

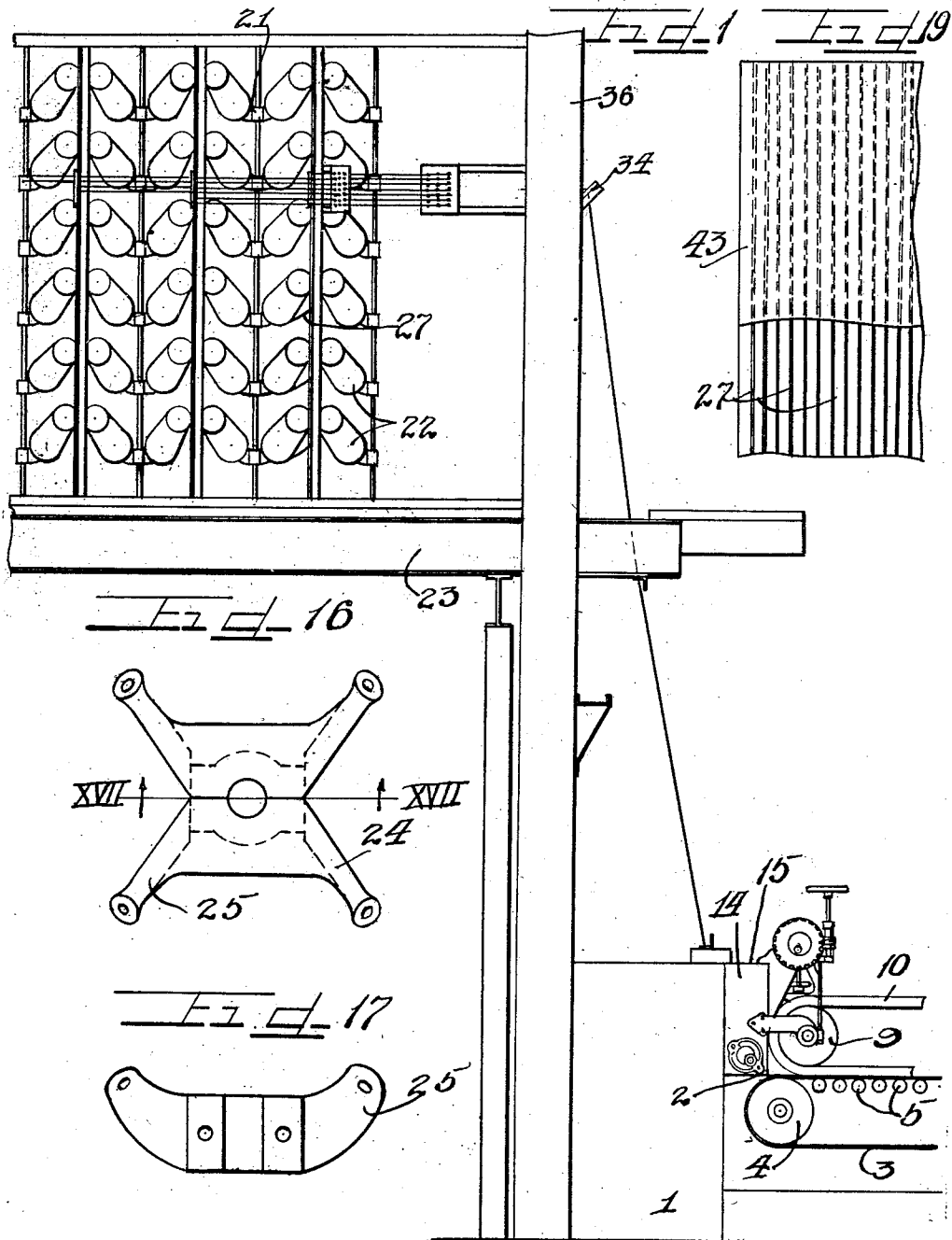
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N. S. STONE ET AL

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METHOD AND APPARATUS FOR MAKING REENFORCED PAPER

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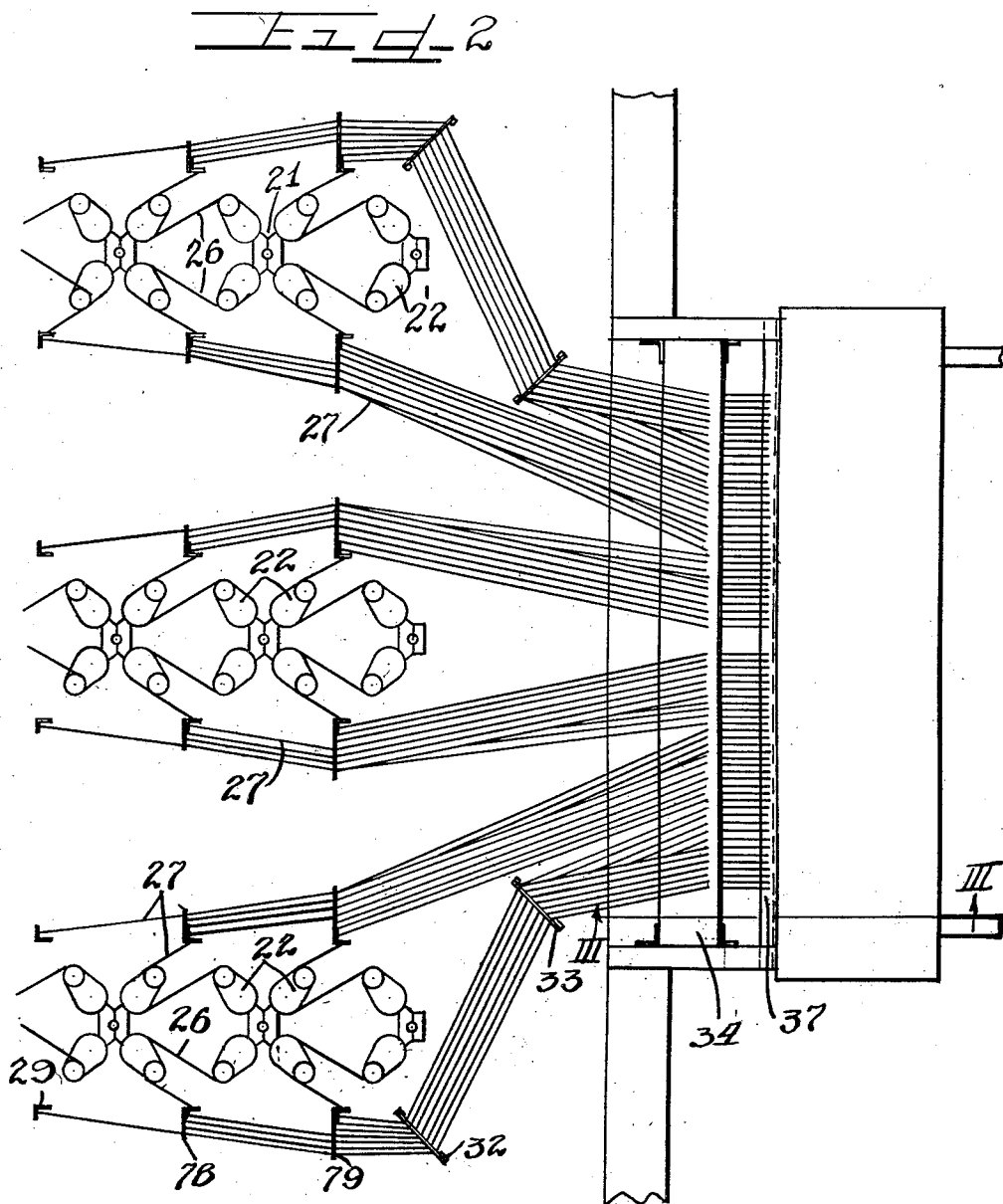
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METHOD AND APPARATUS FOR MAKING REENFORCED PAPER

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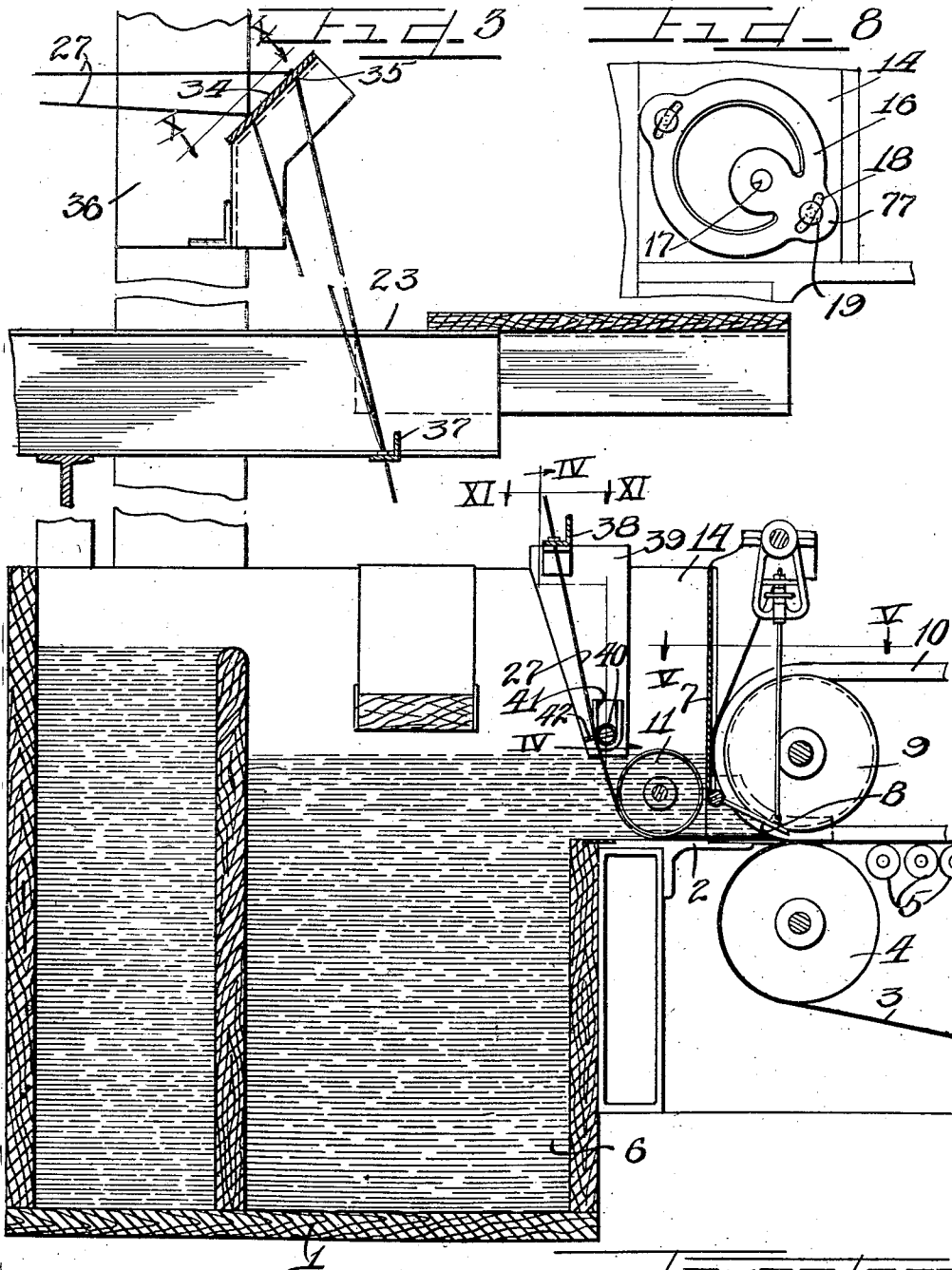
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METHOD AND APPARATUS FOR MAKING REENFORCED PAPER

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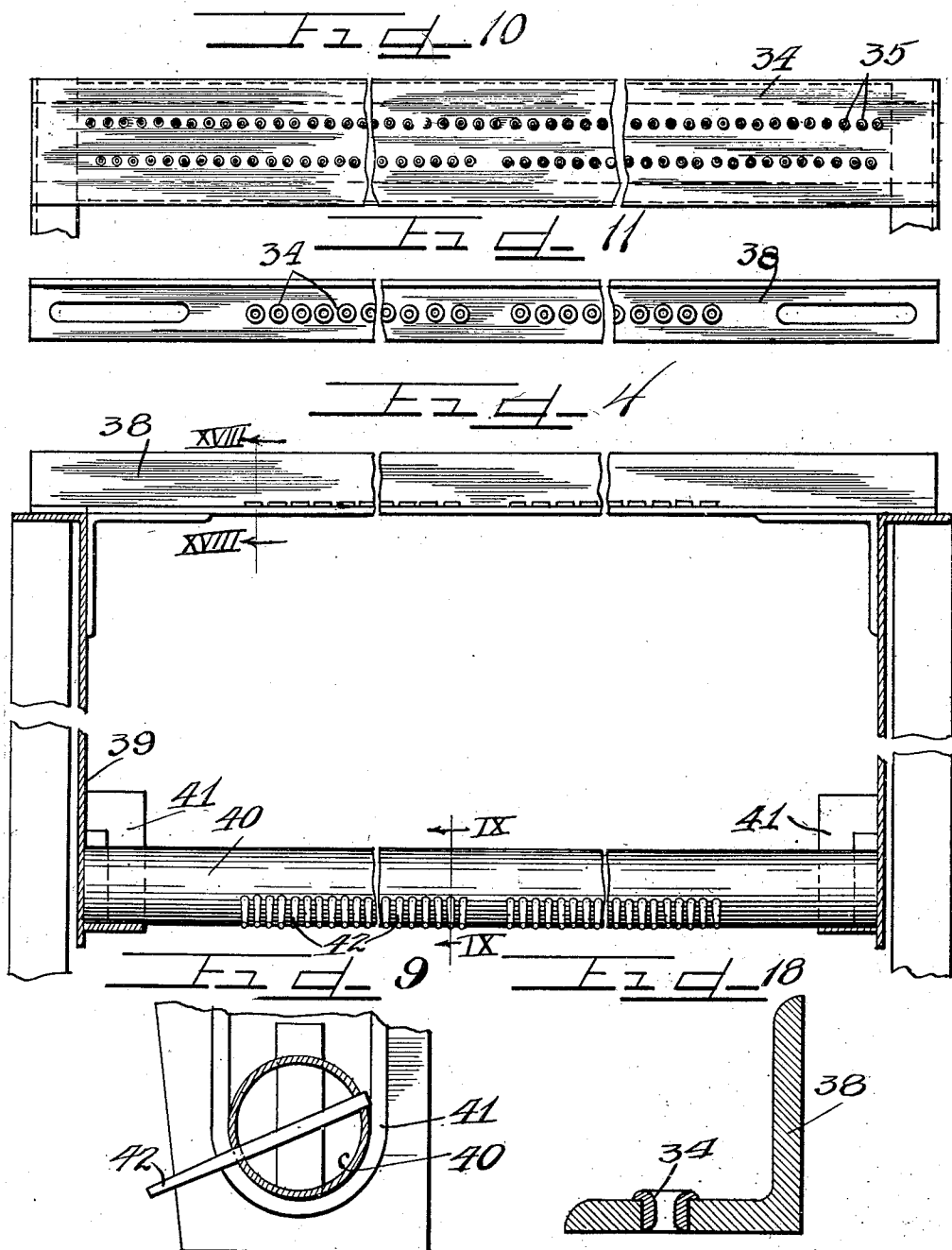
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METHOD AND APPARATUS FOR MAKING REENFORCED PAPER

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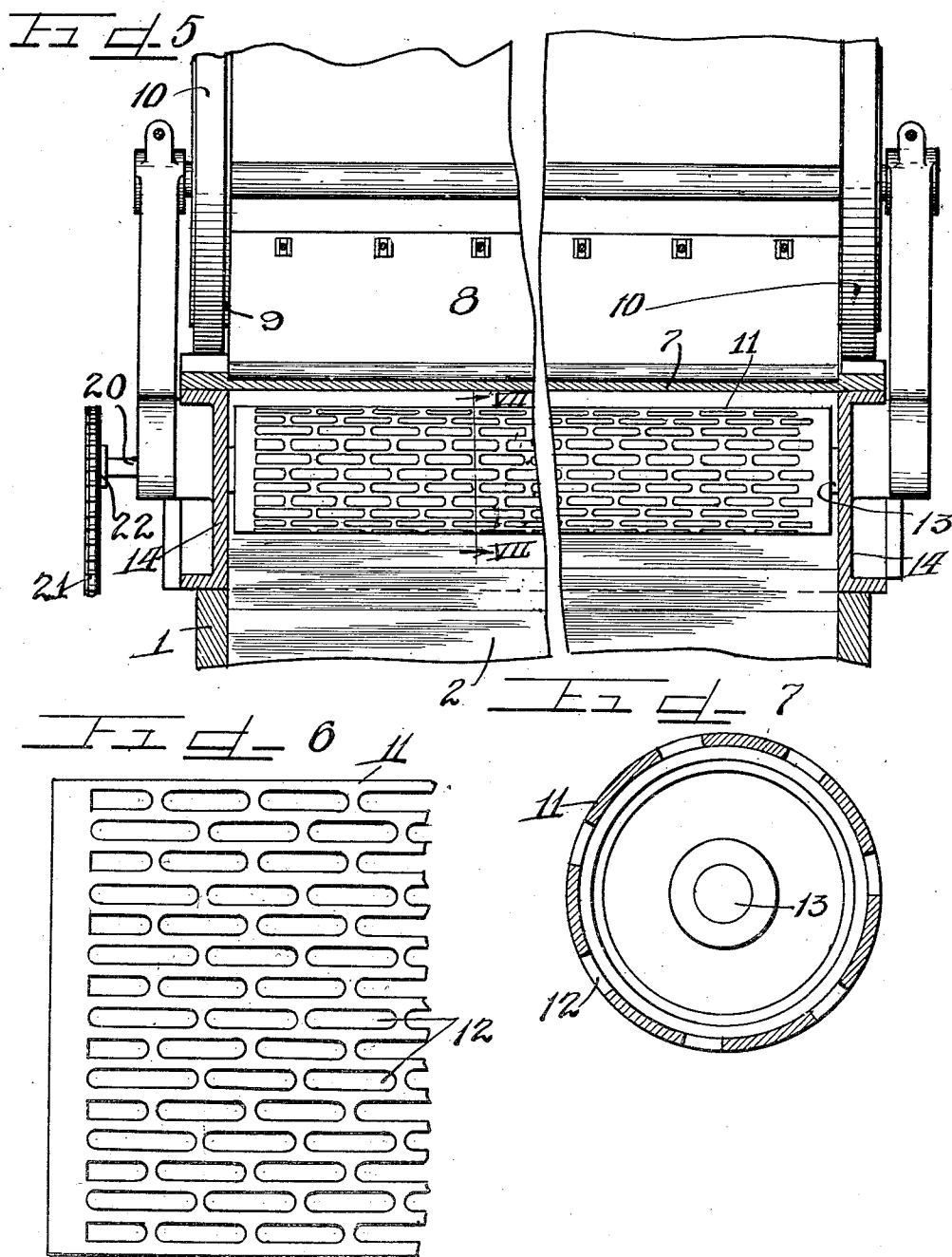
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METHOD AND APPARATUS FOR MAKING REENFORCED PAPER

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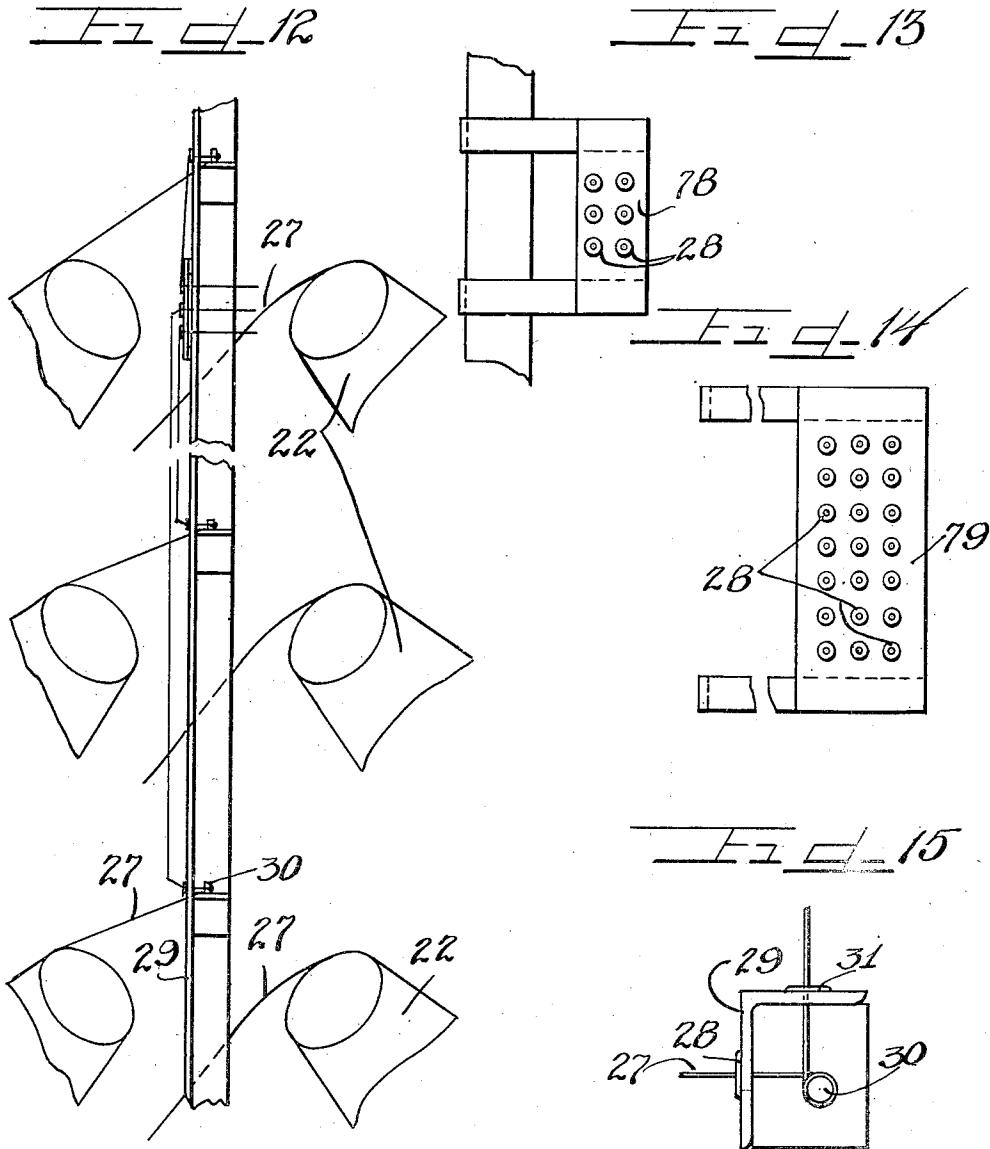
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METHOD AND APPARATUS FOR MAKING REENFORCED PAPER

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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR MAKING REENFORCED PAPER

Application filed April 15, 1929. Serial No. 355,075.

This invention relates to a method and apparatus for making reenforced paper.

It has heretofore been proposed to incorporate reenforcing material, such as fabric and individual strands into paper and the like, either while the paper was in the process of formation or by placing the reenforcing material between two sheets or webs of the partially dried or finished paper. While the bonding of the reenforcing material with the paper fiber is stronger and more satisfactory if the reenforcing material is incorporated during the process of manufacturing the paper, such a method in connection with modern relatively high speed paper machines presents difficulties from the standpoint of continuous and satisfactory operation of the machine.

It is an object of this invention to overcome these difficulties and to provide a method and apparatus for reenforcing paper and the like, wherein the reenforcing material may be continuously incorporated in the paper or like web material during the process of its manufacture without necessitating any substantial alterations or changes in the usual standard types of modern paper making machines.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a side elevational view of the head end of a Fourdrinier paper machine showing the installation of feeding mechanism for incorporating reenforcing material in paper or the like.

Figure 2 is a partial top plan view of Figure 1.

Figure 3 is an enlarged broken sectional view taken substantially on line III—III of Figure 2.

Figure 4 is a sectional view taken substantially on the broken line IV—IV of Figure 3, with parts in elevation.

Figure 5 is a broken sectional view taken substantially on line V—V of Figure 3.

Figure 6 is a fragmentary enlarged plan view of the slotted roll shown in Figure 5.

Figure 7 is an enlarged sectional view taken on line VII—VII of Figure 5.

Figure 8 is an enlarged detail end view of the roll adjusting mechanism.

Figure 9 is an enlarged sectional view taken on line IX—IX of Figure 4.

Figure 10 is a broken enlarged view taken substantially along line X—X of Figure 3.

Figure 11 is a broken enlarged plan view taken substantially along the line XI—XI of Figure 3.

Figures 12 to 17 inclusive are enlarged detail views of the supporting and guiding devices for the reenforcing strands.

Figure 18 is an enlarged sectional view taken substantially on line XVIII—XVIII of Figure 4.

Figure 19 is a fragmentary plan view of a sheet of reenforced paper.

As shown in the drawings:

As best shown in Figures 1 and 3, the reference numeral 1 indicates a stock vat or head box forming a reservoir for the stock from which the paper or like material is to be made. Our invention is here illustrated in connection with a paper machine of the Fourdrinier type, comprising said head box 1, an apron 2 over which the stock flows onto a forming wire 3 traveling over the usual breast roll 4 and table rolls 5. The stock 6 within the head box 1 is allowed to flow onto the forming wire 3 under the desired head, maintained by any suitable type of slice 7, here illustrated as being of the high inlet type with a flexible and adjustable lip 8. The usual deckle pulleys 9 and deckle straps 10 are associated with the Fourdrinier table to govern the width of the paper web formed thereon.

A roll 11 (Figures 3 and 5) preferably perforated, is mounted in the path of the flow of stock from the head box 1 onto the forming wire 3 in a position just in advance of the slice 7 and above the apron 2 with its surface substantially touching the back of said slice and the top of said apron. In this position all, or substantially all of the stock must pass through the perforations 12 of said

roll 11 before passing onto the forming wire 3 and in so doing the eddies and swirls of stock are quieted by passage through said roll 11. Preferably the perforations of said roll 11 are in the form of slots rather than circular apertures for a reason that will appear later.

The shaft 13 of said perforated roll 11 extends through the side walls 14 of the head box extension 15 and the ends of said shaft are journaled eccentrically in circular bearing plates 16 (Figure 8) as at 17. Said bearing plates 16 are provided with diametrically opposed lugs or extensions 17 having arcuate slots 18 through which extend bolts 19 for securing said bearing plates to the outside of said walls 14. By loosening the nuts on the bolts 19 and rotating the bearing plates 16, the height of the bearings 17 may be adjusted to vary the clearance between the surface of the perforated roll 11 and the upper surface of the apron 2. The importance of being able to vary this clearance will more clearly appear hereinafter. The rear end of the shaft 13 is extended as at 20 and provided with a sprocket gear 21 and chain 22, or other suitable driving means, by means of which the speed at which the roll 11 is revolved may be varied for a purpose that will appear later.

According to the principles of this invention, the reinforcing material, which may be strands of paper, manila, jute, sisal, silk, cotton, linen, or the like, is introduced into the flow of stock ahead of the slice 7 by passing said material around and under the perforated roll 11. A creel or creels 21 carrying a plurality of bobbins or spools 22 of the reinforcing strand are positioned upon a flooring 23, or other supporting platform, above the head box 1.

Said bobbins 22 are suitably mounted upon supporting members 24 in vertically and horizontally aligned rows or banks. Each of the supporting members 24 may suitably be provided with four upwardly and outwardly inclined pegs 25, (Figures 16 and 17), each adapted to hold a bobbin 22. In order that the process may be continuous, each bobbin in operation has a corresponding full bobbin connected to it, as by the strand 26, (Figure 2) and adapted to function as soon as the first bobbin is exhausted.

The operating strands 27 of reinforcing material are led from the respective bobbins 22, as best shown in Figures 10 to 18 inclusive, first passing through eyes 28 in vertically supported angle irons 29, and around tensioning pegs or knobs 30, from which the strands are led at right angles through eyelets 31 in the other face of said angle irons 29. The strands 27 then pass successively through guide plates 78 and 79 and thence through a series of guiding plates 32 and 33, which converge the strands to a main guide

plate 34 having two rows of eyelets 35 (Figure 10).

Plate 34 is mounted at an inclined angle from a vertical post or support 36 and deflects the direction of the strands 27 downwardly towards the head box 1. A plurality of apertured angle irons 37 and 38 serve further to guide and space the strands 27. The guide 38 is mounted between brackets 39 secured to the inside of the vat walls 14. Below said guide plate 38 and adjacent the perforated roll 11 is mounted a master comb 40, said comb being supported at its end in yokes 41 formed on the plates 39. The master comb 40 suitably comprises a tube or pipe having a plurality of spaced pins or pegs 42 secured therein and extending outwardly to guide and space the strands 27.

The strands 27 after passing between the teeth 42 of the master comb 40 are conducted under the perforated roll 11 and carried by the flow of stock over the apron and under the slice 7 and flexible lip 8 onto the forming wire 3. In starting up the operation, it is sufficient to bunch the strands 27 together after passing them under the perforated roll 11 and then allow the current of stock to carry the bunched up strands onto the forming wire. After the strands have been carried a short way over the Fourdrinier table, the pull of the stock upon the strands is sufficient to straighten them out and cause them to be under sufficient tension to unwind from the bobbins 22.

The function of the perforated roll 11 is not only to guide the strands 27 into the flow of stock but to produce the desired tension upon the strands and locate them at the desired position relative to the surfaces of the web of paper or the like being formed on the forming wire. The amount of tension put upon the strands 27 as they flow out over the forming wire is controlled by regulating the speed of revolution of the perforated roll 11, which may be varied at will. In conjunction with the tension put upon the strands 27, the elevation of the perforated roll 11 determines the position of the strands within the finished sheets. If the roll 11 is raised to increase the clearance between the bottom surface of said roll and the upper surface of the apron 2, especially if the tension on the strands 27 is lessened, the strands will tend to float upon the sheet of stock as it flows onto the wire and will become imbedded in the upper surface of the sheet as formed.

On the other hand, if the perforated roll 11 is lowered to afford as little clearance as possible and the tension increased, the strands will tend to sink to the lower side of the web being formed on the Fourdrinier table and will be found on the wire side of the finished sheet. As is often preferable, the strands 27 are caused to assume an inter-

mediate position between the surfaces of the sheet or web of paper or like material, so that an equal thickness of fiber lies above and below the parallel strands of reinforcing material.

5 The method and apparatus above described is suitably adapted for the manufacture of any type of reinforced paper or the like of varying caliber, but is especially suited to the manufacture of a reinforced kraft
10 paper. The natural strength of the kraft paper is still further increased by the reinforcing strands to make a sheet, such as the sheet 43 (Figure 19), wherein the presence
15 of the longitudinal strands 27 prevents tearing of the sheet in the across the machine direction. It has been found preferable to use a strand of sisal or other material having short fibers or fiber ends extending from the main strand, since with such material a more
20 perfect bonding between the pulp or paper fibers and the reinforcing strands is possible. It will be understood however that any suitable reinforcing material may be used and that transverse as well as longitudinal
25 strands may be employed.

One of the important features of our invention is the provision of a perforated roll located ahead of the slice and adjustable both
30 as to speed and height to serve as a guide and tensioning means for the strands. The apertures in the perforated roll 11 are preferably slots rather than circular holes with the slots extending longitudinally of the roll,
35 since by the use of slots rather than circular apertures the strands 27 have less of a tendency in passing around the roll 11 to become displaced in their relative position. This is because the slots 12 can be made narrower
40 than circular apertures of the same area so that the roll 11, where slots are used, presents a more nearly cylindrical surface of contact for the strands 27.

We are aware that many changes may be made and numerous details of construction
45 may be varied through a wide range without departing from the principles of this invention, and we, therefore, do not purpose limiting the patent granted hereon otherwise
50 than necessitated by the prior art.

We claim as our invention:

1. In combination with a paper machine including a flow box and forming wire, a
55 roll positioned in the path of the flow of stock ahead of the forming wire and means for guiding spaced reinforcing strands to said roll to pass thereunder into the flow of stock onto said wire.

60 2. In combination with a Fourdrinier paper machine including a flow box, apron, slice and forming wire, a perforated roll positioned over said apron ahead of said
65 slice in the path of the flow of stock onto the forming wire and means for guiding re-

enforcing material to said roll to pass thereunder into the stock flowing onto said wire.

3. In combination with a paper machine including a flow box and forming wire, a
70 roll positioned in the path of the flow of stock ahead of the forming wire, means for rotating said roll at a variable speed and means for guiding spaced reinforcing strands to said roll to pass thereunder into the flow of stock onto said wire.
75

4. In combination with a Fourdrinier paper machine including a flow box, apron,
80 slice and forming wire, a perforated roll positioned over said apron ahead of said slice in the path of the flow of stock onto the forming wire, means for rotating said roll at a variable speed and means for guiding reinforcing material to said roll to pass thereunder into the stock flowing onto said wire.
85

5. In combination with a Fourdrinier paper machine including a flow box, apron,
90 slice and forming wire, a perforated roll positioned over said apron ahead of said slice in the path of the flow of stock onto the forming wire, means for guiding reinforcing material to said roll to pass thereunder into the stock flowing onto said wire and means for adjusting the clearance between
95 said roll and said apron to control the position of the reinforcing material in the paper.

6. In combination with a Fourdrinier paper machine including a flow box, apron,
100 slice and forming wire, a perforated roll positioned over said apron ahead of said slice in the path of the flow of stock onto the forming wire, means for rotating said roll at a variable speed, means for guiding reinforcing material to said roll to pass thereunder into the stock flowing onto said wire
105 and means for adjusting the clearance between said roll and said apron to control the position of the reinforcing material in the paper.

7. A machine for making reinforced
110 paper, comprising a Fourdrinier paper machine, creels carrying bobbins of reinforcing strands in an elevated position above the head end of said Fourdrinier, a perforated roll positioned in the flow of stock
115 onto the wire and guiding and spacing means for leading the reinforcing strands to said roll for passage onto the wire.

8. A machine for making reinforced
120 paper, comprising a Fourdrinier paper machine, creel carrying bobbins of reinforcing strands in an elevated position above the head end of said Fourdrinier, a perforated roll positioned in the flow of stock onto the wire, guiding and spacing means for lead-
125 ing the reinforcing strands to said roll for passage with the flow of stock onto the wire and means for raising and lowering said perforated roll to alter the position of the strands in the finished paper.
130

9. A machine for making reenforced paper, comprising a Fourdrinier paper machine, creels carrying bobbins of reenforcing strands in an elevated position above the head end of said Fourdrinier, said bobbins being connected in pairs to provide for continuous operation, a perforated roll positioned in the flow of stock onto the wire and guiding and spacing means for leading the reenforcing strands to said roll to pass thereunder onto the wire.

10. In a machine for making reenforced paper including a flow box, apron, adjustable slice and forming wire, a perforated roll through which substantially all of the stock must pass rotatably and adjustably mounted above said apron and ahead of said slice, means for varying the speed of rotation of said roll and means for feeding spaced parallel strands of a reenforcing element to said roll for passage thereunder to flow with said stock under the slice onto the forming wire.

11. In a machine for making reenforced paper including a flow box, apron, adjustable slice and forming wire, a perforated roll through which substantially all of the stock must pass rotatably and adjustably mounted above said apron and ahead of said slice, means for varying the speed of rotation of said roll, creels carrying a plurality of strands of a reenforcing element mounted above said flow box and spacing and guiding means for conducting said strands to said roll for passage thereunder to flow with said stock under the slice onto the forming wire.

12. The process of forming reenforced paper which comprises continuously drawing a plurality of spaced strands of reinforcing material into a flow of stock ahead of the forming part of a Fourdrinier paper machine, directing the strands with the stock to the forming part of the machine, positively adjusting the tension on the strands and the height at which the strands are directed toward the forming part of the machine to control the position of the strands in the finished web and forming the fibers of the stock and the reenforcing strands into a paper web.

13. The process of making reinforced paper which comprises contacting a plurality of parallel spaced strands of a reenforcing material under a revolving drum located in the path of the flow of stock onto the forming wire of a paper machine and controlling the depth to which said strands are initially emerged in said stock flow by adjusting the position of the revolving drum.

14. The process of making reenforced paper which comprises contacting a reenforcing material with a revolving perforated drum through which substantially all of the paper stock must pass in its flow to the forming wire of a paper machine and control-

ling the tension on said reenforcing material by varying the speed of rotation of the perforated drum.

15. In a paper machine, means defining a pond for paper stock, a perforated roll rotatably mounted therein through which substantially all of the paper stock must pass, a forming wire below said roll, means for varying the speed of rotation of said roll and means for feeding spaced parallel strands of a reenforcing element to said roll for passage thereunder to flow with said stock onto the forming wire.

16. In a machine for making reenforced paper, including a slice and forming wire, a perforated roll positioned ahead of said slice in the path of the flow of stock onto the forming wire through which the stock flows, means for rotating said roll at a variable speed and means for guiding reenforcing material to said roll to pass thereunder into the stock flowing onto said forming wire.

In testimony whereof, we have hereunto subscribed our names at Mosinee, Marathon County, Wisconsin.

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