

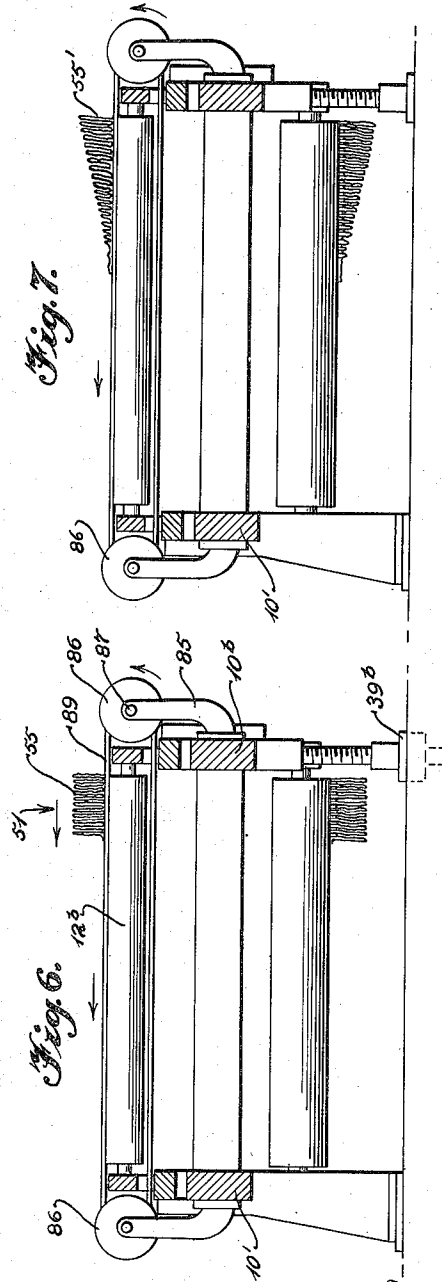
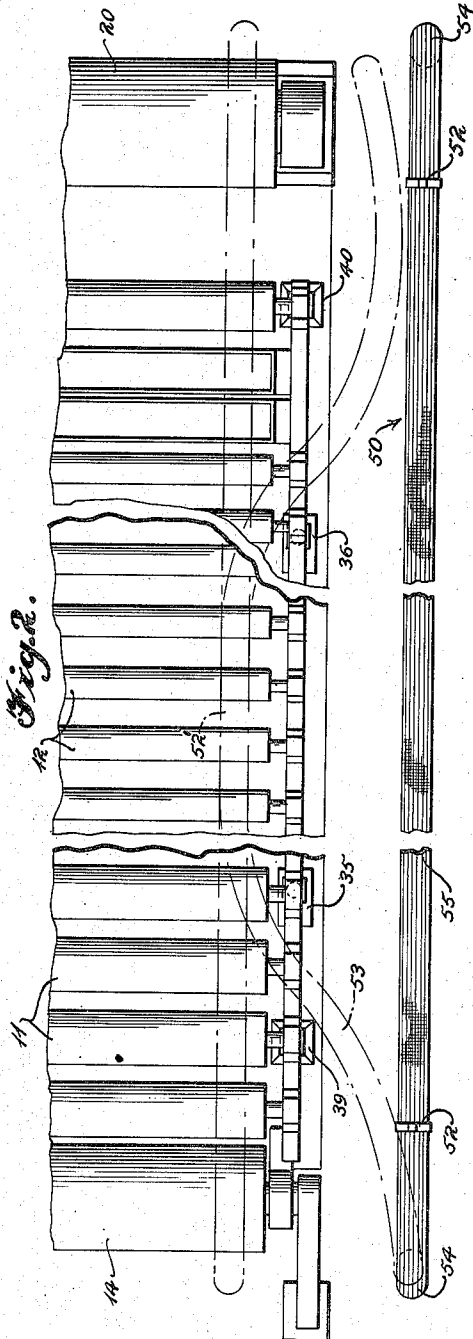
April 24, 1951

H. H. HART
FOURDRINIER MACHINE

2,550,192

Filed June 9, 1947

4 Sheets-Sheet 2



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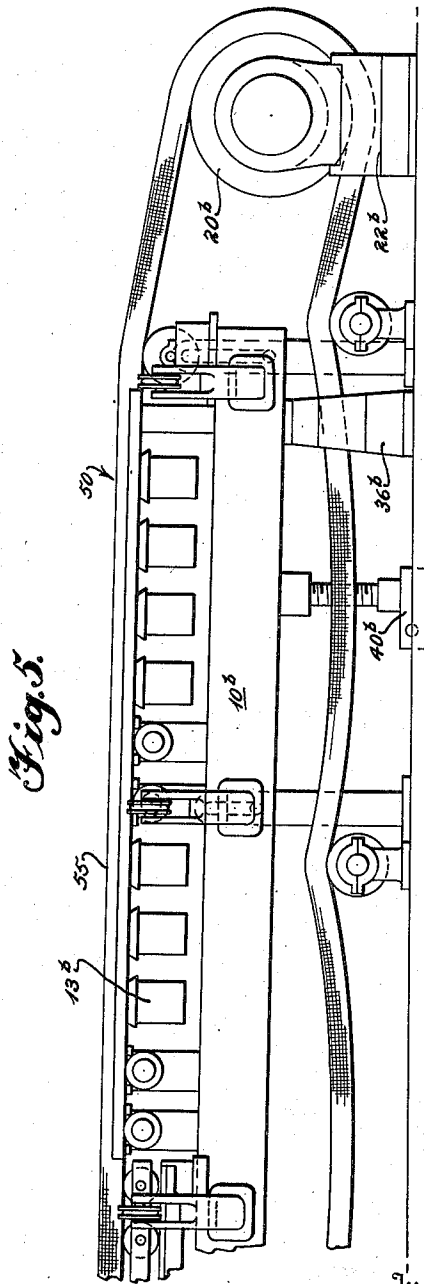
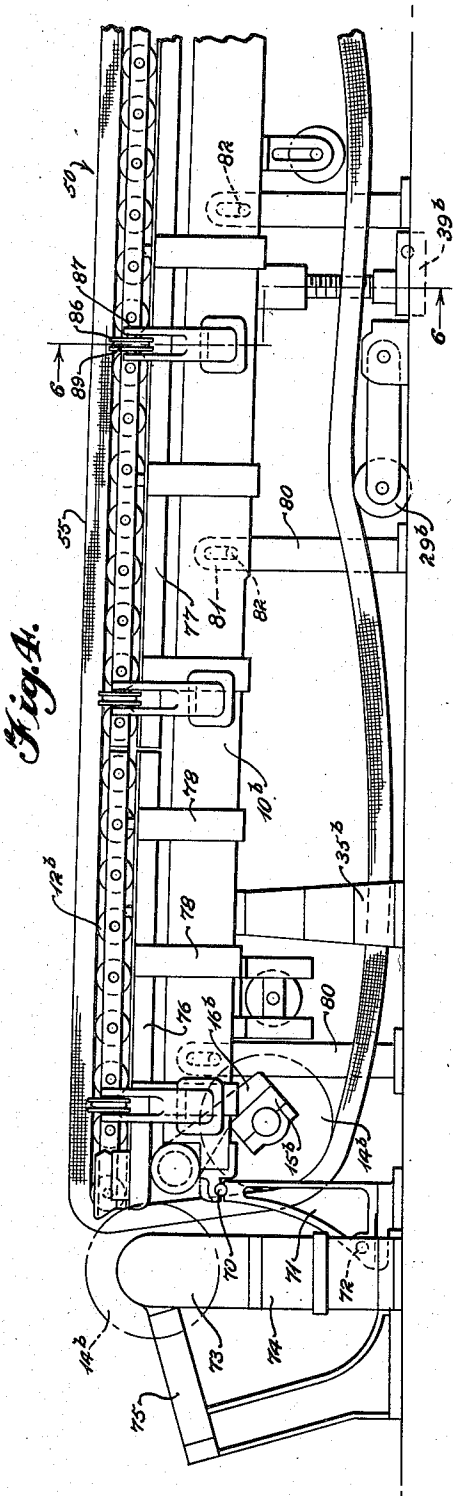
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Filed June 9, 1947

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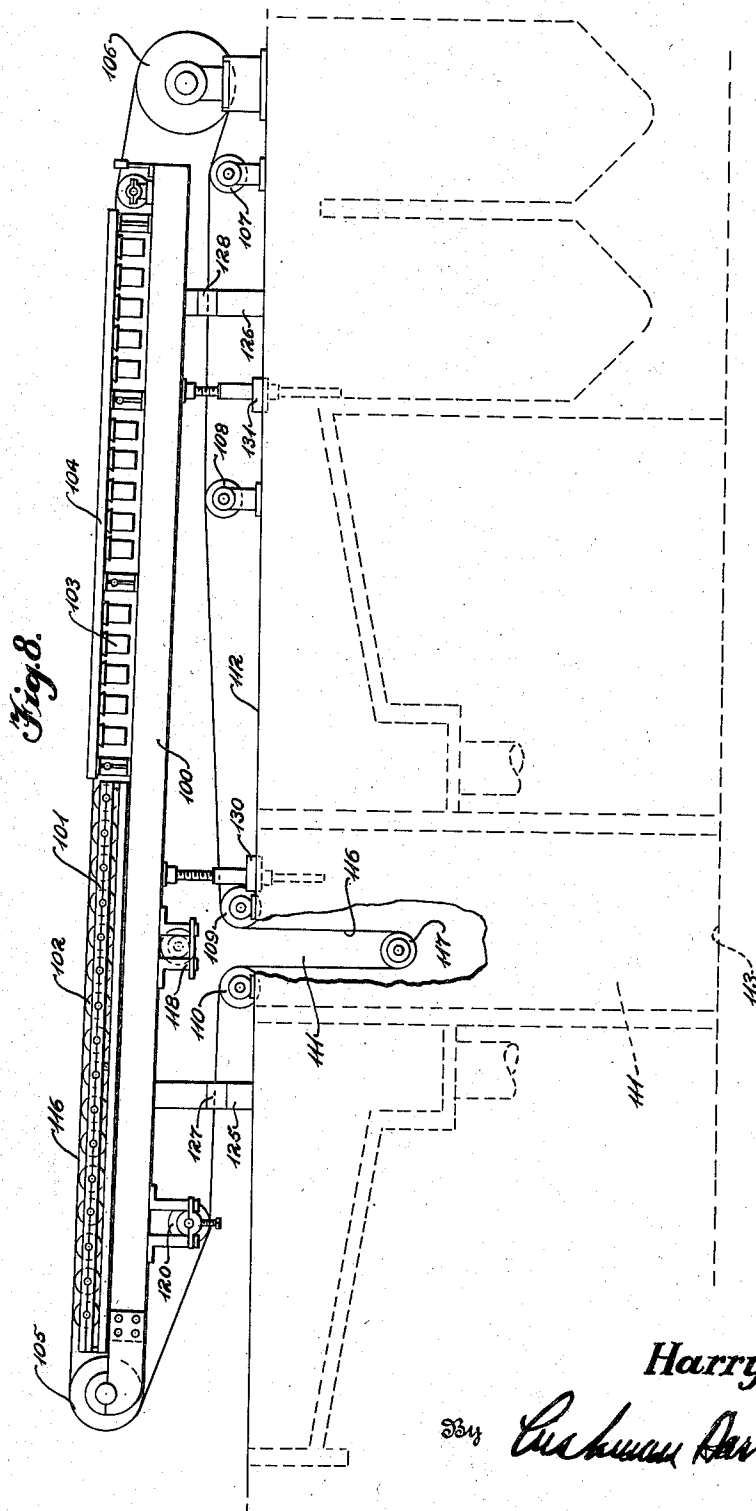
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UNITED STATES PATENT OFFICE

2,550,192

FOURDRINIER MACHINE

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Application June 9, 1947, Serial No. 753,496

1 Claim. (Cl. 92-44)

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The present invention relates to a new method and apparatus for changing the screens of Fourdrinier paper making machines. More particularly, the invention provides a new, improved and greatly simplified Fourdrinier machine structure, adapted to cooperate with a new type of pliable, flexible, tough, non-metallic Fourdrinier screen, and to a new method of installing such a screen on the machine.

In the past, endless Fourdrinier screens of bronze or other metal alloy wire have been employed exclusively in the manufacture of paper on Fourdrinier machines. Such screens have numerous inherent disadvantages, but are the best that the art had produced, prior to the development of the strong, tough, pliable, highly flexible synthetic screen, formed of a woven mesh of single strands of unitary filaments of "nylon" or the like. The prior bronze screens, although extremely expensive, were short-lived and had to be replaced after approximately thirty days' use. Moreover, the replacement operation was slow and costly, not only because of the labor involved in the screen changing operation but because of the fact that the mill had to be shut down, resulting in a complete loss of production.

In an effort to speed up the screen changing operations and to reduce production losses to a minimum, numerous screen changing methods and machines were developed, the most efficient of which is shown in my prior Patent No. 2,299,746, dated October 27, 1942. Equipment of the kind shown in that patent, however, is necessarily heavy, somewhat complicated and expensive. Nevertheless, the economies effected by the use thereof more than justified the initial investment for such equipment.

The bronze screens of the prior art had to be handled with the greatest care during their installation. Any bends or kinks in the wire, caused by mishandling would ruin the screen and make it entirely unsuitable for use, since the bends or kinks would form blemishes in the paper, clearly visible in the finished product. Moreover, any disturbance of the relation of the individual wires, dents or other defects which might be caused by dropping tools or other foreign bodies on the wire during a screen changing operation made the operation slow, difficult and costly. For these reasons, elaborate wire draping machines were developed, to handle the screen with the greatest of care during its installation upon a machine, all of which materially added to the cost of the Fourdrinier machine.

The flexibility, toughness, and resilience of the non-metallic screen referred to above makes possible a greatly simplified method of installing the screen and a corresponding simplification of the Fourdrinier machine.

In accordance with the present invention the complicated screen handling mechanisms of the prior art are entirely eliminated, thereby materially reducing the cost of the machine and facilitating the installation of new screens, both as to cost and time involved.

A primary object of the invention is to provide novel supporting means on the tending side of a Fourdrinier machine, facilitating the installation of the lower run of an endless, flexible, non-metallic Fourdrinier screen.

Another object is to provide means for handling the upper run of such a screen, to carry it across the machine and to smooth out the same.

Another object of the invention is to provide improved screen guiding and tensioning means adapted to cooperate with the flexible, non-metallic screen.

Still another object is to provide improved means for supporting the breast and couch rolls directly from the Fourdrinier frame.

Another object of the invention is to provide a Fourdrinier machine, adapted to cooperate with the new screen, and having an increased number of suction boxes associated therewith, whereby the speed of the screen may be increased or greater amounts of water removed from the wet web, if the speed is the same as heretofore.

Other and further objects and advantages of the invention will be apparent from a consideration of the embodiments of the invention shown in the accompanying drawings for purposes of illustration and described below.

In the accompanying drawings, Figure 1 is a diagrammatic side elevation of one form of apparatus embodying the invention, with sections of the Fourdrinier machine broken away;

Figure 2 is a diagrammatic plan view of a portion of the tending side of a Fourdrinier machine, illustrating a preferred method of installing a new screen;

Figure 3 is a view similar to Figure 1, showing a modified form of apparatus in which the breast and couch rolls are journaled in fixed bearings carried by the Fourdrinier frame;

Figure 4 is a side elevation of the head end of a vertically adjustable, shaking type Fourdrinier, with the invention associated therewith;

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Figure 5 is a similar view of the couch end of the same machine;

Figure 6 is a transverse view, taken substantially on line 6-6 of Figure 4, showing a mechanism for carrying the screen transversely across the table;

Figure 7 is a similar view showing the parts at a later stage in the operation of installing a screen, and

Figure 8 is a diagrammatic side elevation showing a further modification.

As noted above, the present invention eliminates the expensive and somewhat complicated undercarriages and wire handling devices employed in constructions similar to my prior patent identified above and also eliminates the complicated mechanisms employed in known constructions, in which the Fourdrinier table and associated parts are moved transversely into the tending aisle for a wire changing operation. Instead, simple removable or shiftable supports for the tending side of the frame are employed to carry out a novel screen changing procedure.

In Figure 1 a Fourdrinier machine of the fixed pitch, non-shaking type is illustrated, comprising a main frame having a longitudinal side member 10 on the tending side, supporting table rolls 11 and 12 and suction boxes 13 in the known manner. The breast roll 14 may be journaled in bearings 15 carried by arms 16, pivoted to a cross shaft 17 carried by the main frame members 10, after the manner illustrated in Figure 8 of my above mentioned patent, for swinging movement from the dotted position for paper making, to the lowered, full line position for a screen changing operation.

The couch roll 20 may be supported independently of the table by stands, the forward one 21 of which includes a removable blocking section 22, and the rear one of which (not shown) is adapted to support the roll in cantilever fashion during a wire changing operation, when the blocking piece 22 is removed, as is well understood in the art and as is explained in my above mentioned patent. In this type of construction, the suction for the suction couch roll is usually connected through the stand and blocking piece on the tending side of the machine.

The frame 10 carries the usual downwardly projecting hangers 25, 26, on which the return guide rolls 27, 28 for the Fourdrinier screen are journaled. A tension or take-up roll 29 may be journaled in bearings at the ends of arms 30, pivotally mounted in floor-supported brackets 31, as is well understood.

The driving side frame member (not shown) may be supported in the usual manner by fixed stands, not shown. Novel supporting means for the tending side frame member 10 are provided, consisting of stands 35, 36, having removable blocking pieces 37 and 38 associated therewith, positioned adjacent the breast and couch ends of the frame respectively. Vertically adjustable jacks 39, 40, having screws 41, 42 may be positioned between the stands 35, 36, cooperating with depending blocks 43, 43', carried by the frame 10. The jacks are adapted to be operated by shafts 44, 45, extending rearwardly toward the driving side and actuated by suitable mechanism, not shown, rotation being imparted from the shaft to the nuts embracing screws by suitable gearing in the jack housings.

Thus, the frame 10 on the tending side of the machine is normally supported by the jacks and

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the stands 35, 36 with the removable blocking pieces 37, 38 in place.

The operative paper making position of the Fourdrinier screen is indicated by the broken line 49, with the ends of the screen loop trained about the breast roll 14 and the couch roll 20, the upper run disposed above the table rolls and suction boxes and the lower run below the frame or table, in engagement with the guide rolls 27, 28 and tension roll 29. When a new wire is to be installed, the breast roll 14 is swung downwardly to the full line position below the table, and the tension roll 29 is lowered.

The pliable, flexible non-metallic Fourdrinier screen 50 may be folded, pleated, or rolled into a transversely compact bundle 51 and tied by tapes or the like 52 at appropriate intervals, to maintain the same in transversely compacted, longitudinally elongated loop form, as indicated in Figure 2. Such a screen may be installed by the following procedure:

First, the jacks 39, 40 may be lowered, leaving the frame supported exclusively at its ends on the tending side by the stands 35, 36, and the central section 52' of the lower run of the screen passed inwardly beneath the frame behind the jacks 39 and 40, above the roll 29 and below rolls 27 and 28.

Second, the jacks may be raised to support the frame on the tending side.

Third, the removable blocking pieces 37 and 38 may be removed and the adjacent portions 53 of the screen bundle passed through the openings so provided, beneath the ends of the frame.

Fourth, the blocking pieces may be replaced, so that the frame is supported jointly by the jacks and the fixed stands.

Fifth, with the couch roll supported in cantilever fashion, the removable blocking piece 22 may be removed and the end sections 54 of the bundled screen loop and the upper run 55 placed around the ends of the table, the breast and couch rolls and upon the upper surfaces of the table rolls and suction boxes.

Sixth, the screen may now be unrolled or unpleated and drawn across the machine and smoothed out from the tending side to the driving side.

Seventh, the removable blocking piece 22 may be replaced, the breast roll 14 swung upwardly to the operative position and the tension roll 29 raised to take up any remaining slack and to apply the desired tension to the screen.

This method of installing a screen is entirely feasible with a flexible, non-metallic screen, since the bundling, handling and twisting of the material has no deleterious effect thereon and will not leave bends, kinks, or other imperfections in the screen.

In the form of the invention shown in Figure 3, the breast roll 14a and the couch roll 20a are supported directly by the Fourdrinier frame, and this is facilitated by using an extra long screen and a novel take-up or tension device hereinafter explained, in connection with Figure 8. The side frame member 10a on the tending side and its mate on the drive side may carry bearings 15a for the journal of the breast roll. Similarly, the suction couch 20a may be journaled in bearings 60, fixedly attached to extensions 61 of the side frames 10a. The suction connection for the couch may be provided by a conduit 62 at the drive side, leaving the couch unobstructed at the tending side.

Jacks 39a and 40a, and stands 35a and 36a sup-

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port the frame member 10a as previously described. A tension roller 29a, however, may be supported, when in the inoperative position by a hanger frame 65 carried by the table. Below the hanger and the roll 29a is a pit 66, into which the roll 29a may move downwardly to take up slack and to apply tension, as more fully explained in connection with Figure 8.

In the operative, paper making position 17a of the screen, it is trained over floor supported guide rolls 67, 68 into the pit 66.

The method of changing a screen in connection with the apparatus of Figure 3 is substantially identical to that previously explained, with the exception that the tension roll 29a is maintained in the uppermost position, carried by the hanger 65 during the entire screen changing operation and a screen having a substantial excess length is employed, to facilitate manipulation of the ends of the loop around the frame supported breast and couch rolls, and over the top of the frame, after the lower run has been passed beneath the table as previously described. The excess or slack is taken up by the runs downwardly into and upwardly out of the pit 66, after the tension roll 29a has been lowered thereinto.

In Figure 4, a variable pitch Fourdrinier of the shaker type is illustrated, in which the main frame members 10b are pivotally supported for tilting movement at the breast end upon a bearing bar 70, seated at the upper end of pedestals 71, the pedestal on the tending side being mounted for rearward swinging movement about a pin 72, as explained in my above identified patent. The breast roll 14b is adapted to be supported for downward swinging movement to an inoperative position by bearings 15b, carried by arms 16b. When in the upper-operative position, the breast roll is journaled for rotation in a well-known type of shaking mechanism 73, including springs 74 and 75.

Shake rails 76, 77, connected to the main frame by springs 78 carry the usual table rolls 12b and suction boxes 13b may be supported for transverse reciprocation adjacent the couch end of the table in the usual manner.

The frame is supported on the drive side by fixed stands 80, having slots 81 adjacent their upper ends, through which heavy bolts 82 carried by the table project, so as to support the table at the rear side in adjusted position.

Two pairs of jacks are provided, one pair for the tending side and the other for the drive side, and all may be interconnected to raise and lower the frame to change the pitch thereof, by swinging the frame in a vertical plane about the axis of the bearing bar 70. The jacks 39b and 40b on the tending side perform this normal function and, in addition, may be lowered to facilitate a screen changing operation in the manner previously described. To this end, fixed stands 35b and 36b are provided adjacent the ends of the main frame members 10b on the tending side, to support the frame on the side when the jacks are lowered for screen changing.

The suction couch 20b may be of the type employed in Figure 1 and may include a removable blocking piece 22b, adapted to be removed when the roll is supported in cantilever relation on the drive side.

Referring to Figures 6 and 7, the main frame members on the tending side 10b and on the drive side 10' may each carry upwardly projecting brackets 85 having bifurcated upper ends in which pulleys 86 are journaled about horizontal

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stub shafts 87. The top of each pulley is disposed above the table rolls and suction boxes and the lower portion thereof below the lower edges of the side frame members. A rope, belt, or other strand or band 89 is trained about each pair of pulleys 86 with its upper run extending entirely across the machine, in position to support the upper run 55 of the screen bundle 51.

Any appropriate means may be provided to rotate the several pairs of pulleys in unison, or they may be operated by hand. Thus, when the edge 55' of the upper run of the screen on the tending side of the machine is held, and the upper run of each band moves toward the drive side, as indicated by the arrows, Figures 6 and 7, the bundle will be unrolled, unfolded, or otherwise opened up and carried entirely across the machine until its other edge reaches the tending side. Simultaneously, the screen will be smoothed by the engagement of the supporting band therewith. The lower run of the screen, hanging below the table, will similarly be opened up and carried across the machine.

After the screen has been spread in this fashion, the ropes or bands 89, and, if desired, the pulleys 86 and their supporting brackets 85, may be removed.

After the breast roll 14b, the pivot support 71 and the tension roll 29b have been restored to their normal positions, the apparatus is ready for paper making operations.

In the form of the invention shown in Figure 8, the Fourdrinier may be of the fixed or variable pitch type, with shaking or non-shaking breast and table rolls, and the breast and couch rolls may be supported from the main frame or independently, as occasion may dictate. In the diagrammatic illustration of Figure 8, the main frame 100 carries shake rails 101, supporting table rolls 102, in accordance with conventional practice, except that the number of table rolls may be substantially reduced over that commonly used for a Fourdrinier of given length.

Suction boxes 103 may be supported for oscillation across the machine, in the usual manner from rails 104, or stationary suction boxes may well be employed with the new pliable, flexible, tough, non-metallic screen referred to above. The number of suction boxes may be materially increased, as indicated in Figure 8, since the new screen is much more resistant to friction than conventional bronze wire screens and can readily withstand, without undue wear, the frictional contact with an increased number of boxes. The increased number of suction boxes, of course, removes a greater percentage of water from the wet paper web and, therefore, reduces the water removing task performed by the press section and the drying rolls in the line. The drying sections of conventional paper machines are extremely long, occupy a large amount of space, are costly to install and consume tremendous amounts of power in the form of heat, simply to get rid of the water in the paper web. Anything that can be done at the web-forming end of the machine to remove larger amounts of water is of great utility, in reducing the size and expense of the drying section of the machine.

The number of suction boxes heretofore used was limited by the friction factor. That is to say, if the number of boxes were increased, the friction with the wire was increased and the life of the wire was correspondingly reduced. Hence, it was economical to use fewer suction boxes and

more drying rolls, in order not to shorten unduly the life of the wire screen.

The breast roll 105 and the couch roll 106 may be supported by the frame 100 or independently, as desired. The return guide rolls 107, 108, 109 and 110 may conveniently be journaled in stands carried by the mill floor. The last mentioned two rolls are positioned adjacent to the open upper end of a pit 111 extending downwardly through the mill floor 112, to the floor 113 of the basement. When in operative position, the screen 116 is trained downwardly into the pit, around a tension guide roll 117, having its ends journaled in vertically adjustable brackets mounted upon screws or the like associated with the side walls of the pit, for vertical adjustment of the roll.

The roll 117, during a screen changing operation is carried by brackets or a cage 118, secured to the undersurface of the frame 100.

Another guide roll 120, adjacent the breast end of the machine may be hung in journals carried by the frame 100.

On the tending side of the machine, the frame is supported adjacent its ends by stands 125 and 126, having removable blocking pieces 127, 128 associated therewith, and by vertically adjustable jacks 130, 131, as previously described. It will be understood that, if the machine is of the fixed pitch type, the jacks will be positioned on the tending side only but that if it is of the variable pitch type a similar pair will be disposed beneath the frame on the drive side.

A Fourdrinier screen of excessive length may be used with a machine of the type shown in Figure 8, thereby providing the necessary slack to facilitate a screen changing operation and also greatly lengthening the useful life of the screen, due to the reduced frictional contact of any point on the screen with the friction producing element.

In the operating of changing a screen, the procedure outlined above is followed, except that the tension roll 117 is raised into the bracket 118 and held in that position beneath the frame. The jacks 130 and 131 will be lowered and the lower run of the bundled screen placed in position therebehind, with any excess draped downwardly into the pit 111 over the rollers 109 and 110. The jacks are then raised and the blocking pieces 127 and 128 removed, whereupon the remainder of the bottom run of the screen may be placed under the table and the ends of the loop draped around the breast and couch rolls, with

the upper run positioned above the frame on ropes or the like, similar to those shown in Figures 4, 5, 6, and 7, but omitted from Figure 8 for the sake of clarity. The screen may then be unbundled and smoothed across the machine as previously described. The tension roll 117 may be lowered into its vertically adjustable brackets in the pit 111, and adjusted to the proper position, to apply the desired tension, whereupon the machine is ready for operation.

The invention is not limited to the details of construction and arrangement of parts, or to the exact method described above, but includes all constructions and methods coming within the scope of the appended claim and their equivalents.

I claim:

In combination with a Fourdrinier machine, supporting means for the tending side of the Fourdrinier frame facilitating installation below the frame of the lower run of an endless, highly flexible, non-metallic forming screen, bundled into a transversely compact, longitudinally elongated loop, and means for opening up the bundled loop and carrying the screen across the machine and smoothing the upper run thereof across its length, said second mentioned means comprising a plurality of pairs of pulleys, means for supporting one pulley of each pair from the frame at the tending side and the other at the drive side with the pairs in transverse alignment, and a band trained around each pair of pulleys with its upper run above the frame and its lower run therebelow, the upper run of each band being adapted to support the upper run of the bundled screen adjacent the tending side, whereby when the tending side edge of the screen is held stationary, the remainder may be carried toward the drive side and smoothed out, by moving the upper runs of the bands toward the drive side.

HARRY H. HART.

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