

May 5, 1936.

J. K. DARBY

2,039,780

PAPER MAKING MACHINERY

Original Filed Sept. 24, 1923 12 Sheets-Sheet 1

Fig. 1.

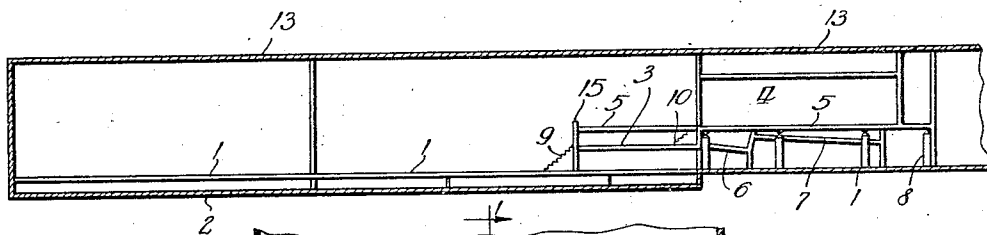


Fig. 3.

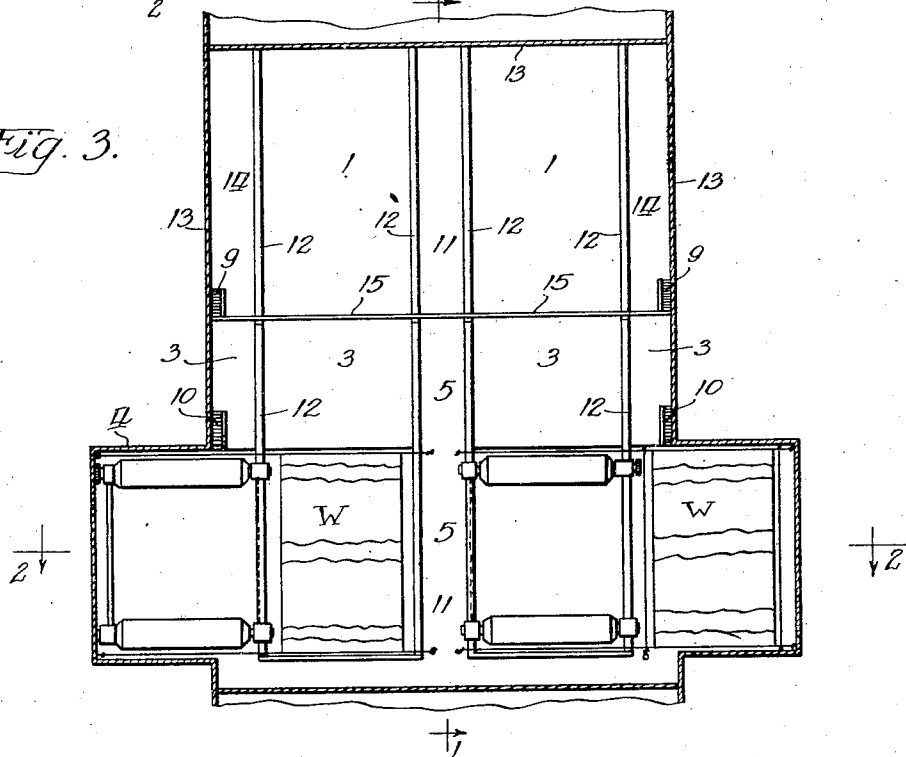
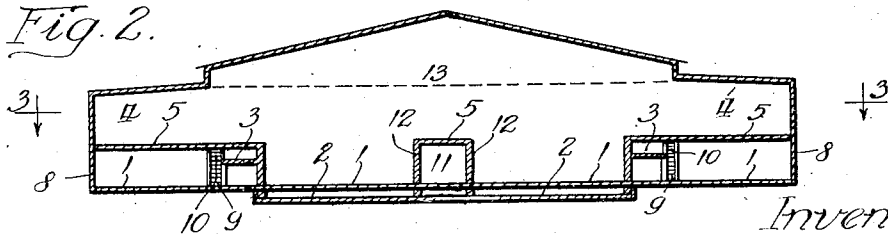


Fig. 2.



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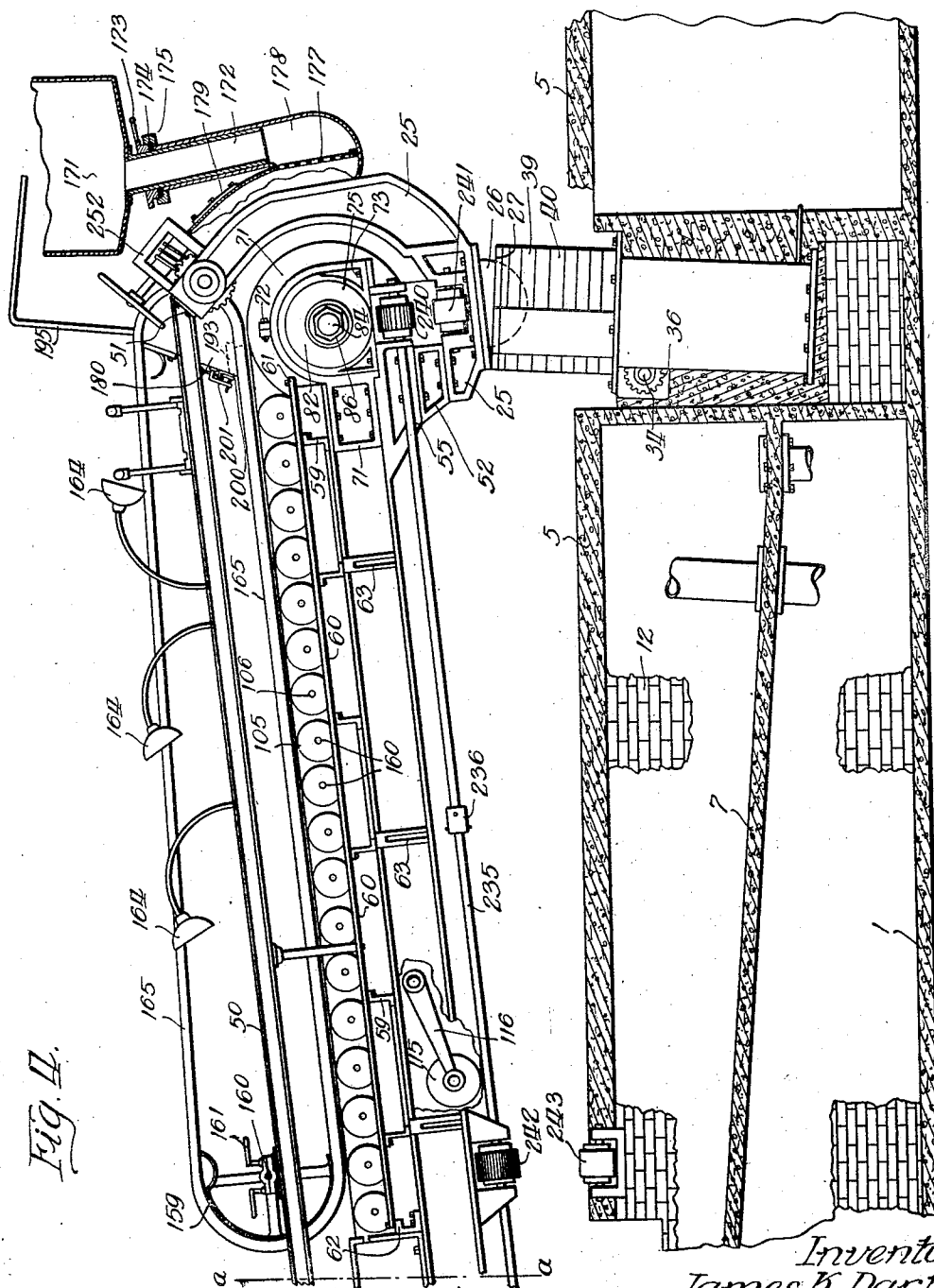
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Original Filed Sept. 24, 1928 12 Sheets-Sheet 2



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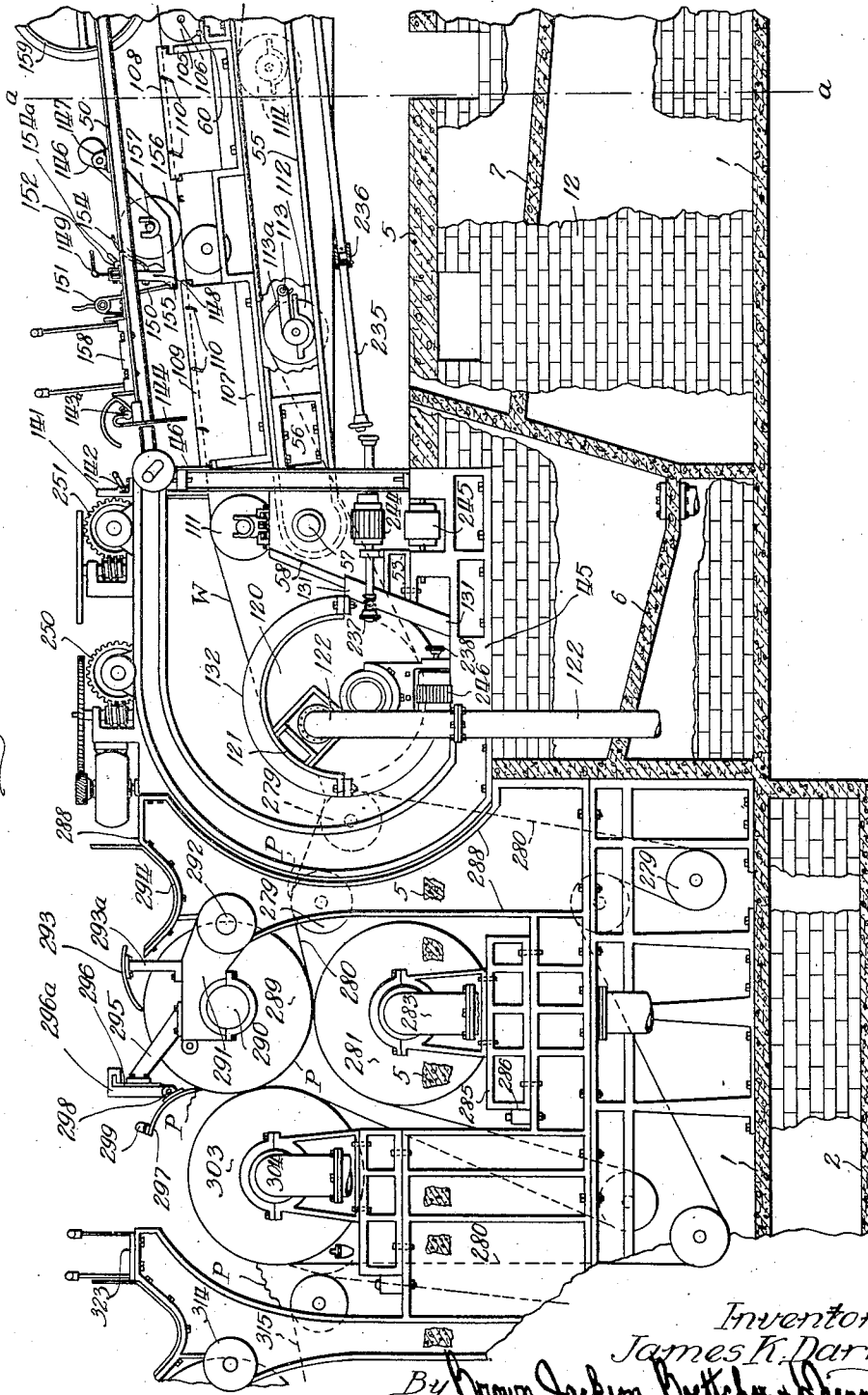
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Fig. 11.



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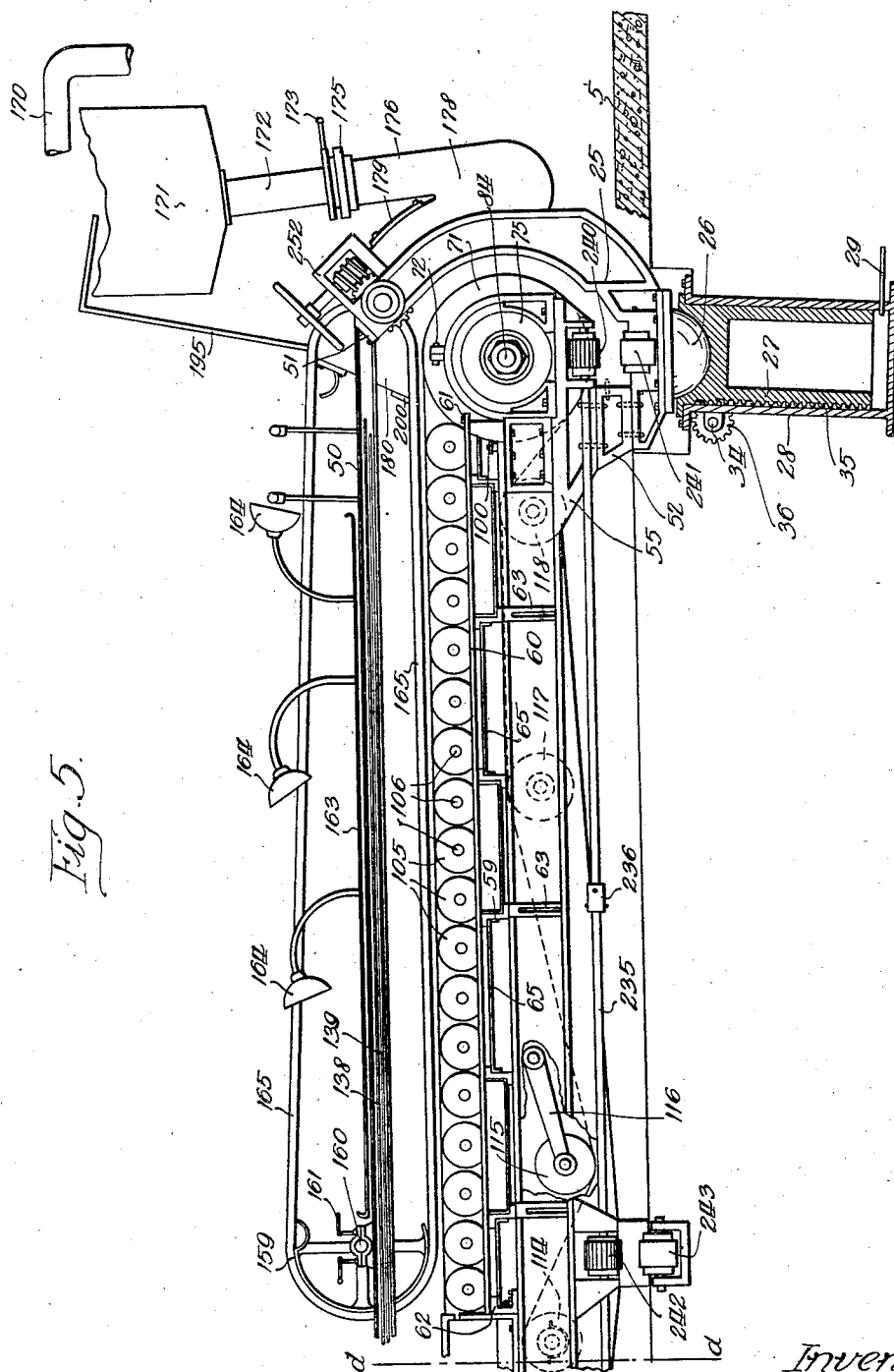


Fig. 5.

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Fig. 5A.

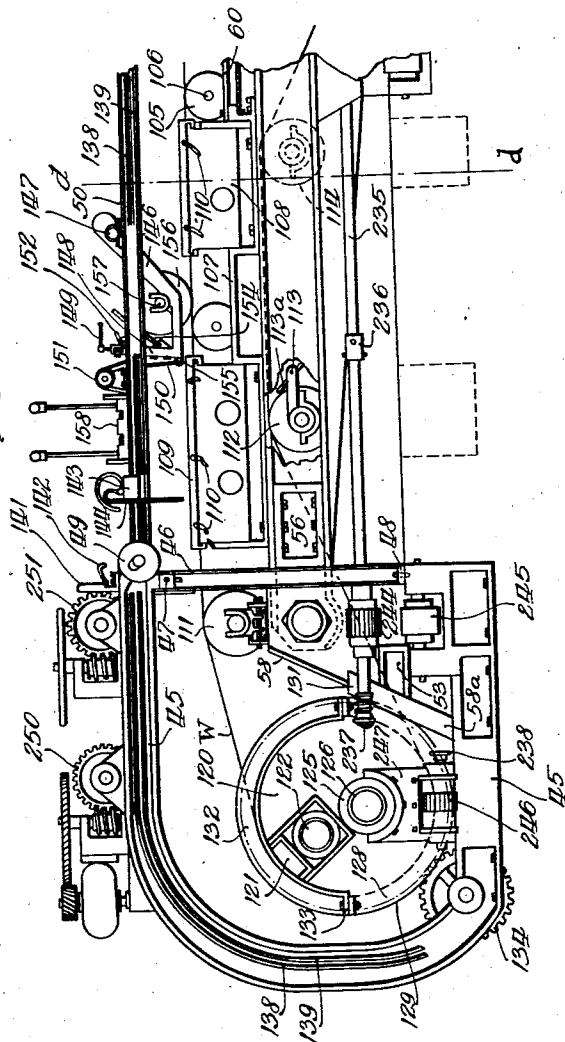


Fig. 21.

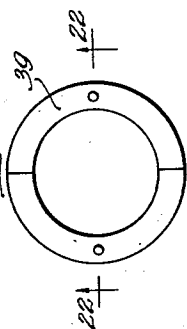


Fig. 22.

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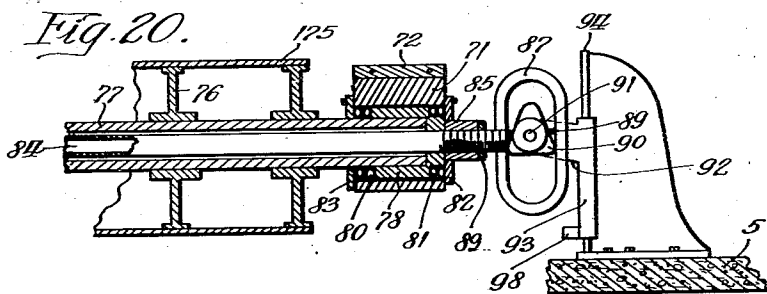
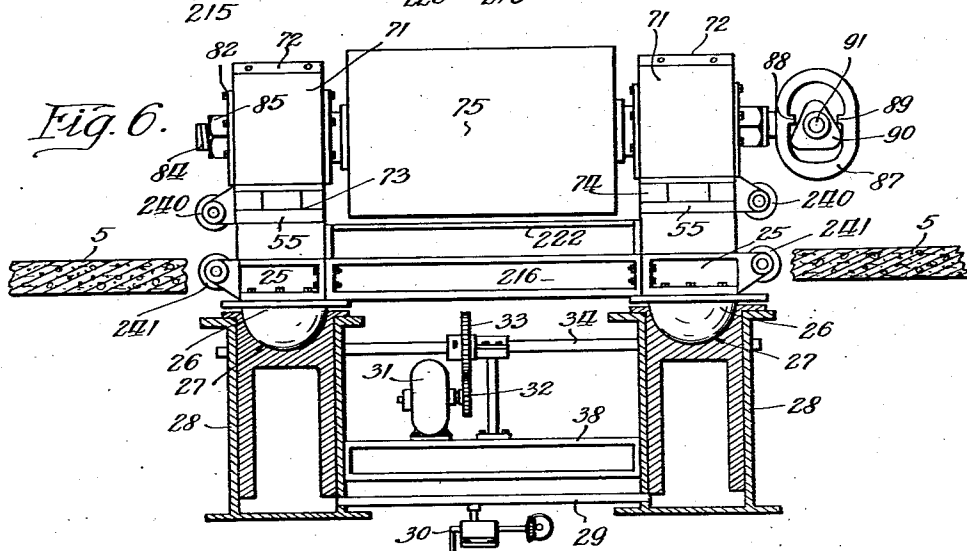
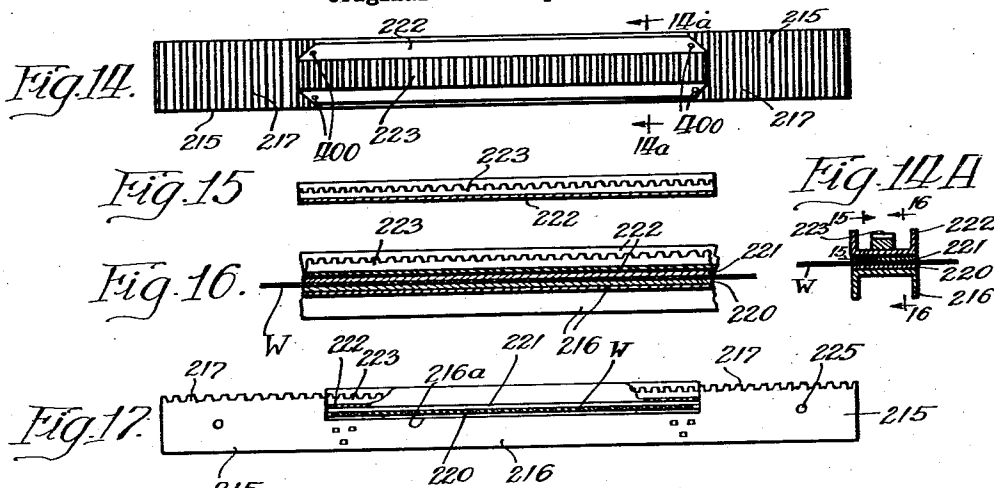
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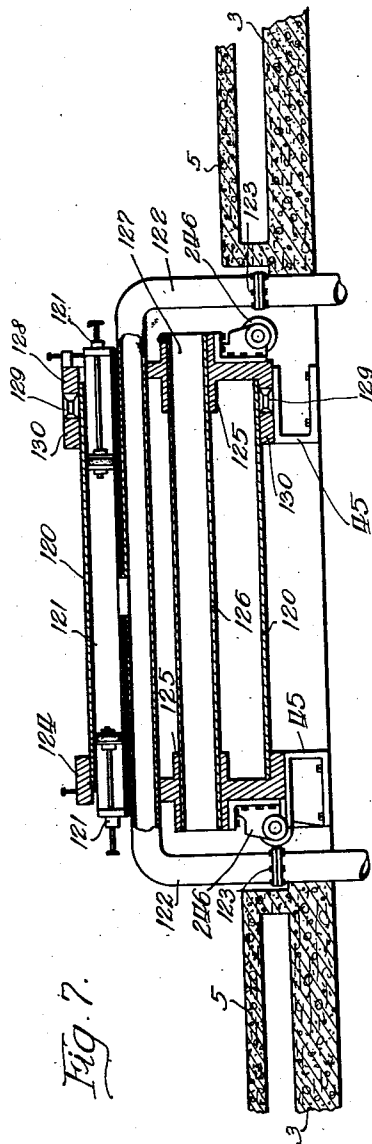
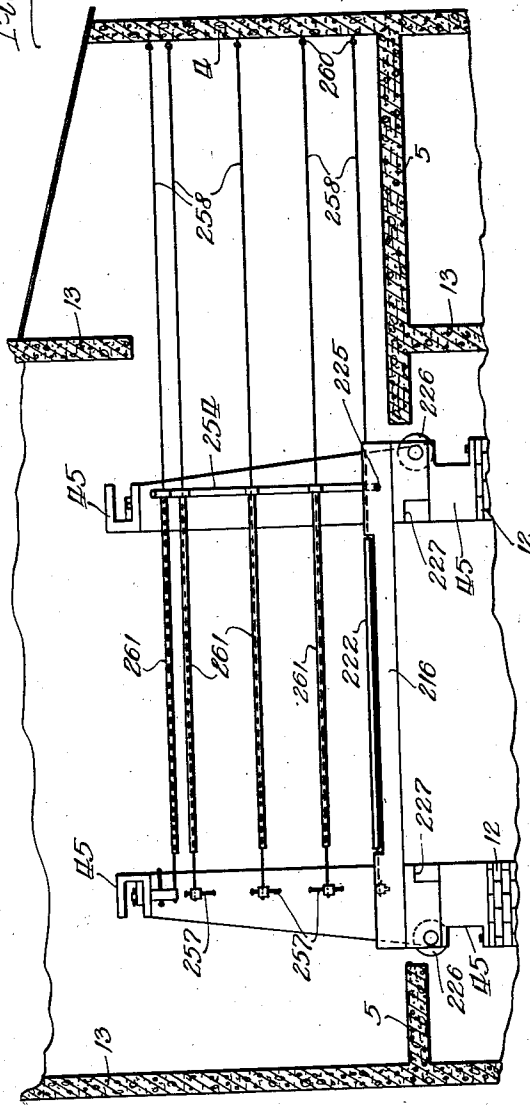


Fig. 13.



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Fig. 10.

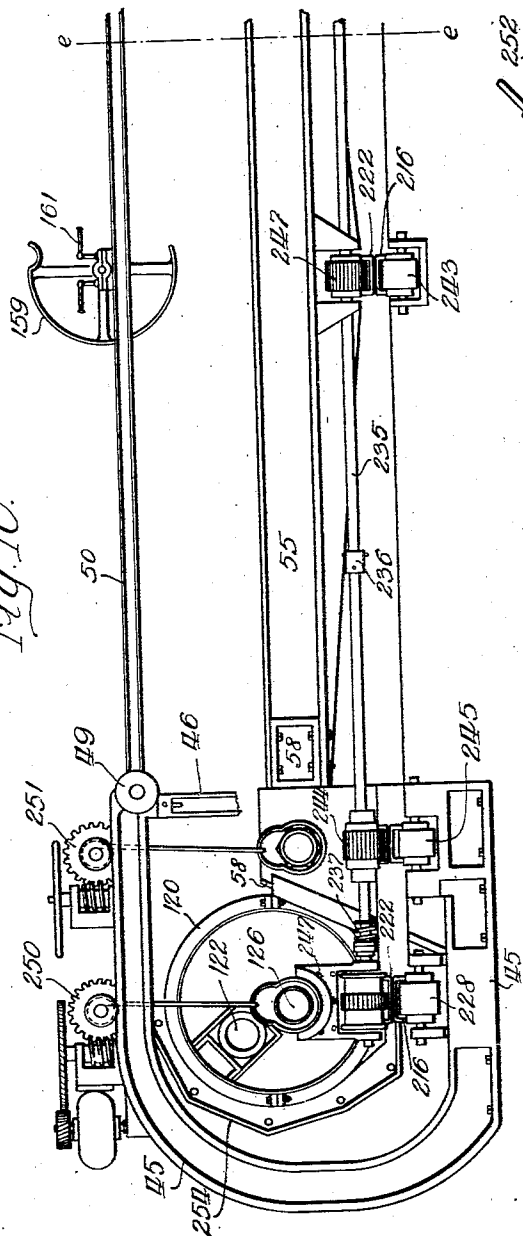
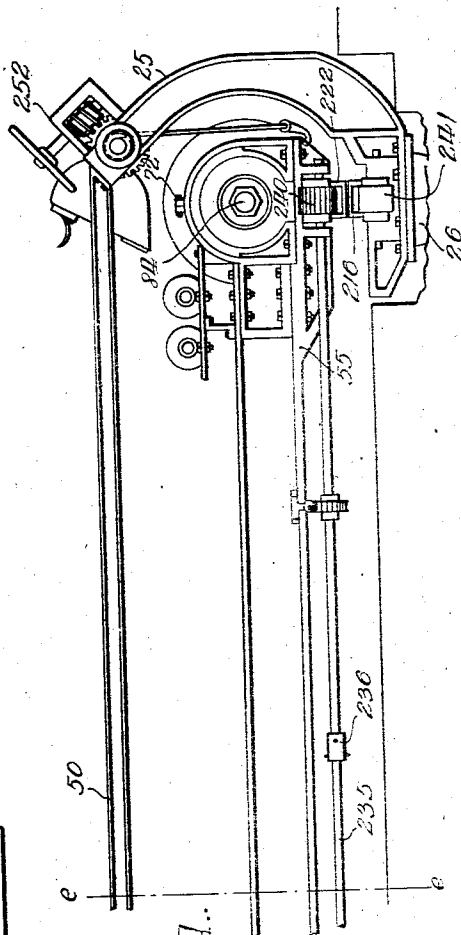


Fig. 10A.



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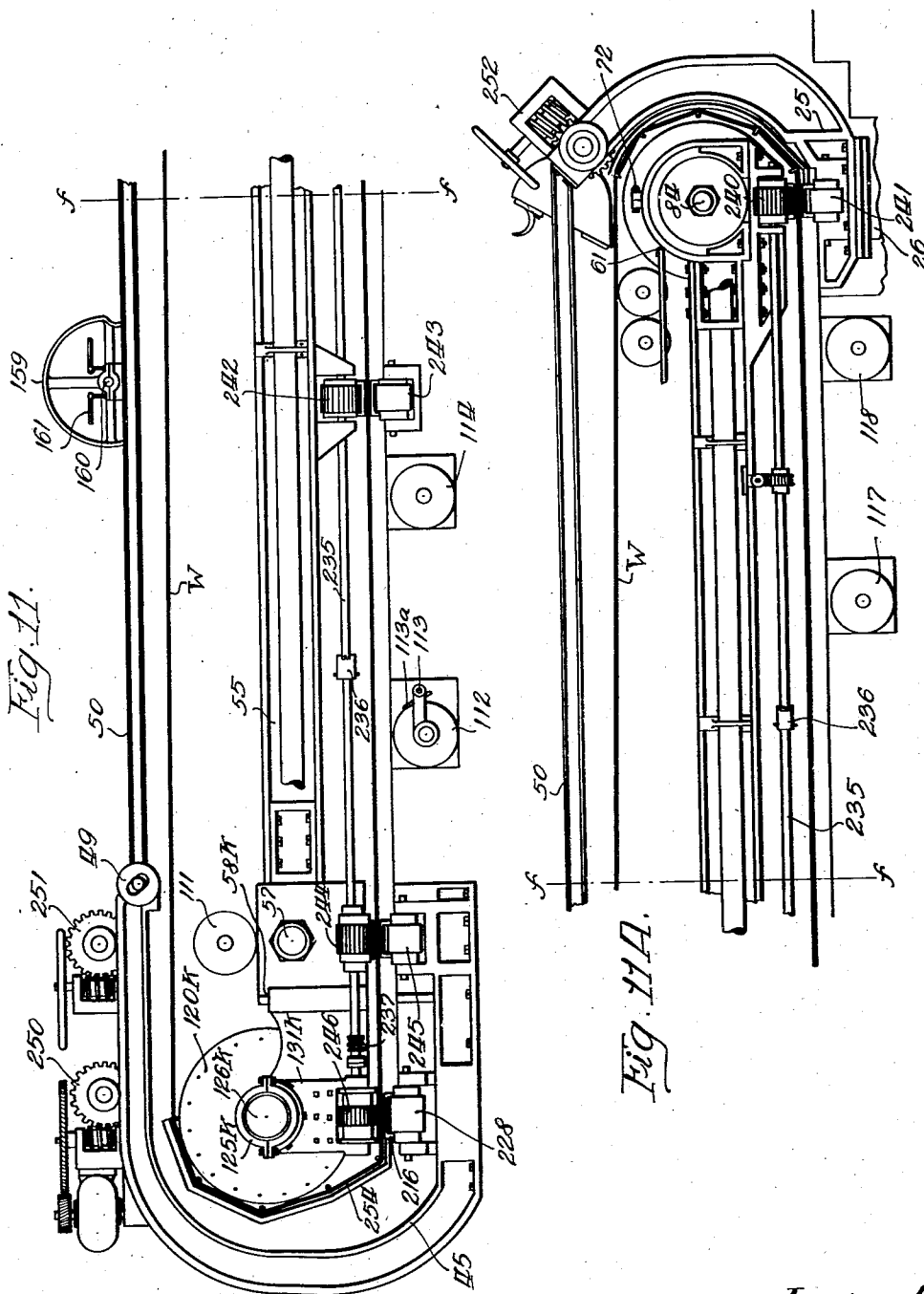
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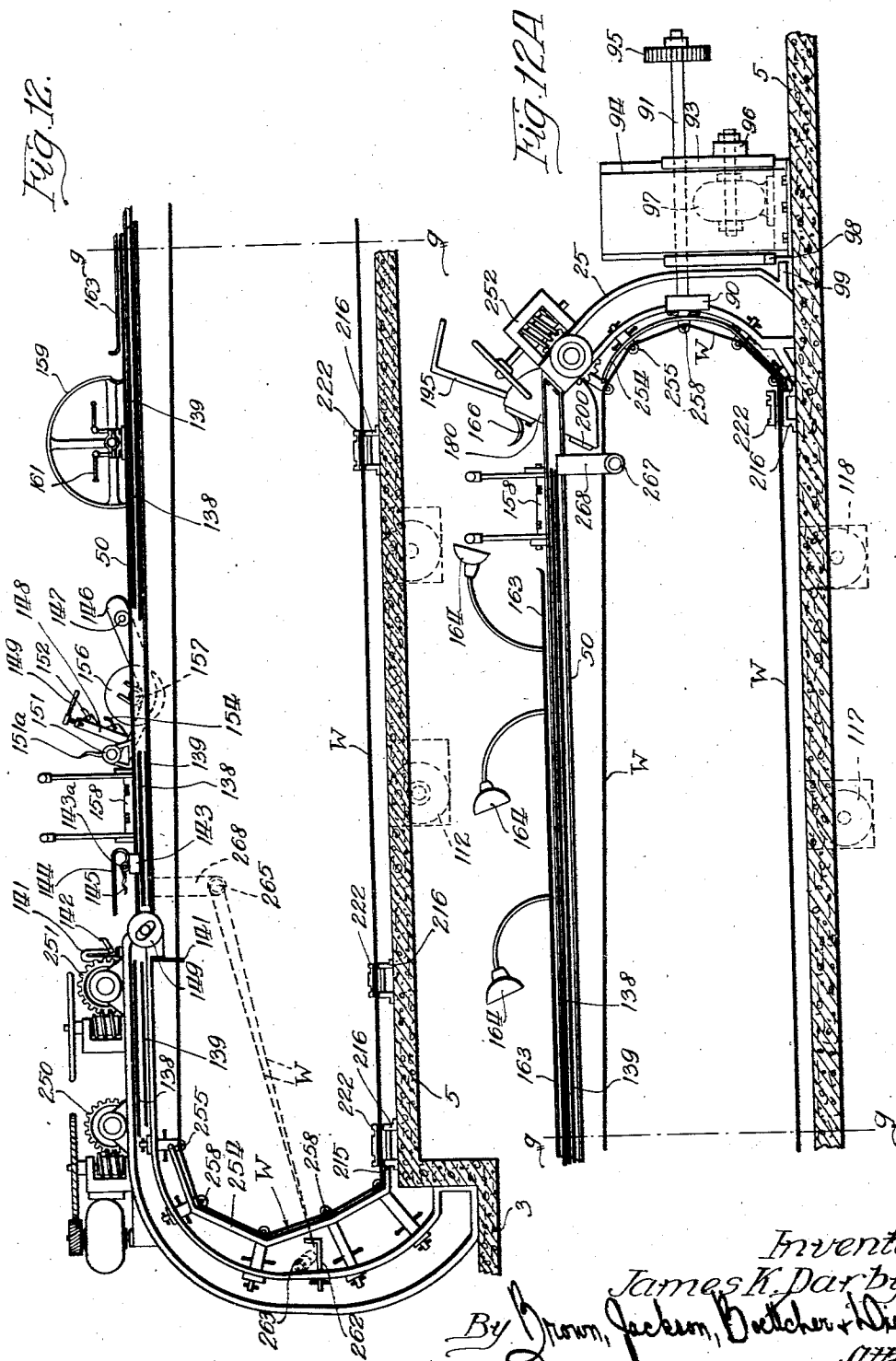
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Fig. 18.

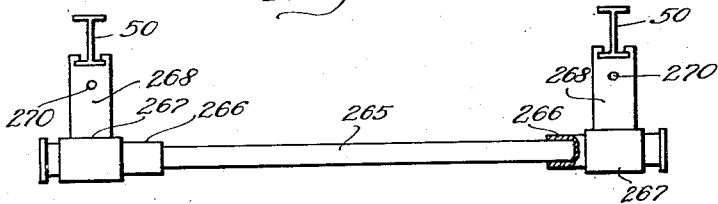
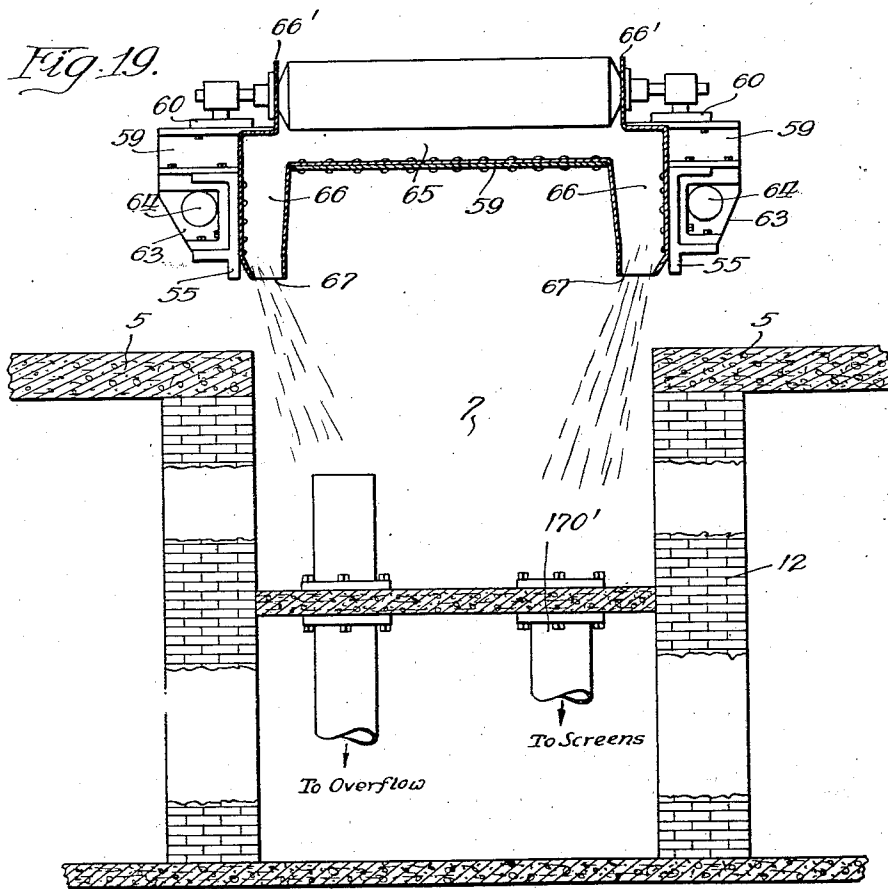


Fig. 19.



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UNITED STATES PATENT OFFICE

2,039,780

PAPER MAKING MACHINERY

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Original application September 24, 1928, Serial No. 307,966. Divided and this application February 27, 1930, Serial No. 431,734

16 Claims. (Cl. 92-44)

This invention relates to paper making machinery and the present application is a division of my copending application Serial No. 307,966, filed September 24, 1928, relating particularly to the method of and means for replacement of the forming wire.

In machines of this sort it is necessary that provision be made for changing the forming wire as and when desired. The reasons for this are well known in the art and need not be reviewed here.

To meet this requirement various wire replacement methods have been previously proposed. It is old in the art, for example, to slip the wire transversely over the machine and it is also old in the art to remove the machine transversely into the aisle adjacent the machine and to string the wire between the main side sills or along the position normally occupied by the machine in its operative position and to then return the machine transversely back into the wire loop.

The first case referred to in the preceding paragraph has required stringing the forming wire in the aisle along the machine and placing auxiliary lifts within the wire loop, these auxiliary lifts being engaged with the side of the machine usually at the couch and breast ends and along the intermediate frame. The machine itself has then had to be lifted by the outer ends of the auxiliary lifts, the removable blocks along the front side frames being removed to leave a passage through which the wire may be passed transversely and the wire loop has had to be expanded to pass over the top, bottom and ends of the machine. The auxiliary lifts must be substantially equal in length to the width of the machine, these auxiliary lifts being engaged or hooked into the frame or other structural part along the front side of the machine and in this position the auxiliary lifts and structural part of the machine form simple beams substantially twice the width of the machine jointed at the middle with substantially one-half of the weight of the machine on the joints. In machines of relatively great width say, for example, 300 inches, the auxiliary lifts and structural part of the machine form beams substantially 50 feet long which would be required to lift a load of the order of 150 tons through the joints between the side of the machine structure and the auxiliary lifts. This necessitates exceedingly heavy auxiliary lifts to carry the load and it is necessary to arrange these auxiliary lifts through the inside of the wire loop which is difficult to do without touching and destroying or injuring the wire which is relatively expensive and exceedingly fragile and easily injured in this manner.

With the second or transversely removable table type machine heavy transverse rails are arranged across the sills being usually supported at their

opposite ends on the front and back side sills and forming simple beams on which the table is movable. Further auxiliary rails must be placed usually in alignment with the first or inner transverse rails transversely across the front side aisle. The weight of the machine is then transferred to the cross rails, the front and back sides of the machine being usually provided with wheels which ride on the inner transverse rails and on the outer auxiliary transverse rails and the entire forming table is then shifted or moved transversely into the aisle. In shifting the forming table out transversely upon the inner and outer rails the machine must cross the joints between the meeting ends of the inner and outer rails and the rails are usually loosely secured because they must be removed later. These loose rails are susceptible to displacement by this movement and their displacement is liable to cause the machine to fall into the pit with injury and possible destruction. As the machine is moved transversely one-half of the weight of the machine at one time rests on the centers of the beams which are supported loosely across the sills and only at the ends on the sills. This makes it necessary to construct these rail members of large section to provide the necessary supporting strength. On a 300 inch machine, that is on a machine which is of width of 300 inches, these rails must have a vertical section of the order of 15 square inches and must weigh in the neighborhood of two and one-half tons each.

After removing the forming table transversely from normal operative position between the longitudinal sills and into the adjacent side aisle along the machine, the inner cross rails which are arranged across the longitudinal sills must be removed to permit stringing the wire in place between the sills with its bottom run beneath the positions occupied by said inner transverse rails in the removal and replacement of the machine. The wire on the wire spool is placed between the sills of the machine usually at the couch end and extended to the breast end, supports being placed within the wire loop to spread the wire and separate the top and bottom runs between the end bights of the loop sufficiently to permit the table to be moved back transversely from the aisle and into the wire loop. The heavy inner transverse rails must then be replaced through the inside of the wire loop over the bottom run of the wire and this has been exceedingly difficult because of the great weight and size of these rails and the necessity for keeping them from touching the fragile and easily injured wire. The Fourdrinier part or table of the machine is then moved transversely on the inner and outer rails into the wire loop and into substantially its normal position over the sills, whereupon the weight of the machine is usually

removed from the rails and transferred to the normal supports, such as the side housings, blocks, or the like, leaving the transverse rails free. The inner transverse rails at least must now be removed from within the loop and this removal must be effected without injuring the wire which is exceedingly difficult.

The various parts must then be placed in their normal positions and the wire must be stretched or tensioned before the machine is ready for operation. In order to provide slack for the application of the wire loop provision is commonly made for reducing the distance between the couch and breast rolls to provide slack between these parts for the application of the wire loop and for increasing this distance to take up the slack and tension the wire.

According to the practice above referred to, the heavy inner and outer rails have had to be separate to permit placing the inner rails into the wire loop for removal and replacement of the table and removal of these rails from within the wire loop after stringing the wire and moving the machine back into the loop. If these inner and outer rails were in one piece the difficulties of removal and replacement of the rails would not only be greatly increased by the greatly increased size and weight of the rails but it would be impossible to remove such rails without removing the entire weight of the machine, not only from the inner but from the outer or aisle rails as well. Even with these rails made up separately with the outer ends of the inner rails along the front side sill and the inner ends of the outer rails along the front side sill as has been the practice, it is necessary to move the entire table outwardly sufficiently to clear the inner rails in order to permit their removal from and replacement within the wire loop. The movement has therefore necessarily been greater than would be required to simply clear the width of the wire loop itself. Various manners of removal of the heavy inner rails from and replacement into the loop have been provided for.

It has been proposed to lift them out and replace them bodily and it has also been proposed to pivot them at their outer ends to the outer sill to be swung into and through the loop for removal and replacement of the table and out parallel or substantially parallel to the outer sill for arrangement of the wire loop between these sills. They all have substantially the same disadvantages.

It is an object of the present invention to eliminate the difficulties and disadvantages above referred to.

It is another object to provide for applying the forming wire loop over all or any desired part or parts of the machine by stringing the wire laterally of the machine, applying the wire loop over the machine or part thereof by relative lateral movement and sustaining the weight of the machine or machine part from outside the wire loop and along the bottom run of the loop in the application of the wire and more specifically sustaining the weight of the machine or machine part through the bottom run of the wire and upon transverse rails beneath the bottom run of the wire. The present invention may be employed along the entire machine or in connection with any desired part or any desired combination of parts around which it is desired to place the wire.

The present invention may likewise be employed in connection with the lateral removal of

all parts which are within the wire loop in the operation of the machine or it may be employed only in connection with the lateral movement of some of said parts or in connection with some laterally removable parts in combination with other parts which may be cleared without lateral movement for the placement of the wire thereover.

The present invention enables the machine to be supported at all times in a positive manner and supports may be provided at any point or points between the end sill supports. The use of lighter and safer constructions for supporting the machine is permitted and the possibility of the machine dropping or falling by excessive stresses upon the structure is eliminated.

Another object is to permit complete removal of the heavy inner transverse rails from within the wire loop at all times. According to this aspect of the invention the rails which sustain the weight of the table or other laterally removable part or parts and which guide this part or these parts are disposed outside the wire loop and below the bottom run of the wire where they may be permanently disposed and need not be removed and replaced in stringing a wire.

Another object is therefore to eliminate the necessity for removal and replacement of the inner transverse rails and particularly to eliminate the necessity for placement of these rails within and removal from the inside of the wire loop.

Another object is to eliminate the necessity for moving the table or other laterally removable part outwardly sufficiently to clear the inner rails for their removal in the stringing of a wire. This enables reducing the aisle clearance requirements necessary, particularly the width of the aisle or the width of the clearance into which the laterally removable part is moved.

By the disposition of the inner transverse rails beneath the bottom run of the wire loop it becomes unnecessary to place any heavy auxiliary parts for supporting the machine within the wire and it becomes unnecessary particularly to place heavy inner rails within and to remove them from the inside of the wire loop. Another feature of the disposition of the rails below the bottom run of the wire is that they will prevent the bottom run of the wire from sagging down and making objectionable contact with objects below the machine during the application of the wire and before it is operatively disposed upon the machine.

With the present invention it is unnecessary to add additional metal or structure to the machine, frames, Fourdrinier table or cross bracing even if joined.

Another feature of the present invention resides in placing the transverse rail means laterally of the machine structure and lifting said structure over the bottom run of the wire by relative transverse movement between said structure and said rail means.

Another feature of the present invention resides in the pad rails for protecting the wire from the shearing or kinking action of any parts of the machine or lifts, the wire being secured between the transverse rail outside the loop and a light pad rail inside the loop. This forms the lifting assembly and the wire may be strung over the relatively heavy outer transverse rails beneath the bottom run of the wire whereupon the light pad rails are placed within the loop and upon the heavy outer rails with the bottom run of the

wire disposed between the heavy outer rails and the inner lightweight pad rails.

The stringing of the wire may be in the side aisle whereupon the transverse outer and inner pad rails between which the bottom run of the wire is secured may be shifted transversely inwardly to slip the wire over the machine or the machine may be moved out transversely into the aisle and the wire strung between the sills with its bottom run between the outer rails and the inner lightweight pad rails whereupon the machine is moved back into the wire loop. The outer rails are the rails which are adapted to sustain the weight of the machine or laterally removable part and these rails may be made relatively heavy without disposing their great weight and bulk within the wire loop. The arrangement of the bottom run of the wire loop over the top of the heavy rails and the movement of these rails into position beneath the machine with the bottom run of the wire between the rails and the machine, as well as the arrangement of the bottom run of the wire above the outer rails with the movement of the machine over these rails with the wire disposed between them and the machine is predicated upon the theory that the forming wire while weak in tension, shear and torsion will withstand infinite crushing pressures. For example, I have arranged an "Appleton" 70 gauge forming wire between pads and have subjected the wire to a crushing pressure of 250,000 pounds without a trace of injury, this being approximately equal to the weight of a machine 600 inches in width which is approximately twice the width of the largest machine constructed so far as I am aware.

Pads are preferably interposed between the bottom rail and the wire and between the wire and the upper pad rail. These pads may be of hard fibre, vulcanized rubber or any other suitable or preferred material which will cushion the wire against bruising action. The removable pad rail within the wire loop is preferably fastened securely against any movement in the wire servicing operation. The rail which is outside the wire loop or beneath the bottom run of the wire may be extremely heavy, of the order of five tons, whereas the upper pad rails which are placed inside the loop for removal may be extremely light. These upper pad rails may even be in the form of thin sheets although some rigidity is preferable with a Fourdrinier wire.

According to one form of the invention selected for illustration the pad rail assembly, including the outer rail beneath the bottom run of the wire, is equipped with rack means which engages pinions mounted on the side of the machine. These pinions may be operated by power shafts extending from the breast end to the couch housing and the pad rail assemblies with the outer heavy rails are adapted to be shifted in transversely by power with the wire cradled, that is, embedded between the two rails, the heavy outer rail and the inner lightweight rail, the pad rail assembly with the outer rails lifting the machine and carrying the wire in over the entire machine by power. In addition to the other features of novelty it is, I believe, broadly new to carry the wire transversely and lift the machine over all of the parts by power at one time.

It is to be understood that the present invention is not limited to use with any particular machine or any particular type of machine nor to the particular embodiment selected for illustration.

In order to acquaint those skilled in the art with the manner of constructing and operating the present invention, I shall now describe, in connection with the accompanying drawings, the illustrated embodiments of the invention.

In the drawings:—

Figure 1 is a more or less diagrammatic longitudinal section through a plant layout in which the illustrated embodiment of the invention is embodied;

Figure 2 is a vertical section taken transversely through the plant layout across the forming table regions and substantially on the line 2—2 of Figure 3;

Figure 3 is a plan section taken on the line 3—3 of Figure 2 showing an arrangement of two paper making machines in the plant layout of Figures 1, 2 and 3;

Figures 4 and 4A are more or less detail views in side elevation partially broken away and partially in section of a paper making machine embodying the present invention (Figure 4 to be laid to the right of Figure 4A with the line a—a of Figure 4 on the line a—a of Figure 4A);

Figures 5 and 5A are views in side elevation partially broken away and partially in section showing the Fourdrinier machine with the breast end in level forming table position. (Figure 5 is to be laid to the right of Figure 5A with the line d—d of Figure 5 on the line d—d of Figure 5A);

Figure 6 is a view in elevation of the breast end of the Fourdrinier machine as shown in Figure 5, a part of the structure being shown in section;

Figure 7 is a view in longitudinal section of the couch roll assembly in one form;

Figure 8 is an end view partially in section of the couch roll assembly showing wire replacement means embodying the present invention in connection therewith;

Figure 9 is an end view of the couch roll assembly showing wire replacement means embodying the present invention in connection therewith and showing the couch roll assembly supported for movement of the Fourdrinier machine laterally to either side for replacing the forming wire;

Figures 10 and 10A are views in side elevation of the couch roll assembly and breast end assembly, showing hoists for raising the structure for replacing the forming wire. (Figure 10A is to be placed beside Figure 10 with the line e—e of Figure 10A on the line e—e of Figure 10);

Figures 11 and 11A are views in side elevation showing the breast end of the machine and a couch roll assembly of modified construction with the wire replacement means of the present invention embodied in connection therewith. (Figure 11A is to be placed to the right of Figure 11 with the line f—f of Figure 11A on the line f—f of Figure 11);

Figures 12 and 12A are views in side elevation of the couch and breast ends of the machine showing the machine cleared and the wire stringing means in position for replacing the wire. (Figure 12A is to be placed to the right of Figure 12 with the line g—g of Figure 12A on the line g—g of Figure 12);

Figure 13 is a view in elevation of the wire stringing means at the couch end of the machine with the walls of the plant in section;

Figure 14 is a top plan view of one of the wire replacement rail assemblies showing one of the relatively heavy rails which is arranged outside the wire loop and beneath the lower run of the

loop and also showing the cooperating relatively lightweight pad rail therefor;

Figure 14A is a detail section taken on the line 14A—14A of Figure 14;

5 Figure 15 is a longitudinal section through the upper relatively lightweight pad rail taken on the line 15—15 of Figure 14A;

Figure 16 is a detail longitudinal section taken on the line 16—16 of Figure 14A;

10 Figure 17 is a side elevational view of the lower or outer rail which is disposed outside the wire loop and beneath the lower run of the wire;

Figure 18 is a detail view partially in section of 15 suitable wire stringing means;

Figure 19 is a transverse section showing the filter system;

Figure 20 is a detail view of the breast roll assembly including the shake stand partly in 20 section; and

Figures 21 and 22 are detail views of the blocks for supporting the breast end of the Fourdrinier machine at variable elevations.

The making of paper being a continuous process and a paper mill operating as a rule twenty-four hours a day, conditions that prolong interruption of operation, such as the prior methods of replacing the Fourdrinier wire which require dismantling and again erecting much of the machine structure with great risk of sustaining injury to the wire and the prior methods of passing the wet web of the forming paper from the Fourdrinier machine to the driers which results frequently in the web breaking at intermediate 35 points on the driers with excessive accumulation of waste paper and prolongation of the time the apparatus is out of production and conditions whatsoever that interfere with or reduce the production time of the apparatus are of primary 40 importance from the viewpoint of output and production costs in the paper making industry. So far as the improvements in the threading of the wet web of the forming paper as it leaves the Fourdrinier machine and passes onto the 45 drier are concerned, the parent application of which this is a division is directed to that and other features which may not be discussed in detail in the present application which relates particularly to the new forming wire replacement method and means.

The parent application also points out that the present requirements of plant layout for operating and servicing the paper making apparatus adds heavily to the plant investment and that 55 there is an increasing demand in the industry for economies both in the plant layout and in the time and labor costs for servicing the apparatus.

Some of the economies in the plant layout are the result of features of the parent application and so far as they are they are claimed in that application. Other economies, such as the reduction in the lateral clearance required for a laterally removable table type machine, are the result 65 of the new wire replacing method and means of the present application and this wire replacement method and means also effects economies in the time and labor costs for servicing the 70 apparatus. For example, the present invention expedites the servicing of the apparatus and thereby reduces the time and labor costs and by making it unnecessary to completely clear the inner transverse rail portions which are arranged transversely across the longitudinal sills

of the machine with each wire replacement the amount of lateral clearance required is reduced and space economies are effected.

Referring now to the drawings and particularly to Figures 1, 2, 3, 4, 4A and 13, the reference character 1 designates the main floor elevation. 5 Below the main floor level 1 are pits 2 in which portions of the apparatus are located, the floor elevation on the rear side of the apparatus, opposite the presses and suction couch of the Fourdrinier machine being indicated at 3 and the floor elevation of the Fourdrinier machine being indicated at 5.

Alcoves 4 in the plant layout illustrated in Figures 1 to 3 are located at the rear sides of 15 the Fourdrinier machine in opposite wings of the plant, the arrangement as shown being for two paper making machines installed side by side and operated in coordinated relation. The alcove floors 5 are supported on foundations 8—8a. 20

The saveall below the suction couch is indicated at 6 and the saveall below the forming table is indicated at 7 (Figures 4 and 4A), all of the filter water being delivered into the latter. This arrangement eliminates the usual troughs 25 in the rear of the machine and is an important factor in the space saving provision of the parent application.

Steps 9 are placed between the floors 1 and 3 and steps 10 are placed between the floors 3 and 30 5 on the rear side of the Fourdrinier machine.

The front side aisle of the apparatus on the main floor 1 is indicated at 11, the width of the aisle being shown as substantially one-third of the width of the Fourdrinier machine, although 35 this may all vary widely within the present invention.

The Fourdrinier machines are supported on foundations 12 extending longitudinally of the machines as shown in the plan view of the sills 40 in Figure 3. The over-all width of the main machine room for both machines is indicated by the walls 13.

The driving connections for the presses and couch rolls of the Fourdrinier machine are located on the rear side of the machine (not shown) in the spaces indicated at 14. A ban- 45 nister rail 15 is placed as here shown between floors 1 and 5 as a safeguard between the different elevations, the main aisle being extended under as well as above the floor 5 from the ban- 50 nister rail forward to the breast end of the Fourdrinier machine as indicated in Figures 1 and 2. This double floor level is immaterial so far as the present invention is concerned but the present application being a division of my copending application Serial No. 307,966, filed September 24, 1928, some views of the above application, including these features, are necessary to impart a full 60 understanding of the wire replacement method and means of the present invention and where such showings are included they are being described just briefly in the manner of the description of the parent application. The full advantages of the double floor level arrangement and such space saving features as are not the result 65 of the wire replacement method and means of this invention will not be reviewed here.

In the drawings, the Fourdrinier machine is 70 shown in side elevation in Figures 4, 4A and 5, 5A certain details of construction common in the art being shown more or less conventionally. It will be noted that the breast roll 75 of the machine as best shown in Figure 4 is preferably supported 75

at an elevation which causes the paper forming wire W to be inclined downward from the breast roll to the couch roll 120 in accordance with the Eibel system for effecting gravity movement of the paper stock with the movement of the wire.

The breast housing 25 as best shown in Figures 4, 5 and 6 has bolted to it the male members of ball and socket joints 26, 27, the latter being parts of opposite hydraulic jacks 28 upon which the breast end of the machine is normally supported at variable elevations. The mechanism for operating the jacks consists of a water supply pipe 29, and pump 30 operated by a motor 31 and connected to the jacks by gears 32, 33 and the shaft 34. Gears 35 of the shaft 34 operate racks 35 which have secured to their upper ends the lower members of the joints 26, 27.

The opposite sides of the breast housing are connected one with the other by a cross frame member, the opposite jacks being joined together and braced laterally by a frame member 38.

The jacks 28 serve for raising the breast end of the machine to any desired elevation within the limits of operation for determining the inclination of the paper forming wire as may best suit the nature of the paper stock and the conditions of operation. It will be apparent that the ball and socket relation between the part 26, 27 will compensate for the angular movement of the breast end of the machine as it is moved to raised position by means of the hydraulic jacks thus relieving the structure of stresses which would otherwise occur in more or less degree. The lifting jacks as shown are preferably set at a suitable angle to compensate for the changes in the weight center on the jacks as the machine is raised.

Upon raising the breast end of the machine to the desired elevation, as illustrated in Figure 4, the structure is supported on opposite sides upon split blocks 39, 40 adapted for building up the support for the machine more fully disclosed in the parent application, these blocks preferably being of the required accuracy in thickness for supporting the opposite sides of the machine at level elevation.

Connected to the opposite sides of the couch housing 45 at the opposite end of the machine, as shown in Figures 4A and 5A, are vertical supports 46 secured by dowelings 47, 48 and connected by compensating slotted joints 49 to opposite rails 50 extending from the breast end to the couch end of the machine, the rails being connected at the breast end at 51. Removable blocks 52 at the breast end and 53 at the couch end support the parts of the machine within the wire loop.

The structural parts within and in the adjacent lateral planes of the wire loop consist of opposite truss rails 55 which extend from the blocks 52 to the blocks 53 and yoke bearings 56 secured to the opposite rails 55 and supported at 57 on the table housing 58 which in turn rests on the blocks 53. The rails 55 are cross-braced by rails 59 which project laterally outwardly of the rails 55, the projecting ends being supported by brackets 63 for preventing torsional displacement of the rails 55.

The table rails 60 are bolted to the cross rails 59 and extend parallel with the rails 55 between the breast end of the machine at 61 and blocks 62 on the rails 55 which support their opposite ends.

Provision is made on the brackets 63 as indicated at 64 (Figure 19) for supporting on the

machine as here shown the self-contained water system. In the arrangement of this system neither the truss rails 55, table rails 60 nor the savealls are included in the shake structure. The arrangement of the savealls serves for preventing backlash of the deckle edges of the paper sheet which develops from the shaking action in machines of the usual construction.

The details of the saveall system consist as best shown in Figures 5 and 19 in the saveall trays 65 10 which are connected to and discharge into troughs 66. The sides of the troughs extend upward to the level of the paper forming wire as indicated at 66' in Figure 19 and are bolted to the cross rails 59 and to the rails 55 and the lower ends of the troughs 66 discharge at 67 into the pits 7 below the forming table.

Supported on the rails 55 as shown in Figures 4, 5, and 6 are the breast roll housings 71 which are split at 72 and are bolted to the rails at 73, 20 74. The breast roll 75 is supported on spiders 76 (Figure 20) secured to a hollow shaft 77 which is journaled at its opposite ends in bearings 78 mounted loosely in the yoke housings 71, the bearings being slidable transversely of the machine on the rails 55 in the shaking movement.

Springs 80, 81 on opposite sides of the bearings 78 serve to compensate for the end thrust in the breast roll journals in the shaking action, these springs being retained in the bearings by plates 82, 83 secured to the housing 71.

Extending through the breast roll housing 77 is a tie shaft 84 having its opposite ends secured in the bearings 78 at 79, nuts 85, 86 being threaded on the ends of the shaft and acting to hold the shaft rigid between the bearings. Secured to one end only of the shaft 84 is a yoke 87 provided with bosses 88, 89 for co-acting with a cam 90 to impart an axial shaking action to the breast roll. The shape of the cam 90 is such, as shown in Figure 6, that a rapid triple shaking action, in addition to a long, relatively slow, overall stroke is given to the breast roll upon each rotation of the cam with corresponding effect on the paper stock on the forming wire. The cam 90 as best shown in Figures 12A and 20 is secured to an operating shaft 91 supported in bearings 92 on vertically adjustable bearing bases 93 which are slidable on base housings 94 supported on the floor 5. A gear 95 on the shaft 91 meshes with a gear 96 driven by a motor 97 which is mounted on one of the sliding bases 93. A boss 98 on the block 93 coacts with a boss 99 on the breast housing 25 for effecting the vertical adjustment of the breast roll shaking apparatus.

As best shown in Figure 12A the cam shaft 91 has a relatively long extension for disconnecting the shaft so that the base housing 94 on the rear side of the machine will not be in the way for replacing the paper forming wire. For putting on the wire the shaft 91 is shifted endwise as shown for disconnecting it from the shake mechanism.

A board 100 secured to the truss rails 55 coacts with the breast roll 75 in the usual manner for wiping the surface of the roll. The table rolls 105 are supported in bearings 106 on the rails 60 in the usual relation. The suction boxes 108, 109 are supported on an angle plate 107 secured to the rails 55 in the relation shown in the parent application. A water line connection 110 for the suction boxes is shown more or less conventionally being substantially the same in arrangement as more fully disclosed in my prior Patent No. 1,679,854 of August 7, 1928.

A guide roll 111 for the paper forming wire W is supported on the couch table housing 58 as shown in Figures 4A and 5A. A wire carrying roll 112 supported in bearings 113 is provided with a doctor blade 113a which acts to prevent fiber carried on the wire from the forming table from accumulating on the roll 112 and injuring the wire, the doctor blade being self-contained in the assembly of the carrier roll 112 for convenient removal of these parts as a unit for replacing the wire.

Wire carrying rolls 114, 117 and 118 and a roll 115 supported on pivoted arms 116 (Figures 5 and 5A) are provided in the lower draw or lower run of the wire, the rolls 114, 117 and 118 being supported on the opposite rails 55 and the roll 115 being supported on the pivoted arms 116 and acting to stretch or tension the wire.

In Figures 4A, 5A, 7 and 10 is shown a couch roll 120 of the Millsbaugh suction couch type. The general arrangement of this structure which is well known in the art presents peculiar difficulties in replacing the paper forming wire. An object attained with my present invention consists in a modified arrangement of this structure for replacing the wire with less difficulty. The base of the couch housing 45 as shown is well below the main Fourdrinier floor 5, the suction couch roll 120 being supported in a pit and the forming wire from the guide roll 111 to the couch roll 120 and from the couch roll 120 to the first carrier roll 112 being disposed at acute angles thus causing a greater bite of the couch roll for driving the wire, which, in the degree attained by the arrangement shown, is a desirable condition of operation more especially in Fourdrinier machines of large capacity. In a machine having a capacity for producing paper 400 inches wide the couch roll will be approximately four feet in diameter. Thus the elevation of the forming table in a machine of large capacity and of the usual construction would be above the line of view of the operator which presents an impracticable condition of operation.

In Figures 4A and 7 are shown the suction couch roll 120, the suction box 121 and the suction pipes 122. The end bearings 124, 128 of the couch roll 120 are joined together by a cross tie shaft 126, the ends of the shaft extending through the bearing hubs 125. The couch roll drive gear 129 is mounted between the bearing 128 and a split bearing 130 at one end of the roll and the couch roll supporting structure is connected to the opposite bases 131 (Figures 4A and 5A) which are slidable on inclined ways 58 on the couch roll housing 45. The driving connection to the gear 129 consists of a gear 134 (Figure 5A) and a drive shaft connection on the rear side of the machine, the driving connection as shown keeping the rear side of the machine clear for replacing the forming wire.

The base construction of the couch roll consists of the couch housing 45, blocks 53, the table couch housing 58 and the sliding bases 131 tied together in an integral assembly. As the couch roll is raised for replacing the forming wire the bases 131 slide on the ways 58 thus shortening the distance between the couch roll 120 and the breast roll 75 thereby giving added slack to the wire for clearing the enlarged end bearings 124, 128 for the couch roll.

Another form of couch roll construction known commercially as the Kilberry couch roll is shown in Figure 11. In this form the couch roll 120K is supported on journals 125K, 126K the roll be-

ing driven by gears (not shown) on the side of the machine opposite that shown in Figure 11.

The difference in the two forms of couch roll construction, so far as the present application is concerned, lies in the different forms of journals for supporting the couch roll. In the construction shown in Figure 7 the journals are larger in diameter than the diameter of the roll and accordingly require the added slack in the forming wire provided by the inclined ways 58 and the sliding bases 131 which travel thereon in raising the couch roll assembly. In the form illustrated in Figure 11 the couch roll journals are smaller in diameter than the roll and the added slack in the forming wire is not required. Accordingly, in the form shown in Figure 11 no provision is made for shortening the distance between the breast and couch rolls for replacing the forming wire, it being understood that this distance may be shortened or not shortened as desired and that where shortened the particular manner of shortening the same may vary widely within the scope of this invention.

In the couch roll assembly shown in Figure 11 the couch roll 120K is supported in head bearings 131K which have sliding movement on vertical bearings 58K, the roll journals 125K, 126K being of normal diameter smaller than the diameter of the roll.

The planes of movement of the paper forming wire as herein shown and described and their effect upon the operation of the wire and upon the amount of slack obtainable in the wire for replacing the same correspond to the disclosure of the parent application and are shown herein simply in order to impart a clear understanding of one embodiment of this invention, it being understood that these features may vary widely within the broader aspects of this invention. At the same time, however, I desire to reserve any novelty in these features per se and I also desire to reserve any novel coordination between any of these features and the wire replacement method and means of the present invention.

A more detailed description of these features is as follows:—

From the breast roll 75 to the guide roll 111 the wire W moves in a straight line in an angular plane according to the elevation of the breast end of the machine. From the roll 111 to the couch roll 120 the plane of the wire changes to an acute angle downwardly and from the couch roll 120 to the carrying roll 112 the plane of the wire W is at an acute angle upwardly, the rise of the wire preferably approximating the elevation of the suction boxes. Between the carrying roll 112 and the roll 114 the plane of the wire is substantially parallel with the adjacent portion of its upper run and from the roll 114 to the roll 115 and from the roll 115 to the roll 117 the plane of the wire varies with the tension of the wire.

From the roll 117 to the roll 118 the plane of the wire is again substantially parallel with the adjacent portion of its upper run and from the roll 118 to the breast roll 75 the wire inclines at an acute angle downwardly.

The advantages of the arrangement and travel of the paper forming wire per se are disclosed in the parent application of which the present application is a division and will not be repeated here.

Outside of the wire loop and along the upper course or upper run of the wire are the rails 50 which effect rigidity in the span from the breast to the couch end of the machine. Extending longitudinally with the rails 50 as best shown in 75

Figures 4, 4A and 5, 5A is a water line 138 and at 139 is a steam line, the water and steam lines 138 and 139 being extended along the front rail 50. An angle cross brace extends from the front to the back side of the couch housing 45 and supported upon the couch housing is a water jet 141 connected with the water line 138 by means of a hose 142. Another water jet 144 connected to the water line by means of a hose 145 (Figure 12) is supported on a bracket 143, the jet 144 being adjustable transversely of the machine and also angularly to any desired position by a set screw 143a (Figures 4A and 12). The water jets 141 and 144 are cut squirts disposed above the top run of the forming wire. These cut squirts are adapted for cutting the sheet of paper so that it may be more readily picked up and transferred to the press rolls.

A dandy stand 146 of the construction illustrated in the parent application is secured to the rail 50 at 147 being mounted upon vertical legs 148 by means of a vertically adjustable bearing 149 for adjusting the dandy roll 156 relative to the forming wire W. A cable 150 (Figures 4A and 5A) operable on a windlass 151 supported on the rail 50 is adapted for moving the dandy roll 156 out of operative relation with the wire for replacing the wire. A pipe 152 connected to the water line 138 by a hose (not shown) is secured to the dandy stand 146, a hose 154 connected to the steam line 139 being extended parallel with the pipe 152 and connected to the steam line 155, all of said connections being above the lateral plane of the wire. The water and steam lines 138, 139 and 155 may be supported in any suitable manner parallel to the plane of movement of the forming wire for supplying water and steam to the dandy roll which is journaled at 157, the water and steam lines being oblong in vertical cross section as shown for stiffening the pipes to prevent sagging between the supports. The purpose of the water and steam supplies to the dandy roll is to clean the same and prevent plugging of the meshes of this roll. The water and steam supply is preferably intermittent although the water supply may be continuous and the steam supply is adapted for use with or separately of the water supply as, for example, at the end of a paper forming run on the machine. The dandy roll is indicated at 156 in Figure 4A. The cable 150 is connected with the dandy stand 146 at 155 and the steam and water jets are indicated at 154 and 154' in Figure 4A.

A foot board assembly 158 spans rails 50 in a manner which does not require removal of the foot board for replacing the forming wire on the machine.

The deckle returns 159 are supported in box bearings 160 secured to rails 50, the half section deckle returns being held against turning by lever screws 161. Troughs may be secured to the deckle supports for catching portions of the paper stock carried up by the deckles 165 and are adapted for discharging the accumulation of stock at the side of the machine thereby preventing such material from falling back on the wire which may result in breaks in the paper or injury to the wire. A conduit 163 for electric light wiring is supported on the rails 50 the wiring being self-contained on the machine and provided with connected lights 164 arranged for effecting a better lighting system.

The particular stock circulating apparatus per se may vary widely within the scope of the present invention. The particular apparatus shown is

similar to that more fully disclosed in my copending application, Serial No. 307,966, filed September 24, 1928. The details and advantages per se of this apparatus will not be repeated here. Suffice it to say that the particular apparatus shown is a high pressure, substantially sealed nozzle apparatus for discharging the stock at extreme speed onto the forming wire W.

The water flows from the pit 7 (Figure 19) below the forming wire and thence to the stock 10 mixer and screens (not shown) through a pipe 170' from where it is pumped through a pipe 170 (Figure 5) into a stationary tank 171 supported independently of the Fourdrinier machine. The tank 171 has a downwardly inclined bottom to which a plurality of pipes 172 are connected the particular number of pipes varying with the width of the machine. The pipes 172 are arranged telescopically in pipes 176 slidable thereon and packing joints consisting of parts 173, 20 174 and 175 (Figures 4 and 5) serve to prevent leakage between the pipes. This arrangement provides in effect water-tight flumes communicating between the tank 171 and a stock chest 178 supported between the opposite sides of the breast housing 25. A perforated vertical wall 177 (Figure 4) extends lengthwise through the bottom of the chest 178 and serves for spreading the flow of stock as it moves by gravity to the lower portion of the chest and thence upward into the substantially sealed nozzle 180 from which it is discharged under super-hydraulic pressure upon the forming wire. The entire structure 173-178 inclusive is supported on the breast housing 25 in any suitable manner and moves with the breast housing in the elevation adjustment thereof, the telescopic engagement of the pipes 172 and 176 allowing for the adjustment.

A manhole 179 provides entrance to the chest 40 178 and the perforated wall 177 is removable from the chamber for cleaning as desired.

The nozzle 180 for a Fourdrinier machine 400 inches wide has a capacity of approximately 550 gallons and discharges its full capacity of paper stock a number of times per minute thus producing a lively action of the stock as it moves through the flumes 172, 176 and through the chest 178 and the nozzle 180 to the forming wire. The particular arrangement shown is effective for preventing dead ends in any part of the passage in which stagnant stock can form into lumps and the nozzle is substantially sealed as more fully disclosed in the copending application above referred to. The detailed structure of the nozzle 180 is shown in the copending application above referred to, the nozzle having an outlet to the paper forming wire which may be adjustably controlled by a sluice designated generally at 200 and the other sides of the nozzle being sealed some of the sealing sides at least being flexible and having cooperation or engagement with the wire and the nozzle housing being generally half round in cross section.

The deckle straps 165 pass over and under the nozzle 180 (Figure 4) ample vertical clearance being provided in the guides 193 for preventing injury to the forming wire by the deckle straps. The discharge side of the nozzle is adjustably regulated by the sluice means 200 which extends across the lower front of the nozzle being supported by outwardly projecting brackets 201 on the front of the nozzle housing.

The opposite ends of the sluice means 200 may

be cut away for clearing the deckle straps 165, adjustable wing sluices being preferably provided as more fully disclosed in the copending application already referred to.

Between its opposite ends the nozzle is open to the forming wire W as it passes over the breast roll 75 the paper stock flowing with the movement of the wire under the sluice means 200 to the forming table and the elevation of the sluice means 200 determining the thickness and the spacing of the deckle straps determining the width of the paper. The elevation of the breast end of the machine and the resulting inclination of the forming wire over the forming table, together with the increased intensity of the breast shaking movement and the increased activity in the flow of the stock to the forming wire resulting from the added pressure in the substantially sealed nozzles are factors which operate together to produce a more uniform and more active flow of the stock to the forming wire and a more even spread of the stock on the wire as it moves to the forming table.

The principal aspect of the present invention resides in the improved method of and means for replacing the forming wire on the Fourdrinier machine with the advantages and elimination of previous difficulties all as set out at the outset of this specification.

In Figures 8, 9, 10, 10A, 11, 11A, 12, 12A and 13 the Fourdrinier machine is shown in various arrangements for replacing the wire, Figures 10, 10A and 11, 11A showing modifications in the couch roll construction as herein described and corresponding modifications in the associated structure for replacing the wire.

The successive steps for replacing the wire W consist in raising the couch assembly as shown in Figures 10 and 11 according to the construction, raising the breast end of the machine, removing the blocks 52, 53 on the rear side of the machine, and drawing out a series of rails into the aisle along the side of the machine as shown in Figure 8. The machine is lowered upon these rails, the wire loop being stretched in the adjacent alcove as shown in Figures 3 and 13 or in the adjacent aisle and between the main bottom rail parts which are disposed beneath the bottom run of the wire and the upper auxiliary pad rails whereupon the main outer and inner pad rail assemblies are moved back in transversely between the side sills moving the wire transversely into position over the machine and the machine structure may then be restored to normal relation. It is to be understood that because of the duplex arrangement or arrangement of two machines side by side the aisle 11 (Figure 3) is designated as the front aisle whereas the aisles 14 are designated as the rear aisles and that the main outer and inner pad rails or the forming table, as the case may be, will be described as being moved out laterally to the rear side of the machine but this lateral removal of the rail assemblies or table may be from the front side or from either side within the scope of this invention.

For example, where there is but a single machine with a full width aisle along the entire front of the machine or an alcove adjacent the front side of the forming table, the rail assemblies or table may be withdrawn into and replaced from the front side or this withdrawal and replacement may be into and from the rear side or both sides may be adapted to permit the withdrawal

and replacement of the rail assemblies or table or other structure of the machine.

The detailed structure of the wire replacing rail assemblies above referred to is shown in Figures 14, 14A, 15, 16, and 17 and consists of the main outer wire replacement rails and the upper pad rails. The outer or bottom rails consist of blocks 215 the upper surfaces of which are formed into racks 217 and these blocks 215 are secured to the opposite ends of inverted cross channel rails 216. The blocks 215 at the ends of the rails 216 provide intermediate depressions 216a which are of width sufficient to accommodate the width of the forming wire. The upper pad rails which need be of lengths only substantially equal to the width of the forming wire are indicated at 222. These upper pad rails may be of exceedingly light weight and the length of each is substantially equal to the length of the depression 216a in the associated rail 216, each of the main rail depressions 216a being adapted to receive one of the pad rails 222 and the bottom run of the wire is arranged in these depressions 216a between the main outer rails 216 and the inner or upper pad rails 222 in replacing a wire upon the machine.

Pads 220, 221 are adapted for arrangement in the depressions or recesses 216a one between each main outer rail 216 and the bottom of the lower run of the wire W (Figures 14A and 16) and another between the top of the lower run of the wire W and each upper pad rail 222. These pads 220, 221 protect the wire W when the weight of the machine or machine part is on the rail assembly 216, 222.

As shown in Figure 17, the depressions or recesses 216a are each of a depth to receive the pad rail 222 with the pads 220, 221 interposed between the rail 216 and the upper pad rail and with the wire W interposed between the pads 220, 221 and to present the racks 223 on the upper surfaces of the pad rails 222 substantially flush with the racks 217 to constitute a continuous rail assembly for movement transversely into and out of position in replacing the wire on the machine (Figure 8) or for movement of the machine or machine part transversely into and out of position over these rail assemblies as in the embodiment of Figure 9. In operating relation of the machine the lower channel rails 216 are secured to the blocks 52, 53 except for the rail 216 under the couch assembly which with the upper pad rails 222 and pads 220, 221 are removed. It is to be understood that where the rail assemblies 216, 222 are moved out and replaced transversely that such of the rails 216 as are secured to the blocks 52, 53 are released to permit this movement. Upon replacement beneath the normal operative position of the machine the rails 216, except for the rail under the couch assembly, may be secured to the blocks 52, 53 and may remain in position beneath the machine in the operation thereof.

Where the machine or machine part is moved out transversely and replaced transversely these outer or lower main rails 216 may be secured to remain in place beneath the machine in the operation thereof (Figure 9) and need not be released for transverse movement.

Each set of rails 216, 222 is alike in construction and constitutes the wire replacement rails for the different sections of the machine, the breast end, couch end, couch table and mid-section. The wire replacement method and means of the present invention may be employed in connection

with all of the removable machine parts or only with certain parts or certain combinations of parts as desired. Under the couch roll 120 on both sides blocks 226 offset at 227 (Figures 8 and 9) and supporting wheels 228 are secured removably to the couch housing 45. Extension rails 230 best shown in Figure 8 between the foundation sills of the machine and in Figure 9 on the floor 5 and at the ends of the rail assemblies 216, 222 constitute parts of the structure for replacing the wire and will be understood as this description proceeds. In Figures 4, 4A and 5, 5A I have provided for application of the rail assemblies 216, 222 beneath the couch and breast ends of the machine and at intermediate points for wire replacement action beneath the entire table structure of the machine.

In Figure 8 I have shown the machine supported on the rail assemblies 216, 222 in position over the main sills. This is substantially the normal operating position of the machine with the exception that when in normal operative position the weight of the machine is transferred from the rail assemblies 216, 222 to the main sills or the blocks 52, 53 thereon. In this form of the invention one of the rail assemblies 216, 222 is shown in full lines as partially removed transversely to the right and in dotted lines one of these rail assemblies is shown as partially removed to the left. It is to be understood that the removal may be from one side only, the particular showing being illustrative of removal from either or both sides.

In Figure 9 the couch roll structure 120 which is illustrative of the entire machine or any desired part or combination of parts of the machine is shown moved out partially to the right in full lines and as being moved out partially to the left in dotted lines. As with the rail assemblies of Figure 8 the removal of the machine or machine part may be from one side only, the particular showing in Figure 9 being illustrative of removal from either or both sides.

Secured to the truss rails 55 is a relatively long shaft 235 which extends from the breast end to the couch end of the machine, this shaft 235 having joints 236. Power is applied to the shaft 235 by a worm gear drive 237 from any suitable power connection.

A gear 240 is secured to the shaft 235 below the breast roll and directly below the gear 240 which is mounted on the breast roll housing is a wheel 241. A second gear 242 on the shaft 235 is located intermediate the ends of the shaft and wheel 243 is mounted on the foundation sill of the machine directly below the gear 242. A third gear 244 on the shaft 235 is directly below the wire guide roll 111 and a wheel 245 is mounted on the couch housing 45 directly below the gear 244. A fourth gear 246 on the shaft 235 is supported on a bracket 247 on cross braces 125, 126 of the couch roll assembly, gears 240, 242, 244 and 246 meshing with the racks 217, 223 of the rail assemblies 216, 222.

Directly above the couch roll assembly and on the couch housing is a motor-driven chain hoist 250 and toward the mid-section of the machine is a second chain hoist 251 which is manually operable. Above the breast roll and on the breast housing is a third chain hoist 252 which is also manually operable. In Figure 10 the chain hoist 250 is shown connected to the couch roll assembly for raising the same for replacing the wire, the couch roll assembly as the hoist is operated moving along the inclined ways 58

which shortens the distance between the couch and breast rolls and gives slack to the wire and disengages the couch assembly from the housing 45.

In the modified couch assembly shown in Figure 11 the effect of raising the couch roll is the same as that described in connection with Figure 10 except that the upward movement of the assembly is vertical with no resulting slack in the wire for reasons described in the preceding detailed description of the couch roll structure.

As stated in the foregoing description of the planes of movement of the paper forming wire, the planes of the bottom draw of the wire form a pronounced rise of the wire above the lower crown faces of the couch and breast rolls. As shown in Figures 10-12, the means employed at both ends of the machine for spreading the wire consist of brackets 254 which are connected at 225 on one side of the machine to blocks 215 of the end rail assemblies and act as guides for the wire in its transverse movement. A series of removable stud posts 255 are secured to the couch housing 45 and to the breast housing 25 and transverse cables 258 and cable tighteners 257 are connected to the stud posts 255 and to the back wall of the alcove 4 at 260 (Figure 13). The cables 258 pass through the pipes 261 which are as long as the width of the machine the arrangement being best shown in Figure 13. The cables 258 are substantially twice the length of the pipes 261. Brackets 254 serve to space the cables and also serve to support pipes 261 for axial movement of the wire transversely of the machine.

The wire spool 263 as shown in Figure 12 upon which spool the replacement wire is supported and which spool is also the spool upon which the wire is shipped by the manufacturer, rests upon removable brackets 262 which are temporarily attached to the couch housing 45, the wire being wound in the usual manner upon two round members which are slightly longer than the width of the wire. A pole 265 is passed through the loop of the wire at the outside of the roll to hold the same as wound and for preventing injury to the wire as well as for making the wire ready for application to the machine.

For placing the wire on the machine after the old wire is removed pole 265 is inserted in the outer end of the wire loop and is mounted and supported in opposite hollow members 266 of a trolley stand 268 (Figure 18) which is slidably supported on the lower webs of the rails 50. Drop hangers consisting of parts 267, 268 serve to suspend the pole 265 from the truss rails 50.

The trolley stand is moved along the rails 50 from the couch end to the breast end of the machine the wire spool 263 unwinding as the outer end of the wire loop is drawn forward. The transverse cables 258 and pipes 261 through which the cables pass are then passed through the wire loop and the wires are drawn taut by means of the tightening devices 257. In this position the forming wire is extended loosely across the rails 216 with its bottom run disposed in the recesses 216a and upon the lower pads 220. Where the wire is replaced by transversely removing and replacing the rail assemblies 216, 222 and without transverse movement of the machine or machine parts as in Figure 8 it is to be understood that the wire W is strung in the manner above described out laterally of the machine in the alcove or aisle space, the rail assemblies 216, 222 being withdrawn transversely sur-

ficiently to permit stringing the wire W laterally of the table of the machine and at the same time to permit entry of the bottom run of the wire so strung into the recesses 216a.

The upper pads 221 are then placed within the wire loop and in the recesses 216a on the top of the bottom run of the wire and the relatively lightweight pad rails 222 are placed within the loop and within the recesses 216a upon the upper pads 221 and are secured to the outer rails 216 with the bottom run of the wire between the pads 220, 221 the machine being in substantially the position shown in Figures 8, 12 and 12A.

Power is then applied to turn the shaft 235 which through the engagement of the gears 240, 242, 244 and 246 with the racks 217, 223 moves the rail assemblies with the bottom run of the wire between the outer rails and the upper pad rails transversely into position beneath the machine in its position between or over the main sills. The wire is thus slipped or applied transversely over the machine or machine part, or parts, and with the wire in place the blocks 52, 53 are replaced, pads 220, 221 and pad rails 222 are removed from within the wire loop, the rail assembly 216, 222 under the couch structure is removed, the couch assembly is lowered to normal position upon the supports for supporting it in its normal operating position and all other parts removed for replacing the wire are reassembled on the machine.

As already pointed out, with the methods and means shown and described the paper forming wire may be replaced on the Fourdrinier machine from either side.

In the method above described the wire loop W is strung along the side of the machine in the manner indicated in connection with the right-hand machine of Figure 3, the machine is cleared and raised for receiving the wire and the wire is moved transversely into position over the machine, the clearing and raising of the machine or machine part being produced by the transverse movement of the rail assemblies 216, 222 into position beneath the machine or machine part. This is new.

In the method illustrated in connection with the left-hand machine in Figure 3 and in Figure 9 the portions of the Fourdrinier machine within the wire loop including the forming table and the breast and couch rolls are moved laterally into the aisle or alcove, the removable structure rolling out upon the extension rails 236 which form tracks for supporting it. The wire upon its supporting reel is then moved into position at the couch end of the machine and is unwound and strung between the couch and breast ends, the loop being spread and supported on the cables 258, 261 which are arranged in the manner described in connection with Figure 13. The part or parts removed laterally into the aisle or alcove are operated or moved over the supporting rails by operation of the shaft 235, it being understood that the rail assemblies 216, 222 are not released but being fixed in place across the side sills engagement of the gears 240, 242, 244 and 246 with the racks 217, 223 will move the machine or machine part out transversely into the alcove or aisle and back into position between the side sills.

Upon moving the machine or machine part out transversely the pad rails 222 are removed from the rails 216 and the wire spool is moved forward and placed on temporary supports 262 on the couch housing 45.

Pads 220 are placed in the recesses 216a and

upon the rails 216 the wire loop being moved by the pole 265 which is placed on drop hangers 268 slidably mounted on the rails 56, the drop hangers being moved along the rails 56 to the breast end of the machine for unwinding the wire longitudinally between the sills.

The transverse cables 258 with the pipes 261 slidable thereon are then placed through the wire loop as shown in Figures 12 and 12A and the lower span of the wire is laid in the recesses 216a and rests upon the pads 220. The pads 221 are then placed within the wire loop upon the pads 220 with the bottom run of the wire between the pads as shown in Figure 16 and the pad rails 222 are placed within the wire loop and within the recesses 216a upon the upper pads 221, these pad rails being secured to the bottom rails outside the loop at 400. Power is then applied to the shaft 235 for returning the structure moved into the alcove or aisle back to normal position between the side sills and all other parts which are removed are restored to normal position. In returning the machine or machine part transversely to position over the sills the movement of the machine or machine part over the rail assemblies 216, 222 clears or raises the machine or machine part over the bottom run of the wire and over the rail assemblies. After replacing the machine over the sills the pad rails 222 and pads 221 are removed from the rails 216 and the stringer cables 258 and pipes 261 are disconnected and removed. The motor hoist 250 is again connected to the couch assembly, the rail assembly 216, 222 beneath the couch being removed, and the couch assembly is lowered to normal position, the wire carrying rolls 112, 114 and 117, 118 being reassembled in their operating relation.

It will be noted that in each of the illustrated forms of the invention the rails 216 which sustain the weight of the machine or machine part or parts in the replacement of the wire are disposed outside of the wire loop and beneath the bottom run of the wire.

This eliminates entirely the difficulty of inserting these rails into and withdrawing them from within the wire loop as well as the possibility of injuring or destroying the wire thereby. Furthermore, these outer rails may remain in position beneath the bottom of the machine in its operation with the exception of the rail beneath the couch roll which in the particular embodiments of the invention illustrated is removed, although in some forms of the invention that rail too may remain in place. Heretofore the sustaining rails have been disposed within the loop and it has been necessary to remove them after each wire application. The only parts that need be placed within and removed from the loop are the upper pads 221 and the upper pad rails 222 which may be relatively light weight because the weight of the machine or machine part or parts is sustained by the outer rails 216 and not by these inner pad rails. The pads 220, 221 may be of hard fiber, vulcanized rubber or any other suitable or preferred material which will cushion the wire against any bruising action. The upper pad rails 222 may, as already pointed out, be extremely light but are preferably rigid for use with a Fourdrinier wire.

The rails 216 which are disposed outside the wire loop may be extremely heavy and as long and large in section as desired. The pads and pad rails protect the wire from shearing or kinking, the bottom run of the wire being secured be-

tween the upper pad rails and the outer sustaining rails.

The rail 50 extends from the couch housing to the breast housing and is adjustable with the Fourdrinier table. It supports the elements which are on the top side of the wire such as the water jet cut-off, foot-boards, dandy rolls and stand and deckle pulleys. The rail 50 being an organic part of the Fourdrinier structure is used as a longitudinal member front and back side to support the wire spool as it is strung back between the sills over the outer rails 216. This incorporation of the wire stringing arrangement as part of the structural part is new. The other advantages of the wire replacement means and method of the present invention are fully set out at the outset of this specification and it is believed that with the foregoing detailed description all of the advantages of the invention will be readily apparent.

As already pointed out, the present invention is not limited to the particular machines shown and described and such details as related herein and not bearing on the present invention have been incorporated for the purpose of imparting a clear understanding of certain particular embodiments of the invention.

In the illustrated machine the suction couch roll assembly of the Fourdrinier machine being located in a pit below the floor 5 the press and drier sections of the apparatus are accordingly lowered to location on the floor 1.

As shown in Figures 4 and 4A a series of rolls 279 are traversed by the first felt 280. A lower suction press roll 281 connected with a suction pipe 283 and supported on the frame 288 is of the usual construction. Opposite the press roll 281 is the upper press roll 289 the felt 280 passing between these rolls. The upper press roll is journaled at 290 on a swinging arm 291 operable on a pivot bearing 292 on frame 288. A doctor blade 293 coacts with the press roll 289 the blade being pivoted on a bracket 293a on arms 291. This blade is flexible and is held in yieldable engagement with the periphery of the roll 289 for keeping the roll free of adhering paper stock. Coacting with the doctor blade 293 is a tray 294 extended transversely of the machine along roll 289 and supported on the frame 288, the tray being supported independently of the doctor blade and roll 289. The paper stock adhering to the roll 289 is removed by the doctor blade 293 and accumulates in the tray 294.

A flexible blade 297 is supported on a pivot bearing 298 on carriage 296a and is weighted at 299 for holding the lower edge of the blade against the periphery of the roll 289. The stand 295 is secured to the swinging arm 291 and supports the cross beam 296 which forms a rack for the carriage 296a which is operable transversely of the machine along the press roll 289.

The machine operator standing on the floor 5 can operate the carriage 296a transversely of the machine for severing and skimming the paper from the face of the roll when a break occurs. An auxiliary press roll 303 coacts with press roll 289, the felt 280 and the paper P passing through the nip between the rolls 281, 289, thence the felt moves downward around a roll 279 and thence upward between rolls 289, 303. A second endless felt is indicated at 315 and traverses roll 314. In the particular layout shown a second series of press rolls is arranged rearwardly of the press rolls above described and rearwardly of those are the drier sections and the calender. These are

disclosed in the parent application and forming no part of the present invention have not been illustrated or described here.

I claim:—

1. In a paper making machine of the class 5 described having a structure normally disposed within the wire loop, cross lateral cables drawn taut at fixed points within the wire loop to spread said wire over the remote parts, means to secure said cables, and pipe members slidably mounted 10 on said cables substantially greater in length than the width of said wire.

2. In a paper making machine of the class described in combination having remote end structures normally disposed outside the wire loop and supporting an intermediate table section within the wire loop and said structures outside the wire loop supporting and connected to said structure within the wire loop by means of removable blocks and adjacent laterally removable cross brace 20 transverse rails beneath the bottom draw of said wire, the structure within the wire loop being supported by said removable transverse rails said rails in turn being supported by the remote end structures beneath and outside the wire loop on one side, the removable transverse rails at the remote ends being provided with spacing arms to engage and slide laterally along cross lateral spread cables within the wire loop actuated by the return movement of the removable transverse 30 rails.

3. In a paper making machine of the class described in combination having remote end structures normally disposed outside the wire loop and supporting an intermediate table section within 35 the wire loop and said structures outside the wire loop supporting and connected to said structure within the wire loop by means of removable blocks adjacent laterally removable cross brace transverse rails beneath the bottom draw of said 40 wire, the structure within the wire loop being supported by said removable transverse rails and removable blocks said rails being supported by the remote end structures beneath and outside the wire loop on one side, the removable transverse 45 rails at the remote ends being provided with spacing arms to engage and slide laterally along cross lateral spread cables within the wire loop and means whereby said removable transverse rails are actuated by power to travel between foundation 50 sills supported on lower cross rails securely and permanently bolted to the frames at the remote end housings.

4. In a paper making machine of the class 55 described in combination having remote end structures normally disposed outside the wire loop and supporting an intermediate table section with the wire loop on removable blocks and said structures outside the wire loop supporting and connected to said structure within the wire loop 60 by means of laterally removable cross brace transverse rails beneath the bottom draw of said wire, the removable block structure within the wire loop being supported by said removable transverse rails and said rails being supported by the remote end structures beneath and outside the wire loop at one side, the said transverse rails laterally removed to one side the bottom run of said wire loop supported thereon inner pad rails secured to said removable transverse 65 rails clamping said wire between, cross lateral spread cables at the remote ends pipe members slidable thereon engaged by said spacing arms supported on the movable transverse rails supporting the structure within the wire loop bearing 75

on said rails and wire actuated by power for lateral movement and supported in turn beneath by the remote end structures outside the wire loop and said remote breast end being vertically adjustable in alignment relative to the remote couch end.

5. In a paper making machine of the class described having a structure normally disposed within the wire loop, a couch roll and a breast roll housing at remote ends outside the wire loop securely supporting permanent cross brace transverse rail assemblies outside the wire loop thereon, and means whereby said structure within the wire loop is laterally removed to one side supported over and on said permanent rail structure and extension rails in line therewith outside the said wire loop.

6. In a paper making machine of the class described having a structure normally disposed within the wire loop supported on couch and breast end assemblies normally outside the wire loop, longitudinal rails outside above and adjacent the parts within the wire loop connecting said remote end housings and permanent transverse parts outside above, and adjacent said top wire draw of said wire loop securely supported on said longitudinal rails means.

7. In a paper making machine of the class described in combination having a structure normally disposed outside the wire loop couch housings and breast housings at remote ends supporting permanent cross brace transverse rail parts thereon, longitudinal rails pivotally connecting said remote ends, a laterally removable adjustable structure normally within the wire loop supported on said permanent cross brace transverse rails and removable blocks adjacent and said remote breast housing being pivotally connected and means to adjust said remote breast end vertically relatively, in alignment one part to the other.

8. In a paper making machine of the class described in combination having a structure normally disposed outside the wire loop at remote ends a couch housing and a breast housing, said breast end housing being vertically adjustable in relative alignment to said couch housing and a structure normally within the wire loop supported on said remote end structure and vertically adjusted therewith said structure within the wire loop supporting a breast roll thereon shakable and vertically adjustable in alignment with all the parts and means whereby the structure within the wire loop is vertically adjustable shakable and laterally removable to an adjacent side direct as a unit by power in relative alignment, the structure within the wire loop supported over and on the structure outside the said wire loop.

9. In a paper making machine of the class described having a structure with breast and couch rolls at remote ends and table structure intermediate said ends, transverse cables across said structure and extending laterally therefrom for a distance at least equal to the width of the structure, a forming wire looped over said cables laterally of the structure and drawn taut thereby to form a substantial clearance over said structure and means to draw said looped wire around said structure.

10. In a paper making machine of the class described having a looped forming wire and a structure normally disposed within the wire loop, cross

lateral cables drawn taut at fixed points within the wire loop to spread the wire over remote parts of the structure and means to secure said cables in taut position for replacing the looped forming wire.

11. In a paper making machine of the class described having a structure normally disposed within a looped forming wire, a couch roll housing and a breast roll housing at remote ends of the structure outside the looped wire and longitudinal rails adjacent and above the plane of the top draw of the looped wire connecting said couch roll and breast roll housings.

12. In a paper making machine of the class described having a structure normally disposed within the looped forming wire, a couch roll housing and a breast roll housing at remote ends of the structure outside the wire loop, said breast roll housing being vertically adjustable, longitudinal rails joining said breast and couch roll housings and pivotally connected thereto, said rails being mounted in a plane above the top draw of the looped forming wire.

13. In a paper making machine of the class described having remote end structures normally disposed outside the wire loop, an intermediate table section within the wire loop supported by said end structures through laterally removable cross brace transverse rails beneath the bottom draw of the wire loop.

14. In a paper making machine of the class described having a structure normally disposed within the wire loop, a couch roll housing and a breast roll housing at opposite ends thereof outside the wire loop, transverse rail assemblies outside the wire loop secured to and supported by said roll housings and means to laterally move the structure within the wire loop over and on the said rail assemblies.

15. In a paper making machine of the class described in combination having a structure normally disposed outside the wire loop, couch housings and breast housings at remote ends supporting thereon permanent cross brace transverse outer rail parts and inner pad rails thereon forming rail assemblies, longitudinal rails outside above and adjacent said parts within said wire loop pivotally connecting said remote end housings, permanent transverse parts supported on said longitudinal rails, and a structure normally within the wire loop supported on the remote end housing assemblies vertically adjustable at one remote end as a unit in relative alignment, extension rails in line with permanent cross brace transverse outer and inner pad rail assemblies and said structure within said wire loop laterally removable to an adjacent side as a unit without interference by the adjustable structure outside the wire loop.

16. In a paper making machine of the class described in combination having a structure normally disposed within the wire loop supported on remote end structure assemblies normally disposed outside the said wire loop and permanent cross brace transverse rail assemblies having an outer permanent rail and an inner pad rail and extension rails in line therewith, the said structure with the wire loop being laterally removable as a unit to an adjacent side while resting on said permanent cross brace rail assembly and said extension rails.

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