

Nov. 19, 1940.

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2,222,469

APPARATUS FOR MAKING PAPER

Filed Oct. 17, 1936

2 Sheets-Sheet 1

Fig. 1.

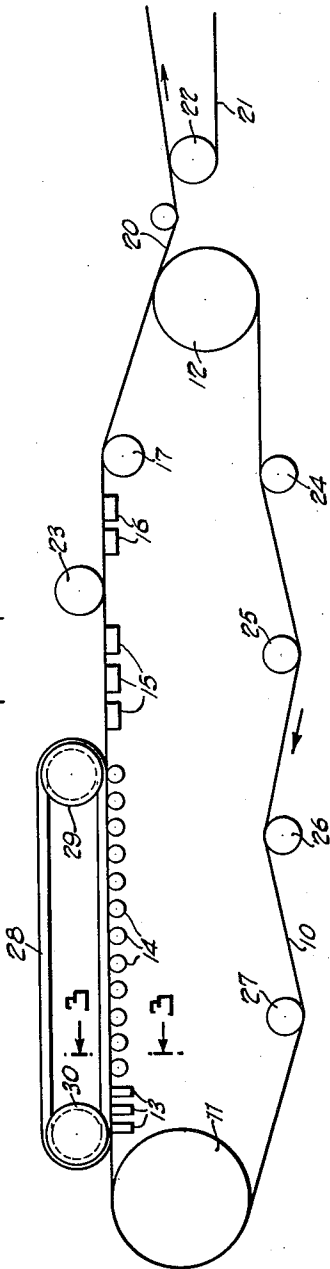
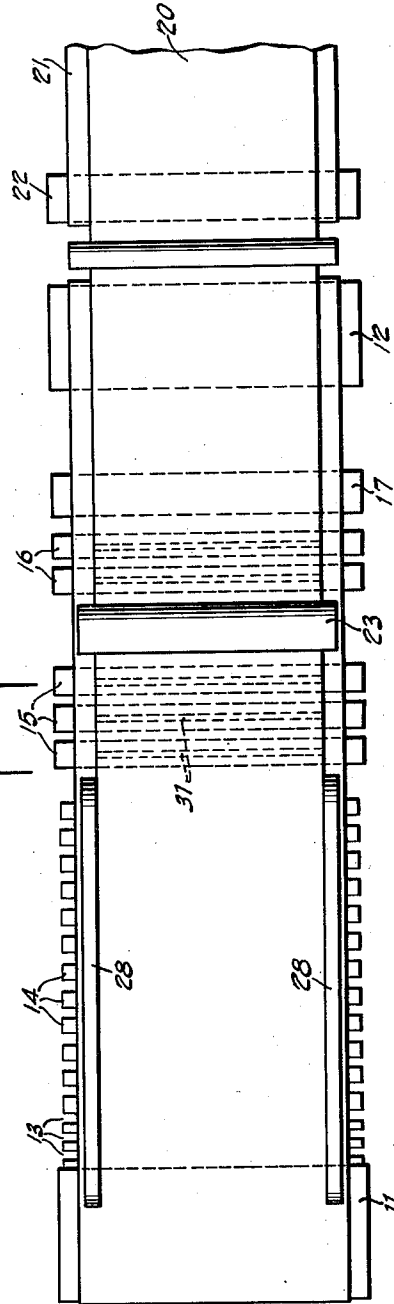


Fig. 2.



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Fig. 3.

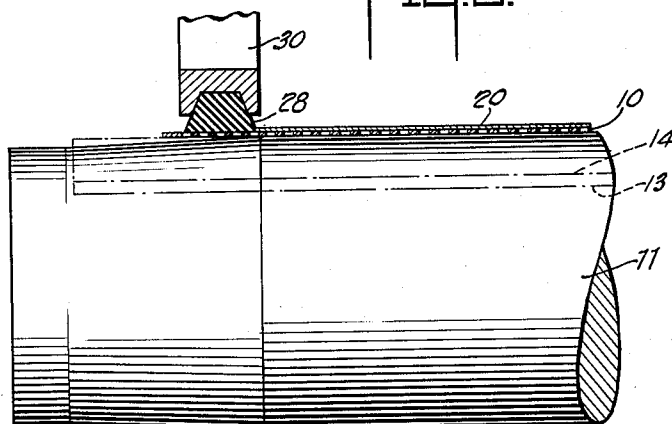
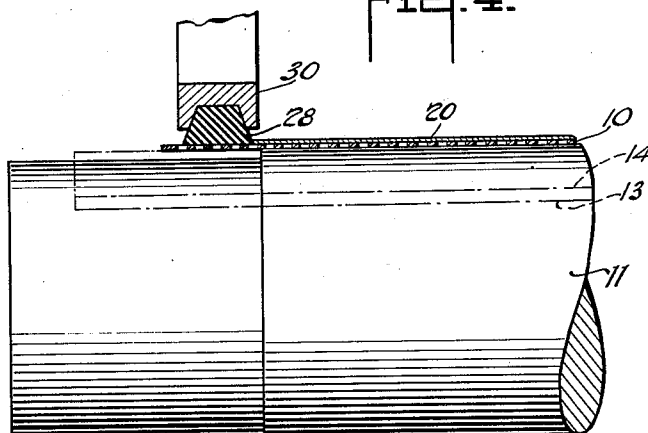


Fig. 4.



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to International Paper Company, New York,
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Application October 17, 1936, Serial No. 106,131

1 Claim. (Cl. 92-44)

My invention relates to a method and apparatus for making paper, or more particularly, to a method and apparatus for increasing the life of a Fourdrinier wire, thereby lessening the cost of making paper. In greater detail the invention comprises the elimination of a great percentage, if not all, of the stresses and strains which cause Fourdrinier wires to split adjacent their edges long before the body of the wire has rendered full use.

It is a common experience in the use of Fourdrinier wires to find that the edges of the wire start to crack after several days of use, and in a very short while these cracks usually become enlarged and extend inwardly toward the center of the wire. In many instances such cracks or tears at the edge of the wire catch on a suction box or other portion of the mechanism and cause the wire to tear inwardly to such an extent that it must be discarded immediately. This means that the width of paper which may be formed on a machine gradually, or quickly as the case may be, decreases as the deckle straps are moved inward beyond the ends of the cracks until the machine is running at such lowered efficiency that further use of the wire is no longer possible.

The object of my invention is to eliminate the reason for the formation of these edge cracks or tears and thereby to increase the lifetime of the wire to a considerable extent. In other words, the lifetime of the wire on a machine employing my invention is determined by the length of time corrosion and friction of the wire on the rolls, suction boxes and other parts of the machine wear the wire to such an extent that the wire as a whole is obsolete. The average lifetime of a Fourdrinier wire is thereby increased several weeks and the annual expense of running a Fourdrinier machine lessened by a large amount.

The full details of my invention will be apparent from the following specification which, taken in connection with the accompanying drawings, discloses preferred embodiments thereof.

Referring to the drawings wherein like numerals refer to like parts throughout:

Fig. 1 schematically discloses a side elevation of a conventional Fourdrinier machine;

Fig. 2 is a plan view thereof;

Fig. 3 is a detailed view of a roll of the Fourdrinier machine, in this instance the breast roll, having my invention embodied thereon; and

Fig. 4 is a similar view showing an alternative form of the invention.

Referring to Fig. 1, there is disclosed the usual Fourdrinier wire 10 which consists of a foraminous, endless sheet extending about the breast roll 11 at the wet end of the machine and the couch roll 12 at the dry end of the machine. In the usual machine the wire passes over drain boards 13 where the greatest percentage of the water is removed from the pulp, table rolls 14 where more water is removed, suction boxes 15 where the moisture content of the pulp is reduced to such an extent that the web begins to appear as a sheet of paper, secondary suction boxes 16 which remove more of the water and a guide roll 17. The paper web 20 formed on the wire then passes to the usual felt 21, passing about the felt roll 22, and into the dryers and other mechanism where the water content is reduced to a minimum and the paper is otherwise finished. The numeral 23 refers to the usual dandy roll which operates to smooth the paper surface of the web as it is being formed. The wire passes about the couch roll 12 and contacts tensioning rolls 24, 25, 26 and 27 and then passes around the breast roll 11 toward the mechanism previously described. The usual machine is supplied with deckle straps 28, passing about adjustably spaced deckle pulleys 29 and 30 mounted above the wet end of the wire, for the purpose of confining the stream of pulp while it is in extremely liquid condition at the wet end of the machine.

Referring to Fig. 2, it is seen that the distance between the inner edges of the deckle straps 28 is less than the width of the wire in order that drainage throughout the surface of the wire will be uniform, since leakage at one or the other side of the wire would permit a sudden rush of water to disrupt the fibre formation. It is therefore apparent that the web 20 is of lesser width than the wire 10 and that each edge area of the wire is not in use as a web-forming medium. The suction boxes 15 and 16 comprise means forcibly to withdraw water from the forming web and for this purpose consist essentially of almost completely closed receptacles provided with openings 31 adjacent the surface of the wire 10. The suction boxes are suitably connected to some means for producing at least a partial vacuum therein and water is drawn through the wire and openings 31 for the purpose described. Since the width of the paper web is variable in accordance with the spacing of the deckle straps 28, the length of the openings 31 is adjustably determined by suitable means well known in the art in order that portions of the wire beyond the edges of the web will not be in contact with

openings communicating to the interior of the suction boxes. There is, therefore, a portion of the wire at each edge thereof which performs no web forming work and which is not subjected to the greater frictional drag of the suction boxes adjacent the area carrying the web nor exposed to the chemicals causing corrosion within the area of drainage. The area of drainage of the wire is therefore abraded and corroded to a greater extent than the edge areas of the wire.

It is necessary in order that the Fourdrinier wire shall run smoothly that it be placed under tension by the action of rolls 24, 25, 26, 27, and it also becomes necessary after long usage of the machine to regrind the surfaces of certain of the major rolls such as rolls 11, 12, 17, 24, 25, 26 and 27 since they are chemically corroded to a greater extent in the area of drainage than at their ends. It is my discovery that the formation of edge cracks and tears in the wire (heretofore thought to be due primarily to flapping of the edge of the wire, uneven tension applied to the wire, catching of the wire on edges of the suction boxes, drain boards, etc. or other causes) is due to the greater corrosion and abrasion of the wire adjacent the area of drainage and to the greater abrasion and corrosion of the major rolls adjacent the area of drainage. Since the decrease in thickness of the wire due to the above actions is often only a few thousandths of an inch it has always been considered that automatic tensioning devices or manual tensioning devices placed the proper longitudinal strain upon all elements of the wire throughout its width. However it will be seen, if the wire is considered a cylinder of inner radius r , that the amount of wear on the inner surface of the wire increases the radius by an amount x , and the inner circumference of the cylinder will be increased by an amount equal to $2\pi x$. The following table shows that a considerable increase in the internal length of the wire results from a very small decrease in its thickness:

Table

x inches	$2\pi x$ inches.
.005	$.031416 = \frac{1}{32} + \text{in.}$
.01	$.062832 = \frac{1}{16} + \text{in.}$
.15	$.094248 = \frac{3}{32} + \text{in.}$
.02	$.125664 = \frac{1}{8} + \text{in.}$

Therefore, in order to place the proper tension upon the major portion of the wire to prevent it from slipping after the wire has been in use for some time, it is necessary to overload the edge portions of the wire which have not become worn and thus to place the edges under tensile strains far beyond the maximum safe loads. This effect is especially aggravated if the rolls have not been reground for a considerable length of time since the edges of the wire are placed under greater tensile strain before the wire is used.

My invention comprises correcting this difficulty by reducing the diameters of at least one, or several, or the majority, or all, of the major rolls of a Fourdrinier machine beyond the normal area of drainage. Fig. 3 shows in exaggerated detail the preferred form of the invention, and Fig. 4 likewise shows in exaggerated detail a second form of the invention. Referring to Fig. 3 there is shown the breast roll 11 and,

in skeleton outline, the drain boards 13 and a table roll 14. The wire 10 is indicated as extending beyond the deckle straps 28 which limit the area of drainage. Substantially at or near the edge of the area of drainage the breast roll is progressively decreased in diameter toward the end of the roll. Since the deckle straps 28 press the wire against the drain boards 13 and table rolls 14 these members are preferably of uniform diameter throughout in order to provide a level foundation for the wire. The forming paper web 20 is shown as extending to the inner edge of the deckle straps 28. The reduction in diameter of the roll 11 is greatly exaggerated in the drawing since a reduction of one-sixty-fourth of an inch in radius in the last several inches of the usual breast roll is usually sufficient. The rolls 12, 17, 24, 25, 26 and 27 may be similarly treated, either alone or together with other rolls, but the invention is preferably applied to the breast roll or the couch roll or both of said rolls. It is therefore seen that the strains in the edge areas of the wire will be substantially the same or less than the strains in the drainage area of the wire since, first, the rolls may be abraded and corroded to a considerable extent before their intermediate diameter become lesser than their end diameters, and secondly, the inner surface of the wire itself may be abraded and corroded to a considerable extent. As the tensioning devices take up the slack thus created in the drainage area of the wire the sole effect will be to cause the edge areas of the wire more closely to approach the recessed surfaces of the ends of the rolls. Since the edge areas of the wire perform no useful work it does not matter that they may be diverted from the plane of the drainage area of the wire, especially if the drain boards and table rolls remain uniform throughout their lengths.

Fig. 4 discloses an extreme modification wherein the two ends of the rolls are uniformly reduced in diameter beyond the drainage area. It is obvious that other modifications in contour of the reduced portions may be provided within the purview of my invention.

It is not my intention to disclaim a similar reduction in the diameters of the ends of the table rolls 14, or a reduction in the height of the baffle boards 13 or suction boxes 15 and 16 adjacent the edge areas of the wire, it being obvious that such would be within the purview of my invention. I consider my invention to comprise lessening the total distance around wire-contacting elements of the machine at their ends beyond the area of drainage in order to permit the drainage area of the wire to become worn without placing the edge areas under increased tension.

I claim:

In a paper making machine of the Fourdrinier type provided with the usual traveling wire, breast and couch rolls and suction devices, at least said breast roll having a uniform diameter throughout the greater portion of its width and having its ends decreased in diameter, said wire being of a width equal to the overall length of the roll and greater than the effective drainage area of said suction devices.

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