be understood that such direct contact rolls may be above and/or below the advancing paper sheet.

As shown in FIG. 2, each of press rolls **14, 20** and/or **22** is shown as having a metal core **24** and an elastomeric veneer **26**. The metal core, for example, is in the form of a solid or hollow cylinder composed of metal such as steel or cast iron, or other dimensionally stable material. The veneer contains a matrix of an elastomer **28** and dispersed, randomly distributed fiber strands **30**. Preferably, the elastomer is synthetic and, most advantageously, is selected from the class consisting of chloroprene, chlorosulfonated polyethylene and ethylene propylene terpolymer. Preferably, the fiber strands are composed of a hydrophobic synthetic polymer, and, most advantageously, are selected from the class consisting of polyesters, polyamides and acrylics. Best results have been achieved with linear polyamides such as polyhexamethylene adipamide. For present purposes, the term hydrophobic is applied to a material having a regain of moisture from a bone dry condition of less than 5% based on original bone dry weight in an atmosphere having 65% relative humidity at 75° F. Preferably, by total weight of the combination, the strands range from 0.5 to 10.0% and the elastomer ranges from 99.5 to 90%. For best results, the strands range from ½ to 5 denier and from 1/64 to 2 inches long. Preferably the final composition ranges from 20 to 200 plastometer, ⅛" ball, Pusey and Jones.

EXAMPLE I

A press roll of the foregoing type was produced as follows. Polyhexamethylene adipamide strands, 1½ denier and 1½" long, were uniformly carded into a mass of uncured chloroprene rubber. The resulting dispersion of strands in chloroprene rubber was such that, by total weight, the strands were approximately 5% and the chloroprene composition was approximately 95%. The chloroprene composition was formulated in accordance with typical practice to give a hardness of 25 plastometer, ⅛ inch ball, Pusey and Jones. An iron core, 34 inches in diameter by 184 inches in length, was roughened by grit blasting and coated with cement in accordance with well established roll covering techniques. The foregoing formulation was applied in a 1 inch thickness onto the iron core and cured, finished and ground in accordance with well established roll manufacturing techniques. Examination revealed that the ends of the strands penetrated through the ground surface of the chloroprene roll cover. This ground surface was characterized by exceptional release characteristics with respect to wet paper sheet in contact therewith.

EXAMPLES II, III AND IV

The foregoing example is repeated with 50, 75 and 100 plastometer, ⅛ inch ball, Pusey and Jones, with similarly excellent results.

OPERATION AND CONCLUSION

The superior release characteristics of the rolls illustrated above are believed to be based, at least in part, on the effect of the free ends of the fiber shreds on the surface tension of a film of water on the roll. These free ends interrupt the uniform wetting of the roll by the wet paper sheet and, thereby, interrupt the uniformity of the surface tension of the layer of water that otherwise would exist on the roll cover. The result is that cellulose fibers from the wet paper sheet, which are swollen with moisture, have a greatly decreased tendency to adhere to the surface of the roll.

Since certain changes may be made in the foregoing disclosure without departing from the scope of the invention involved, it is intended that all matter shown in the accompanying drawing and described in the foregoing specification be interpreted in an illustrative and not in a limiting sense.

What is claimed is:

1. A roll for use in a paper making machine, said roll comprising a cylindrical core and a veneer, said veneer having an elastomeric matrix and fiber strands dispersed therein, free ends of said strands penetrating and protruding through the outer surface of said elastomeric matrix, said strands being composed of a hydrophobic synthetic polymer selected from the class consisting of polyesters, polyamides and acrylics, said matrix being selected from the class consisting of chloroprene, chlorosulfonated polyethylene and ethylene propylene terpolymer.

2. The roll of claim **1** wherein said strands are composed of a linear polyamide, being approximately within the ranges of ½ to 5 denier in diameter and 1/64 to 2 inches in length, said strands by total weight of said veneer ranging approximately from 0.5 to 10% and said elastomeric matrix by total weight of said veneer ranging approximately from 99.5 to 90%.

3. A process for squeezing water from a wet paper sheet, said process comprising the steps of advancing the paper

sheet between a pair of pressure surfaces, at least one of said surfaces being constituted by an elastomeric matrix interrupted by hydrophobic, synthetic, polymeric fiber strands which penetrate and protrude through the outer surface of said elastomeric matrix, reducing the surface tension of water in contact with said one of said surfaces by operation of said fiber strands, and freely advancing said paper sheet from contact with said one of said surfaces, said strands being composed of a hydrophobic synthetic polymer selected from the class consisting of polyesters, polyamides and acrylics, said matrix being selected from the class consisting of chloroprene, chlorosulfonated polyethylene and ethylene propylene terpolymer.

4. The process of claim **3** wherein said strands are composed of a linear polyamide, being approximately within the ranges of ½ to 5 denier in diameter and 1/64 to 2 inches in length, said strands by total weight of said veneer ranging approximately from 0.5 to 10% and said elastomeric matrix by total weight of said veneer ranging approximately from 99.5 to 90%.

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