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MANUFACTURE OF PAPER

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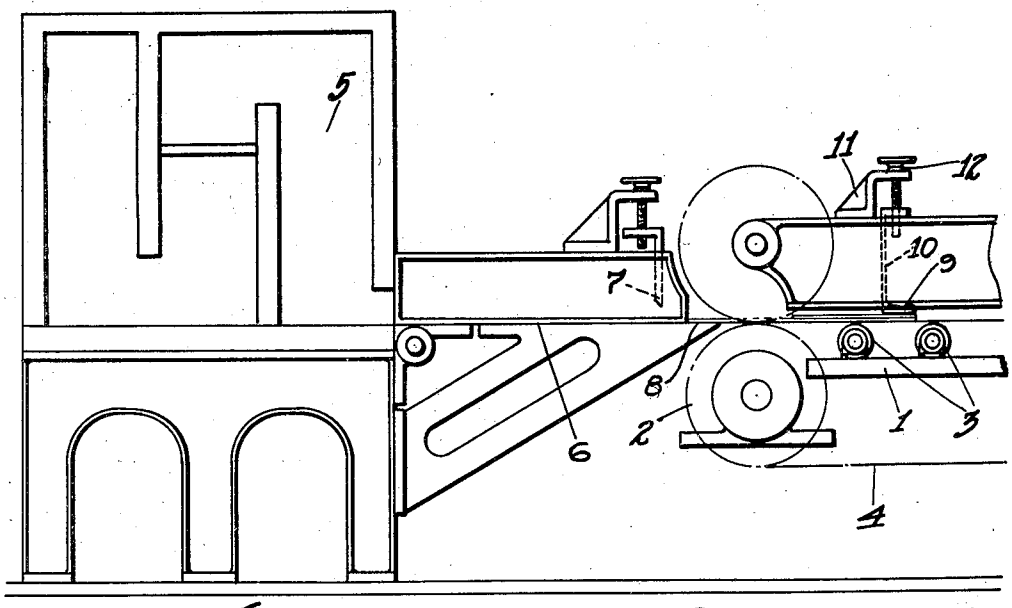
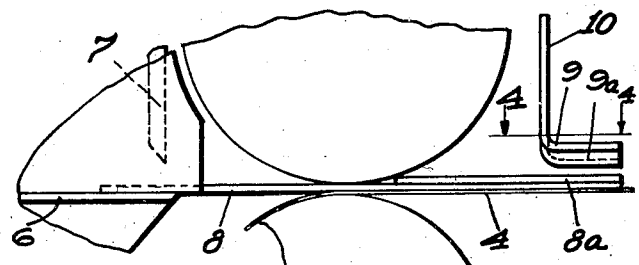
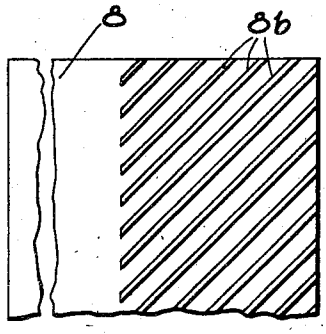


Fig. 1.





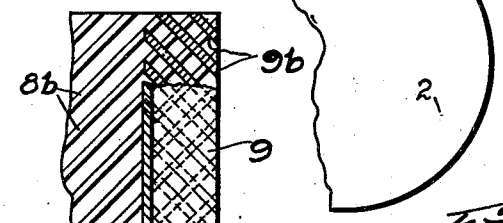


Fig. 2.

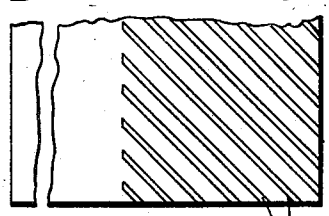


Fig. 3.

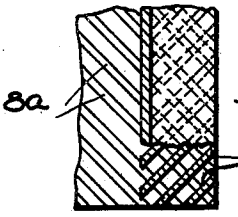


Fig. 4.

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MANUFACTURE OF PAPER

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Application July 1, 1932, Serial No. 620,454

10 Claims. (Cl. 92—44)

The present invention relates to the manufacture of paper, and has for its object to provide an improved mode of manufacture and apparatus therefor, whereby paper having a high degree of strength and toughness and other desirable qualities can be produced.

The invention is particularly adapted for use in connection with paper making machines of the Fourdrinier type, in which a stream of paper pulp stock is flowed onto a moving wire for the formation of the paper web as the water is removed from the stock. Briefly stated, the invention contemplates the provision of means whereby the fibers of the paper stock are caused to flow in different directions as the stock stream passes onto the wire, so that the fibers will lie in interlocking relation in the paper web, as formed on the wire. The practice of the invention thus results in the formation of paper of uniform quality and having great strength and durability, due to the interlocking of the fibers extending in different directions. The above and other advantageous features of the invention will hereinafter more fully appear from the following description with reference to the accompanying drawing, in which:—

Fig. 1 is a view in side elevation of the flow box end of a Fourdrinier machine embodying the invention.

Fig. 2 is a view of a portion of the parts of Fig. 1, on an enlarged scale.

Fig. 3 is a top plan view of a stock formation apron for conveying the stock water to the wire.

Fig. 4 is a horizontal section along the line 4—4 of Fig. 2, looking in the direction of the arrows, and showing the relation between the formation slice and apron.

Like reference characters refer to like parts in the different figures.

Referring first to Fig. 1, the portion of a Fourdrinier machine shown therein consists generally of a table 1 for supporting a breast roll 2 and table rolls 3, over which passes a wire 4. The paper pulp stock contained in the flow box 5 is carried to the wire 4 over an apron board 6, with the amount of stock passing onto the wire 4 determined by the position of the lower edge of a pond slice 7 vertically adjustable with respect to the apron board 6, in the usual manner.

As best shown in Fig. 2, a flexible formation apron 8 composed of rubber, or other material, extends from the apron board 6 to the wire, and in accordance with the present invention, the apron 8 is so formed as to direct a portion of the fibers of the stock stream in different directions. As best shown in Fig. 3, that portion of the formation apron 8 which extends beyond the slice 7 and overlays the wire 4 is provided with two sets of raised ribs 8*a* and 8*b* arranged in spaced relation, with one set of ribs 8*a* extending at an angle to the direction of travel of the wire 4, while the other ribs 8*b* extend at an angle opposite to that of the ribs 8*a*. Therefore, as the pulp stock flows onto the wire 4 over the surface of the formation apron 8, the ribs 8*a* and 8*b* serve to deflect the lowermost layer of fibers in the pulp stock in opposite directions with respect to the line of movement of the wire 4. Obviously, the layer of fibers in the pulp stock immediately above the top of the deflecting ribs 8*a* and 8*b* will remain more or less parallel to the direction of movement of the wire 4, so that as the paper web is formed on the wire 4, there will be an interlocking effect between the fibers of the lowermost layer and the fibers of the layer immediately above.

In order to increase interlocking of the fibers in the paper web, the invention further contemplates the provision of a formation slice 9 cooperating with the apron 8. As best shown in Figs. 2 and 4, the slice 9 is in the form of a bar with its under surface providing sets of raised ribs 9*a* and 9*b* spaced apart and oppositely inclined with respect to each other. Furthermore, when the formation slice 9 is positioned above the apron 8, the ribs 9*a* and 9*b* are also oppositely inclined with respect to the opposed ribs 8*a* and 8*b* respectively, of the apron 8. Therefore, the slice 9 serves to deflect fibers in the uppermost layer of pulp stock oppositely with respect to fibers in the lowermost layer, as deflected by the ribs 8*a* and 8*b*, all as indicated in dotted lines in Fig. 3.

For the purpose of varying the space between the opposed ribs of the slice 9 and the apron 8, the slice 9 is mounted on a carrier 10 supported from a bracket 11 by means of adjusting screws 12. Obviously, turning of the screws 12 will serve to raise, or lower, the formation slice 9 with respect to the formation apron 8. The above described vertical adjustment of the slice 9 permits it to be set at the proper distance above the apron 8, so as to obtain the desired degree of intermeshing of the fibers in the paper web formed on the wire 4.

In the manufacture of paper on a Fourdrinier machine embodying the invention, the passage of the pulp stock stream onto the wire 4 from between the slice 9 and apron 8 will be accompanied by the arrangement of the stock fibers in three different layers. In the lowermost layer, the fibers will extend at different angles from the center of the wire outwardly; in the middle layer, the fibers will extend substantially in the direction of the travel of the wire; while in the uppermost layer, the fibers will extend oppositely, not only with respect to each other, but also with respect to the fibers in the lowermost layer.

Consequently, as the paper web is formed on the wire 4 following removal of the water therefrom, the fibers in the different layers will arrange themselves in interlocking relation, as the fibers become condensed into the web. Obviously, the amount of interlocking can be controlled by varying the depth and degree of inclination of the several sets of ribs 8*a*, 8*b*, 9*a* and 9*b*, as well as the distance between the ribs of different sets, as determined by the setting of the slice 9.

It has been found that the above described interlocking of the fibers, as the paper web is formed on the wire, results in a number of advantageous features in the finished paper, not heretofore obtainable in the manufacture of paper on an ordinary Fourdrinier machine in which all the fibers flow onto the wire in substantially the same direction. In the first place, finished paper produced by the practice of my invention exhibits a high resistance to puncture and tearing, with the shearing strength of the paper substantially the same, whether torn longitudinally of the web or crosswise, owing to the uniform interlocking of the fibers throughout the sheet. Furthermore, paper resulting from the practice of the invention is less liable to crack or tear when creased or folded, due to the greater tenacity resulting from the interlocking of the fibers. It has also been found that such paper is of uniform thickness throughout, due to the elimination of thin spots, such as sometimes occur from unequal distribution of fibers all extending in substantially the same direction.

From the foregoing, it is apparent that by the present invention there is provided an improved mode of manufacturing paper on machines of the Fourdrinier type, characterized by the positive and predetermined deflection of the fibers in the pulp stock stream as it flows onto the Fourdrinier wire, the initial disposition of the fibers being maintained as the paper web forms on the wire to secure interlocking of the fibers in the finished product.

I claim:

1. The improvement in the manufacture of paper, which consists in causing the fibers in the lowermost layer of a stream of paper pulp stock to extend in different directions with reference to the undisturbed fibers in the layer immediately above, as the stock stream flows onto a moving Fourdrinier wire.

2. In apparatus for the manufacture of paper, the combination with a moving Fourdrinier wire and a flow box for delivering a stream of paper pulp stock thereto, of means interposed between the flow box and the wire for positively causing deflection of the lowermost and uppermost layers of pulp stock in different directions, both with respect to each other and with respect to an intermediate layer of fibers moving in the direction of said wire as the stock stream flows thereon.

3. In apparatus for the manufacture of paper, the combination with a moving Fourdrinier wire and a flow box for delivering a stream of paper pulp stock thereto, of an apron extending between the flow box and the wire for positively deflecting the fibers in the lowermost layer of stock as it flows onto the wire.

4. In apparatus for the manufacture of paper, the combination with a moving Fourdrinier wire and a flow box for delivering a stream of paper pulp stock thereto, of an apron extending between the flow box and the wire and providing spaced ribs oppositely inclined with respect to the direction of movement of the stock stream onto the wire.

5. In apparatus for the manufacture of paper, the combination with a moving Fourdrinier wire and a flow box for delivering a stream of paper pulp stock thereto, of an apron extending between the flow box and the wire for positively deflecting fibers in the lowermost layer of stock flowing onto the wire in opposite directions and a slice spaced above said apron for simultaneously deflecting the fibers of the uppermost layer of stock.

6. In apparatus for the manufacture of paper, the combination with a moving Fourdrinier wire and a flow box for delivering a stream of paper pulp stock thereto, of an apron extending between the flow box and the wire provided with spaced ribs for deflecting fibers in the lowermost layer of stock in different directions and a slice spaced above said apron providing spaced ribs oppositely inclined with respect to the ribs of said apron.

7. In apparatus for the manufacture of paper, the combination with a moving Fourdrinier wire and a flow box for delivering a stream of paper pulp stock thereto, of an apron extending between the flow box and the wire provided with spaced ribs for deflecting fibers in the lowermost layer of stock in different directions and a slice spaced above said apron providing spaced ribs oppositely inclined with respect to the ribs of said apron for deflecting the fibers in the uppermost layer of stock oppositely with respect to the fibers of the lowermost layer.

8. In apparatus for the manufacture of paper, the combination with a moving Fourdrinier wire and a flow box for delivering a stream of paper pulp stock thereto, of an apron extending between the flow box and the wire provided with spaced ribs for deflecting fibers in the lowermost layer of stock in different directions and a slice spaced above said apron providing spaced ribs oppositely inclined with respect to the ribs of said apron for deflecting the fibers in the uppermost layer of stock oppositely with respect to the fibers of the lowermost layer.

9. In apparatus for the manufacture of paper, the combination with a moving Fourdrinier wire and a flow box for delivering a stream of paper pulp stock thereto, of an apron extending between the flow box and the wire provided with spaced ribs for deflecting fibers in the lowermost layer of stock in different directions and a slice spaced above said apron providing spaced ribs oppositely inclined with respect to the ribs of said apron for deflecting the fibers in the uppermost layer of stock oppositely with respect to the fibers of the lowermost layer, with the fibers of an intermediate layer extending substantially in the direction of movement of the wire.

10. The improvement in the manufacture of paper, which consists in causing the fibers in the lowermost and uppermost layers of a stream of paper pulp stock to be simultaneously deflected in different directions, both with respect to fibers in the same layer and fibers of the other of said deflected layers, said deflection of the fibers taking place without disturbing the fibers of an intermediate layer and as the stock stream flows onto a moving Fourdrinier wire.

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