

Nov. 7, 1933.

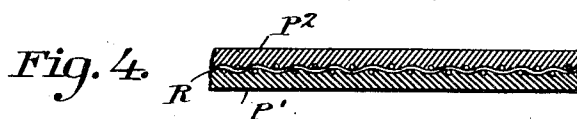
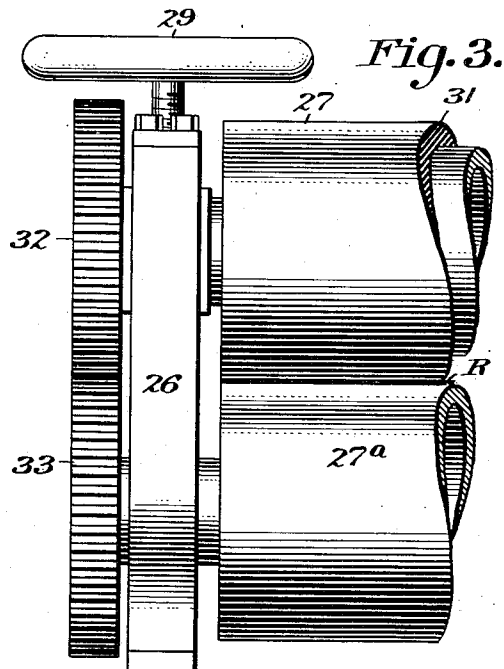
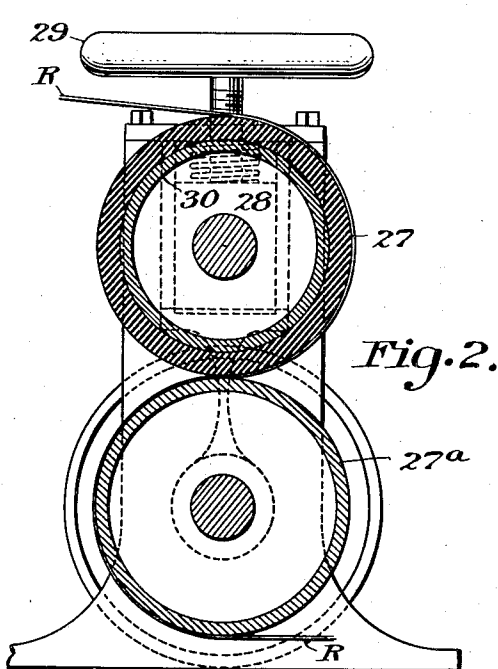
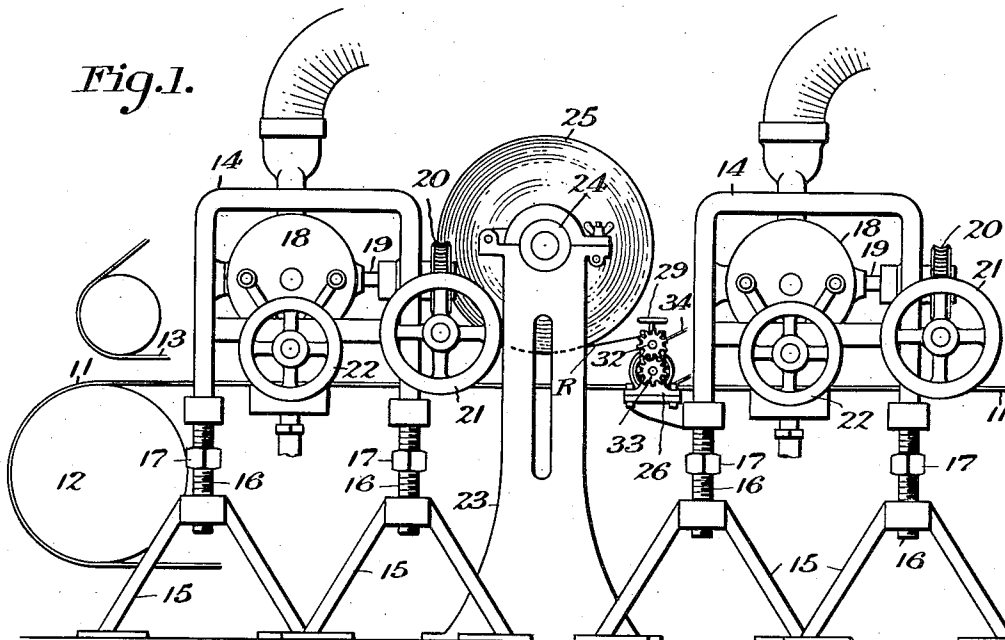
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1,934,589

METHOD OF AND APPARATUS FOR MAKING REENFORCED SHEETS

Filed May 10, 1929

3 Sheets-Sheet 1



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METHOD OF AND APPARATUS FOR MAKING REINFORCED SHEETS

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3 Sheets-Sheet 2

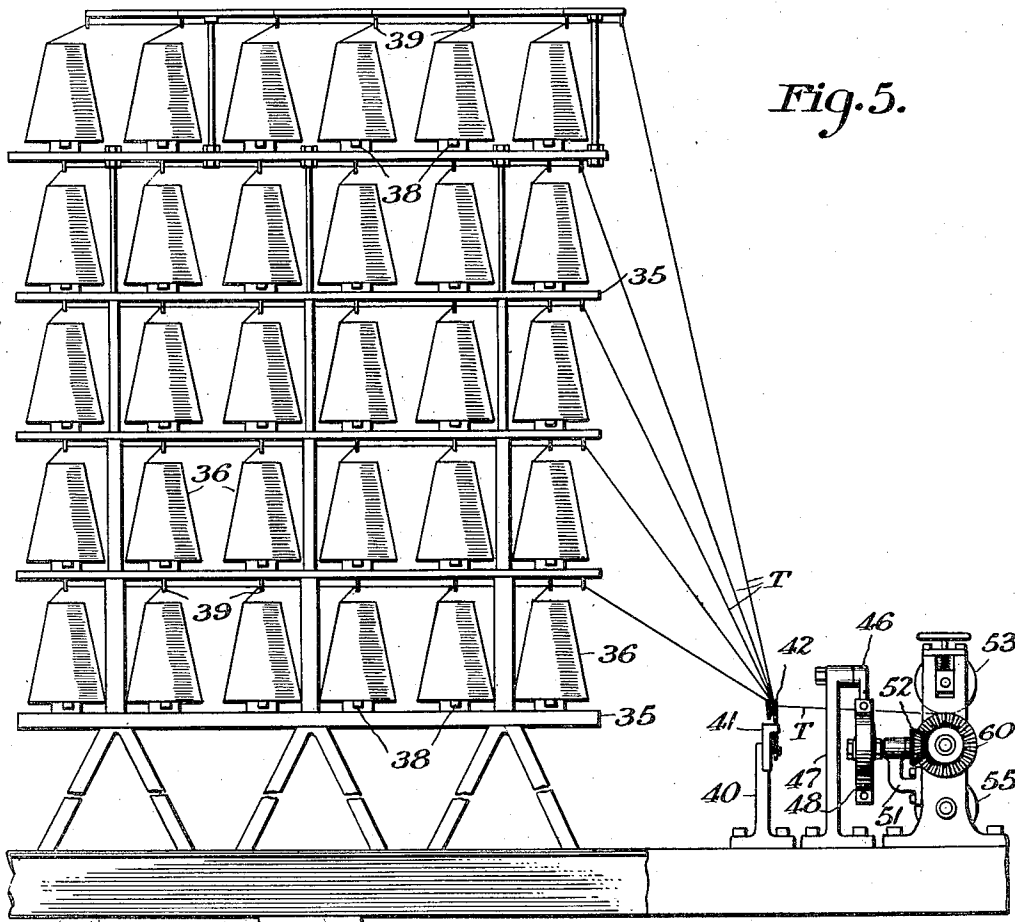
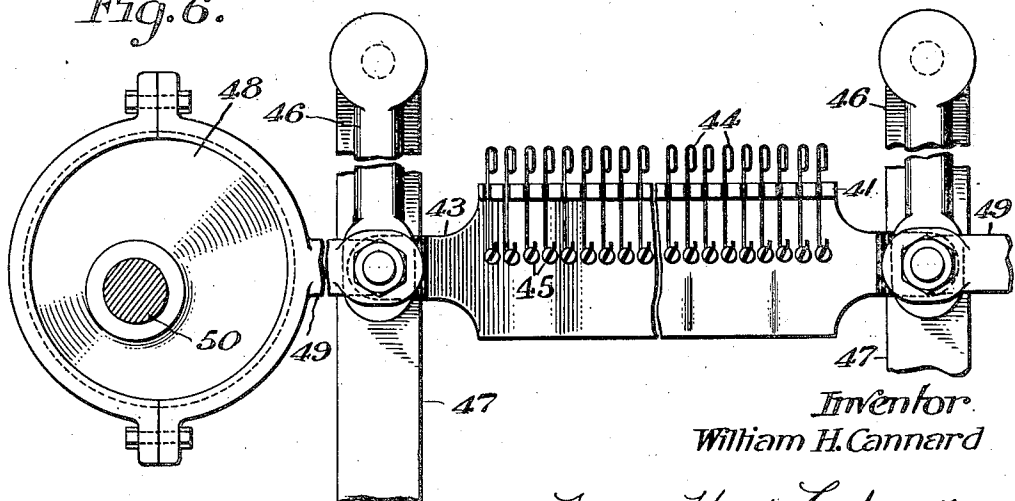


Fig. 5.



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3 Sheets-Sheet 3

Fig. 7.

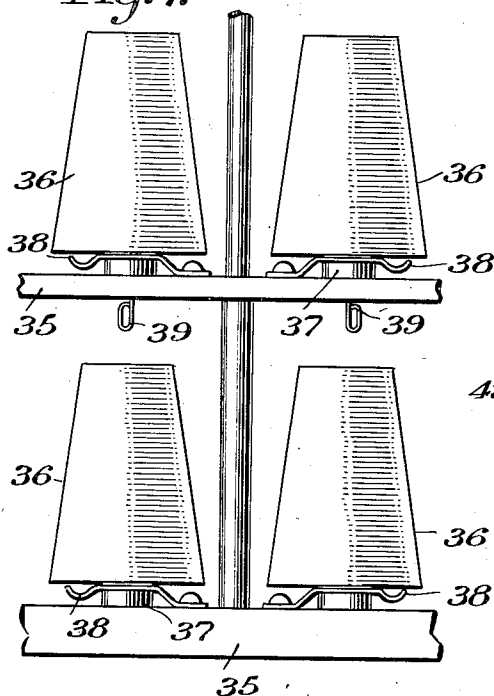


Fig. 8.

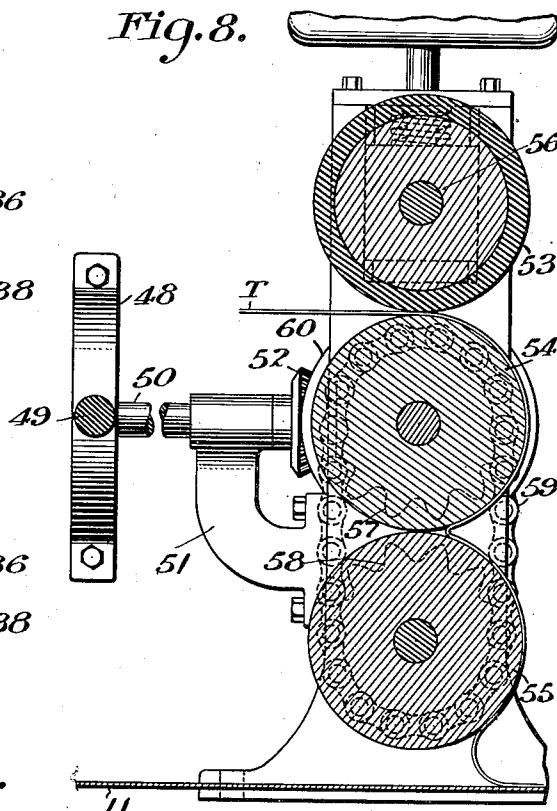


Fig. 9.

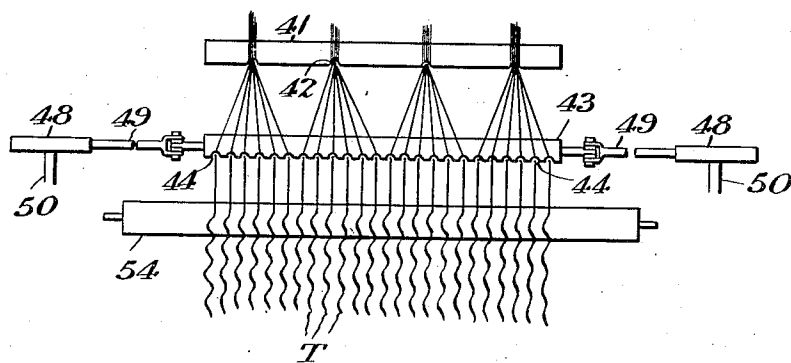
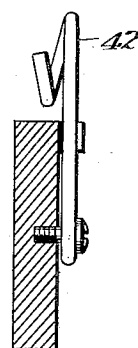


Fig. 10.



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UNITED STATES PATENT OFFICE

1,934,589

METHOD OF AND APPARATUS FOR MAKING REINFORCED SHEETS

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Application May 10, 1929. Serial No. 362,026

8 Claims. (Cl. 92—40)

This invention relates to improvements in reinforced sheets and method of and apparatus for making the same.

It has heretofore been proposed to make a reinforced paper sheet by inserting between two sheets of paper a layer of woven material, such as scrim, an adhesive such as asphaltum being used to unite the components into the completed product. Such a sheet is expensive to manufacture and is limited in its uses because it is not sufficiently strong for all purposes.

It is an object of my invention to produce a reinforced sheet of great strength, adapted to many uses, and which may be formed directly upon any well known type of paper making machine.

Another object of the invention is to provide a reinforced sheet wherein the reinforcement material is securely embedded in the pulp from which the sheet is made, and thus is, in effect, an integral part of the sheet.

Another object of the invention is to provide a reinforced sheet in which the reinforcement may be either in the form of a woven fabric or separate threads.

The invention also contemplates a method of producing a reinforced sheet of the character set forth, and by following which the sheet may be made directly upon a paper making machine in a single continuous operation.

A further object of the invention is to provide a method of making reinforced sheets in which a layer of pulp is first deposited upon the traveling screen of any well known type of paper making machine, a layer of reinforcing material is then deposited upon the layer of pulp, and thereafter a second layer of pulp is deposited upon the structure thus formed.

Still another object of the invention is to provide apparatus for making a reinforced sheet, including means for depositing a layer of pulp upon the traveling screen of a paper making machine, means for applying to said layer of pulp a layer of reinforcing material, and means for depositing upon the structure thus formed a second layer of pulp.

Still another object of the invention is to provide an apparatus for making a reinforced sheet which is provided with spaced pulp supplying means between which is located a source of supply of reinforcing material, mechanism being provided for feeding the reinforcing material to the layer of pulp deposited by one of said pulp supplying means.

A further object of the invention is to provide

an apparatus of the character set forth in which separate threads may be incorporated in a sheet of paper which is being formed upon the machine during the process of its formation, the said threads serving to reinforce the sheet and being thoroughly embedded therein.

Other objects of my invention and the many advantages thereof will in part be obvious and in part more fully brought out as the description proceeds.

In the accompanying drawings, I have illustrated two practical embodiments of an apparatus constructed in accordance with my invention and upon which a reinforced sheet of the character described may be manufactured in accordance with the method set forth above. It is to be understood that these drawings are illustrative merely, and that the invention is in no way to be construed as limited to the details of construction therein disclosed. The invention is susceptible of a wide range of modification and equivalency without sacrificing the salient features thereof, or departing from the scope of the invention defined in the appended claims.

In these drawings:

Fig. 1 is a side elevation of a machine constructed in accordance with my invention, and showing particularly the arrangement of pulp supplying means and reinforcing material supplying means, as applied to a Fourdrinier machine of standard construction;

Fig. 2 is a view in side elevation of the feed rolls for applying the reinforcing material;

Fig. 3 is a fragmentary front elevation of the structure illustrated in Fig. 2;

Fig. 4 is a fragmentary sectional view of a reinforced sheet made in accordance with my invention;

Fig. 5 is a partial view, in side elevation, of a modification and illustrating particularly the mechanism for applying reinforcing material in the form of individual threads.

Fig. 6 is a broken front elevation of a shaker frame employed in connection with the apparatus illustrated in Fig. 5;

Fig. 7 is a detached view of a bobbin supporting frame;

Fig. 8 is a view in side elevation of the mechanism for applying threads to reinforce the sheet and showing the mechanism for imparting reciprocating movement to the shaker frame illustrated in Fig. 6;

Fig. 9 is a plan view, on a reduced scale, of the thread applying mechanism and showing, more or less diagrammatically, the operation of

the mechanism for imparting waves to the individual threads; and

Fig. 10 is a detail of a thread guide.

In Fig. 1 of the drawings, I have illustrated so much of an ordinary Fourdrinier paper making machine as is required to be shown for the purposes of my invention and including a Fourdrinier wire 11 trained about a breast roll 12. The reference numeral 13 indicates the usual deckle strap.

Upon each side of the Fourdrinier wire near the breast roll I have provided a pair of frames 14 supported upon suitable standards 15, the frames 14 being vertically adjustable in the standards by means of reversely threaded rods 16 provided with fixed adjusting nuts 17.

Each of the frames 14 supports a pulp container and supplying device 18 which is in the form of a cylinder extending across the Fourdrinier wire 11, each container being provided with a discharge opening through which pulp may be deposited upon the wire. The pulp containers 18 are adjustable vertically with respect to the wire 11 by adjustment of the threaded rods 16. The discharge openings in the containers 18 are adjustable as to length and width by mechanism more fully described in my copending application Serial No. 356,444, filed April 19, 1929. It is sufficient for the purposes of the present application to state that the width of the discharge opening may be adjusted by compressing the side walls of the cylinder, this being accomplished by means of a shaft 19 operated through a worm wheel 20 which is rotated by a hand wheel 21. The length of the discharge openings is adjusted by means of suitable plugs which are caused to traverse the discharge openings by manipulation of a hand wheel 22, all as described in my said copending application.

Each of the pulp supply units as thus described is operative to deposit upon the Fourdrinier wire 11 a quantity of pulp, the deposition of the pulp being under sufficient pressure to overcome any tendency to flow occasioned by the movement of the wire 11.

Positioned adjacent the wire 11 and between the frames 14 is a suitable supporting standard 23, there being one such standard at each side of the wire, and which are provided at their upper ends with bearings 24 in which is rotatably mounted a roll 25 of reinforcing material. The bearings 24 are of the split type, to facilitate insertion and removal of rolls of reinforcing material. The reinforcing material may be of any type of loosely woven textile fabric, such for example as scrim, and the character of the material may be varied in accordance with the type of reinforced paper that is to be produced.

Between the roll of reinforcing material and one of the pulp supplying units, I have mounted a mechanism for withdrawing reinforcing material from the roll and depositing the same upon the wire 11. This mechanism is fully illustrated in Figs. 2 and 3, and comprises suitable standards 26 in which are journaled two feed rolls 27 and 27^a. The upper roll 27 is mounted in a floating bearing 28 which may be adjusted by manipulation of a hand wheel 29, and a spring 30 is introduced to insure tight contact of the rolls 27 and 27^a. The upper roll 27 is preferably provided with a covering 31 of rubber or like material, and the lower roll 27^a is preferably of metal or other hard material. The rolls 27 and 27^a are further provided with intermeshing gears 32 and 33 whereby they are rotated in opposite directions,

rotation being imparted from any suitable source through a convenient belt 34.

As is indicated in Fig. 2, the reinforcing material R is drawn from the roll 25 and passes around the upper roll 27, thence through the bight between the rolls 27 and 27^a, and then around the lower roller 27^a, and is thus deposited upon the wire 11.

By the mechanism just described, it is believed that my method of forming a reinforced sheet will be quite clear to those skilled in the art. Pulp is discharged upon the wire 11 from the first of the pulp supply units 18, and as the wire travels to the right, as viewed in Fig. 1, the reinforcing material R is deposited upon this layer of pulp. The structure thus formed is carried by the wire 11 under the second pulp supply unit 18, and there a second layer of pulp is deposited. The result is that the structure is composed of two layers of pulp with a reinforcing material between them, and inasmuch as this structure is formed directly upon the machine, it will be quite clear that the pulp will entirely fill the interstices of the reinforcing material and, thus, in effect completely embed the same in the sheet. Thus, the reinforcing material becomes an integral part of the sheet as formed in accordance with my method. This sheet is illustrated in the partial sectional view in Fig. 4, in which the first layer of pulp is indicated by the reference-character P', the reinforcing material by R, and the upper or second layer of pulp by the reference-character P². A sheet thus formed is of great strength in all directions and is useful for a great variety of purposes, and is more readily and more cheaply manufactured than reinforced sheets heretofore devised.

In Figs. 5 to 10, inclusive, I have illustrated a modification of my invention in which individual reinforcing threads are incorporated in the sheet as distinguished from the woven fabric which is incorporated in the sheet heretofore described.

By referring to Fig. 5, it will be seen that this modification includes essentially a suitable supporting structure 35 for a plurality of bobbins 36 each of which is mounted upon a spindle 37 for easy rotation. The spindles are held in position by means of bifurcated spring latches 38 which bear against the bottom of the bobbins. The reinforcing threads of each of the bobbins 36 pass through suitable guides 39 to a mechanism for applying the threads to the first layer of pulp which has been deposited upon the Fourdrinier wire.

Mounted upon a suitable part of the framework of the machine are standards 40 which support a bar 41 provided with a plurality of thread guides 42 similar in construction to the guides 39. The construction of the thread guides is best shown in Fig. 10, and it will be seen that the eye is formed by bending the material of the guide in three different planes, thus facilitating ease of threading. The reinforcing threads pass from the guides 42 to a reciprocating bar 43, the construction and operation of which will now be described.

The bar 43 is provided with a plurality of thread guides 44 similar to the guides 39 and 42 heretofore described, and which are secured to the bar by means of suitable pins 45. The bar 43 is suspended from arms 46 which are pivoted upon standards 47. In order that a wavy effect be imparted to the reinforcing threads, I have provided mechanism for reciprocating the bar 43.

This mechanism includes essentially a pair of eccentrics 48 which are connected to the bar 43 by means of cranks 49. Rotary motion is imparted to the eccentrics 48 through shafts 50 journaled in brackets 51 and provided at one end with pinions 52 which receive their motion from a suitable gear on the feed mechanism now to be described.

The feed mechanism for drawing the threads from the bobbins 36 and depositing them upon the first layer of pulp, includes three feed rolls 53, 54 and 55. The upper roll 53 is mounted in a floating bearing 56 in the same manner as is the roll 27, heretofore described. This roll may also be of the same construction as the roll 27, in that it is preferably provided with a cover of rubber or other material. The rolls 54 and 55 are provided with sprockets 57 and 58, respectively, about which is trained a sprocket chain 59 whereby these two rolls are rotated in the same direction. Upon the shaft of the roll 54 is a suitable gear 60 which drives the pinions 52 heretofore described.

By referring to Fig. 8, the path of travel of the reinforcing threads will be clear. The thread indicated by T, after leaving the guides 44 on the reciprocating bar 43, passes between the rollers 53 and 54 and follows the circumference of the roller 54 until it reaches the bight between the roller 54 and the roller 55. Inasmuch as these two last-mentioned rolls rotate in the same direction, the thread will then follow the contour of the roll 55 and will be deposited upon the wire 11, as clearly shown in Fig. 8. By the mechanism just described, a plurality of individual threads may be incorporated into a reinforced sheet, a wavy effect being imparted to the threads and thus producing a reinforcement which is quite similar to the woven fabric which has been heretofore described. Fig. 9 illustrates completely the action of the mechanism which imparts the wavy effect to the threads, and it is believed that this operation will be quite clear to those skilled in the art.

From the foregoing description, it will be seen that I have provided a novel form of reinforced sheet in which the reinforcing material may be either woven fabric or individual threads, and in either case the reinforcement is directly embedded in the pulp from which the sheet is formed and is, thus, an integral part thereof. I have also provided a novel type of apparatus for manufacturing the reinforced sheet, in which pulp is supplied to the traveling wire of a paper making machine from two sources which are suitably spaced and between which is located a source of supply of reinforcing material. Where it is desired to incorporate an already-woven fabric, the mechanism illustrated in Fig. 1 will be used, and in which case the reinforcing material is supplied from a supply roll which is located between two pulp supplying devices. Where individual threads are to be incorporated in the sheet, the mechanism illustrated in Figs. 5 to 10 is employed; that is to say, a plurality of bobbins containing the reinforcing thread are located between the two pulp supplying devices, the thread being drawn from the bobbins by the feed mechanism described, and having imparted to it a wavy effect by reason of the reciprocation of the thread guide described.

While in the appended drawings and in the foregoing specification I have described my invention as being adapted particularly to a so-called Fourdrinier paper making machine, it will

be readily understood and appreciated that my apparatus may be equally well associated with any other type of paper making machine, such as, for example, the cylinder type.

I claim:

1. Apparatus for making reenforced paper including a traveling screen, a pair of pulp containers mounted in spaced relation above said screen to deposit pulp layers thereon, a plurality of bobbins of reenforcing thread mounted between said pulp-containers, means to draw reenforcing threads from said bobbins and apply them between the pulp layers deposited by the said pulp-containers, and means to impart a wavy effect to said threads.

2. Apparatus for making reenforced paper including a traveling screen, a pair of spaced pulp-containers juxtaposed to said screen and for depositing pulp thereon, means between said containers for supporting a plurality of bobbins of reenforcing thread, a plurality of feed-rolls for drawing thread from said bobbins and introducing it between the pulp layers, a bar provided with thread guides through which said thread passes, and means to reciprocate said bar to impart a wavy effect to the thread.

3. Apparatus for making reenforced paper including a traveling screen, a pair of spaced pulp-containers juxtaposed to said screen for depositing layers of pulp thereon, means between said containers for supporting a plurality of bobbins of reenforcing thread, a plurality of feed-rolls for drawing thread from said bobbins and introducing it between said pulp layers, a bar provided with thread guides through which said thread passes, means to rotate said feed-rolls, and means to translate the rotary motion of said feed-rolls into reciprocating motion of said bar, whereby a wavy effect is imparted to the thread.

4. The herein described method of making a reenforced paper sheet having an integral character which includes the step of depositing downwardly from above a layer of pulp upon a forming screen and, immediately thereafter, before the fibers of such pulp layer have become set, depositing successively thereon spaced reenforcing elements and a second pulp layer likewise deposited so that the fibers of the two pulps layers will intermingle with each other in the spaces between the reenforcing elements and in setting will cause the two pulp layers to become united in an integral whole.

5. The herein described method of making a reenforced paper sheet having an integral character which includes the steps of depositing a layer of pulp upon a traveling forming screen, and, immediately thereafter, before the fibers of such pulp layer have become set, depositing onto the moving pulp layer spaced reenforcing elements, said elements being positively fed to avoid any longitudinal tension between the elements and pulp layer after their association and then immediately feeding a second pulp layer onto the first pulp layer so that the fibers of the two pulp layers will intermingle with each other in the spaces between the reenforcing elements and in setting will cause the two pulp layers to become united in an integral whole.

6. Apparatus for making reenforced paper including a traveling forming screen, a pair of pulp containers mounted in close proximity to each other above said screen for depositing successive layers of pulp upon the screen, the relationship between said pulp containers being such that a second pulp layer will be deposited upon

a previous pulp layer before the fibers of the latter have become set, and means disposed between said pulp containers for positively feeding reinforcing material between the pulp layers.

- 5 7. Apparatus for making reenforced paper including a traveling screen, spaced means located in close proximity to each other for depositing successive layers of pulp upon said screen in immediate time relation so that the fibers in the
10 successive layers of pulp will intermingle and in setting integrally unite said layers; a source of supply of reenforcing material mounted between, said pulp depositing means, and a pair of feed rolls for drawing reenforcing materials from said
15 source of supply and feeding the same between the successive pulp layers.

8. The herein described method of making a

reenforced paper sheet having an integral character which includes the steps of depositing at several points upon a traveling forming screen a pulp suspension, and introducing intermediately thereof spaced reenforcing elements, said reenforcing elements being fed onto the screen to avoid longitudinal tension upon the pulp, the several pulp deposits being made in rapid succession so that the fibers of the first pulp layer will intermingle completely with the fibers of the
85 subsequent pulp layer through the spaces between the reenforcing elements to produce an integral sheet, the internal strength and cohesion of which throughout the final product is the same as the strength and cohesion of either
90 of the pulp layers when taken by themselves.

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20	95
25	100
30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140
70	145
75	150