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Notbohm

[11] **3,772,145**

[45] **Nov. 13, 1973**

[54] **PIVOTAL MOUNTING STRUCTURES FOR VERTICAL TWIN-WIRE PAPERMAKING MACHINE**

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[21] Appl. No.: **129,852**

[52] **U.S. Cl.** **162/273,** 162/200, 162/301

[51] **Int. Cl.** **D21f 1/00**

[58] **Field of Search** 162/273, 301, 303, 162/203, 274, 200

[56] **References Cited**

UNITED STATES PATENTS

3,623,945	11/1971	Tommeraasen	162/273
3,573,161	3/1971	Notbohm	162/203 X
3,597,315	8/1971	Notbohm et al.	162/203
3,578,561	5/1971	McCarrick et al.	162/203 X
R25,333	2/1963	Baxter	162/203 X

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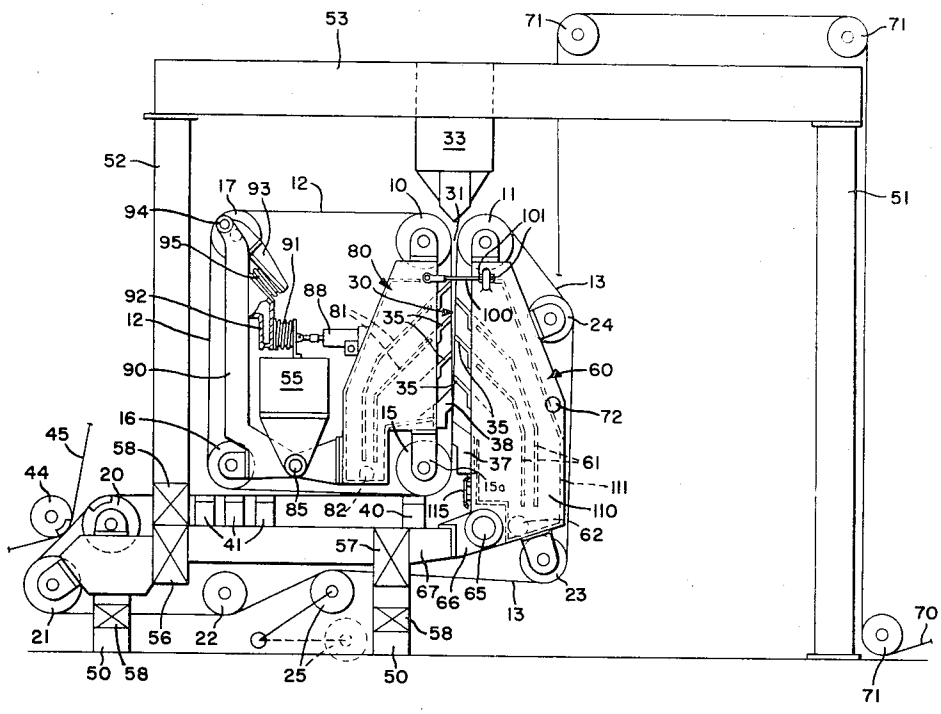
[57] **ABSTRACT**

In a vertical twin-wire paper machine in which the wires may wrap around a common turning roll, the breast roll support rolls and associated deflectors for each of the opposed reaches of the two wires which converge to define the forming zone are supported on essentially unitary frame members mounted for pivotal movement toward and away from each other between operative positions and retracted positions for wire changing and replacement or other maintenance of the deflectors. The common turning roll is mounted on one of the unitary frame members by a bracket and can be located at the lower end of the frame member in machines wherein the wire convergence is downwardly or at the upper end of the frame member in machines wherein the wire convergence is upwardly.

11 Claims, 8 Drawing Figures



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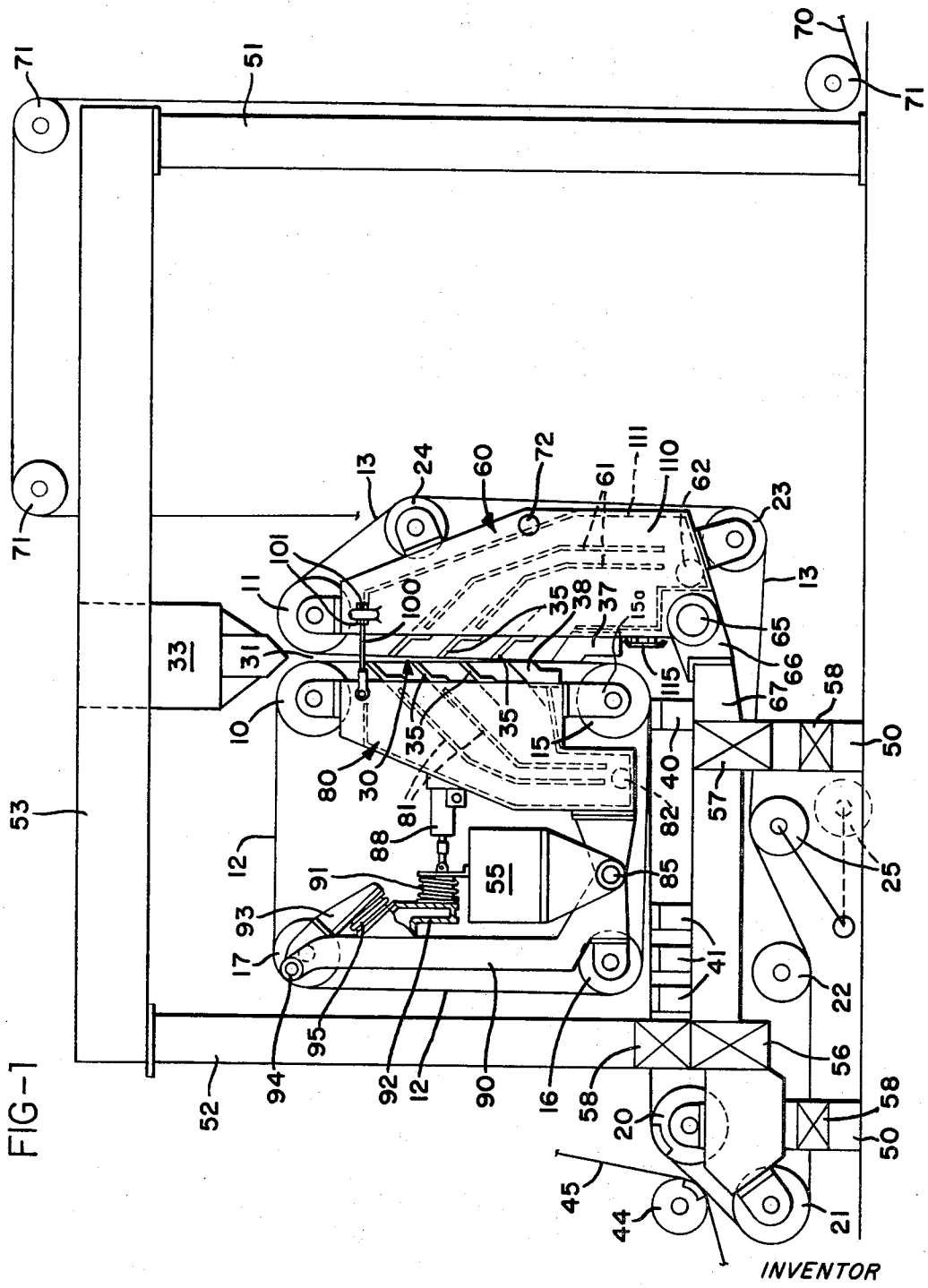

FIG-1

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FIG-3

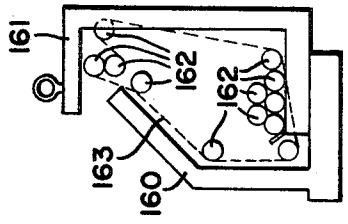
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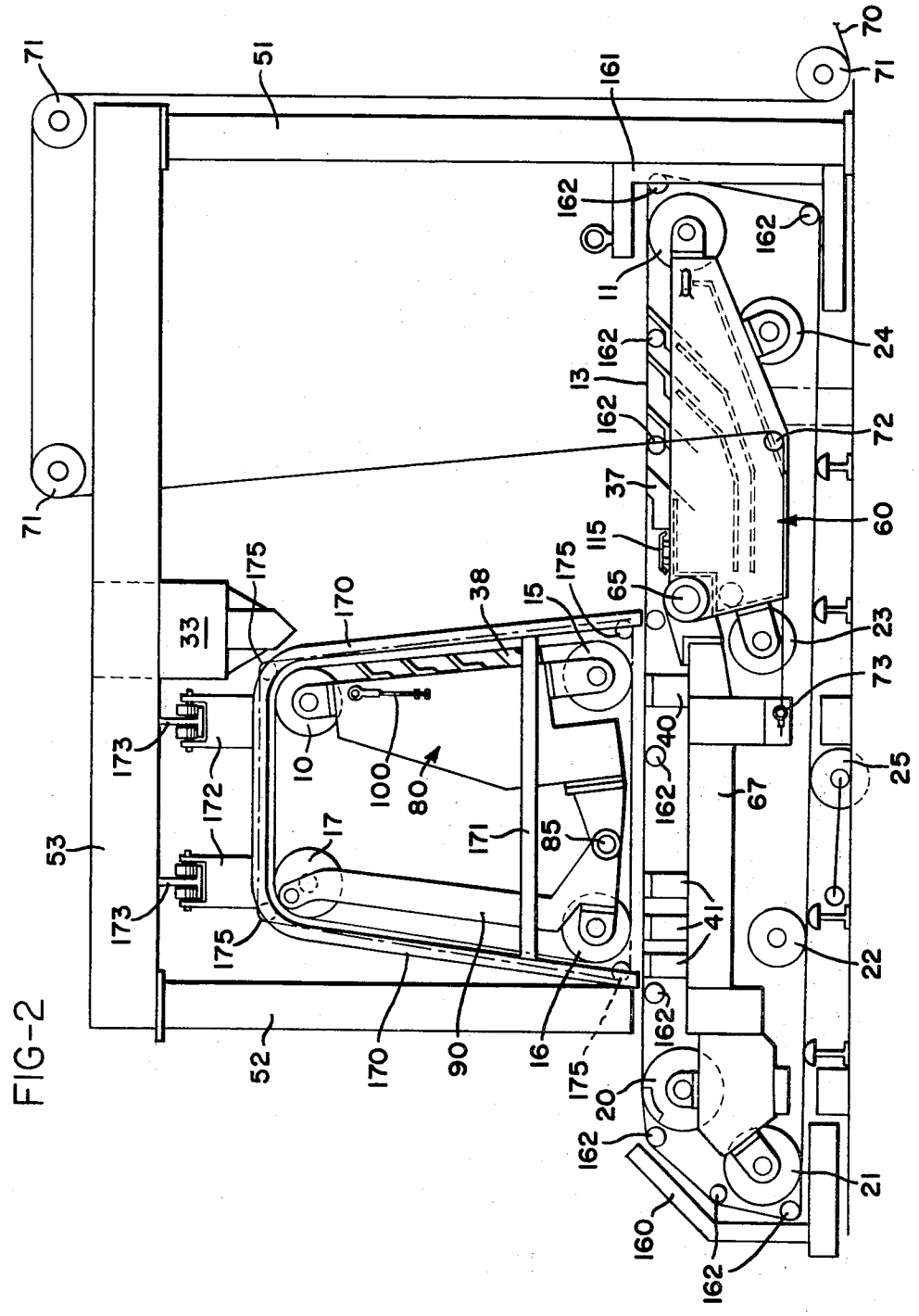
FIG-2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72
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37
60
115
175
65
23
73
175
170
38
15
33
40
25
173
10
100
80
162
67
172
17
171
85
53
41
173
175
22
52
170
90
16
162
175
20
162
21
160
162

FIG-4

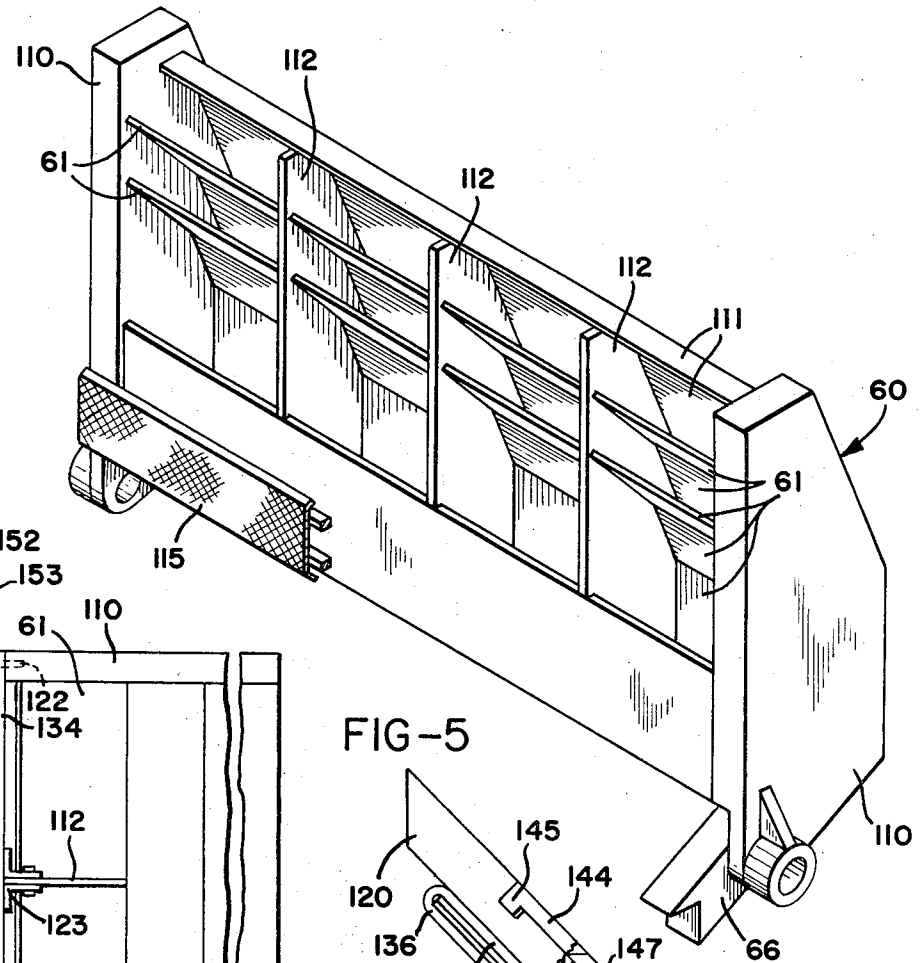


FIG-6

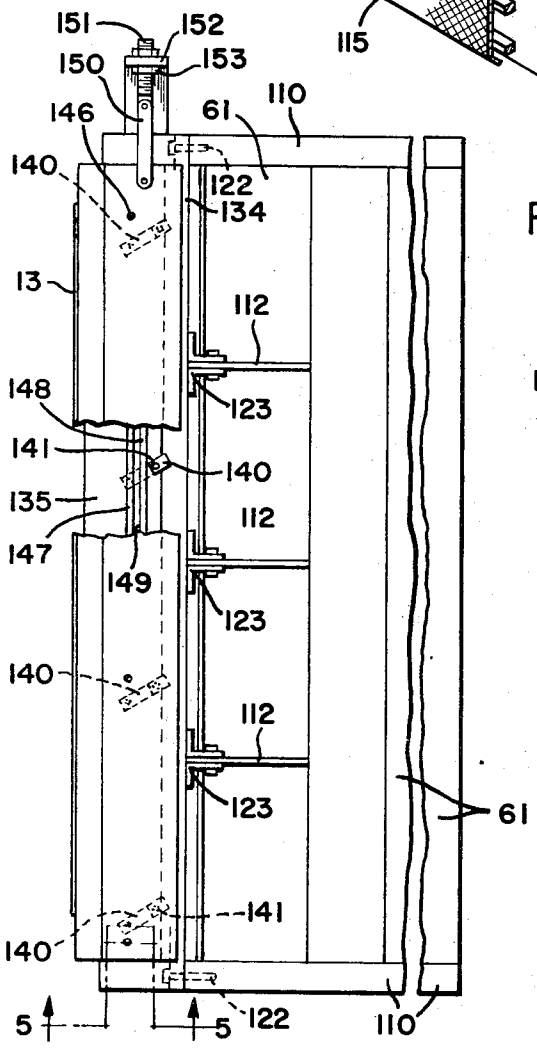


FIG-5

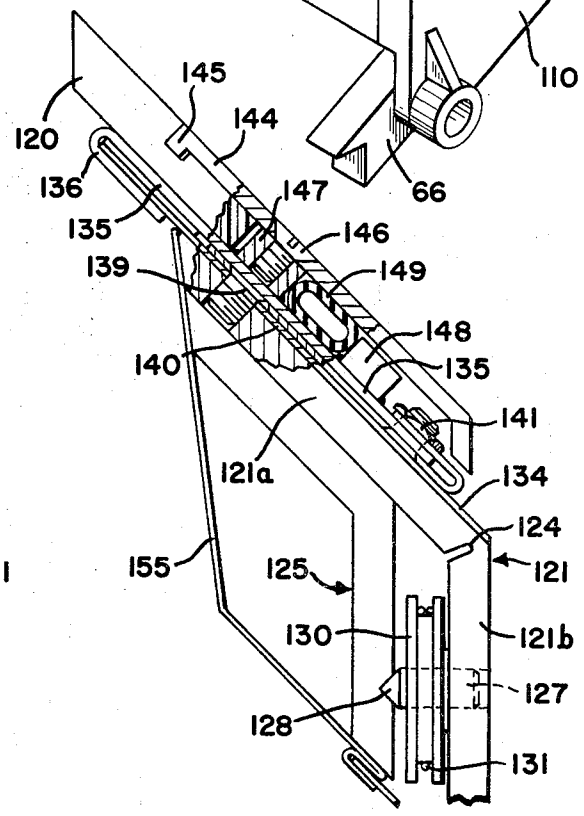
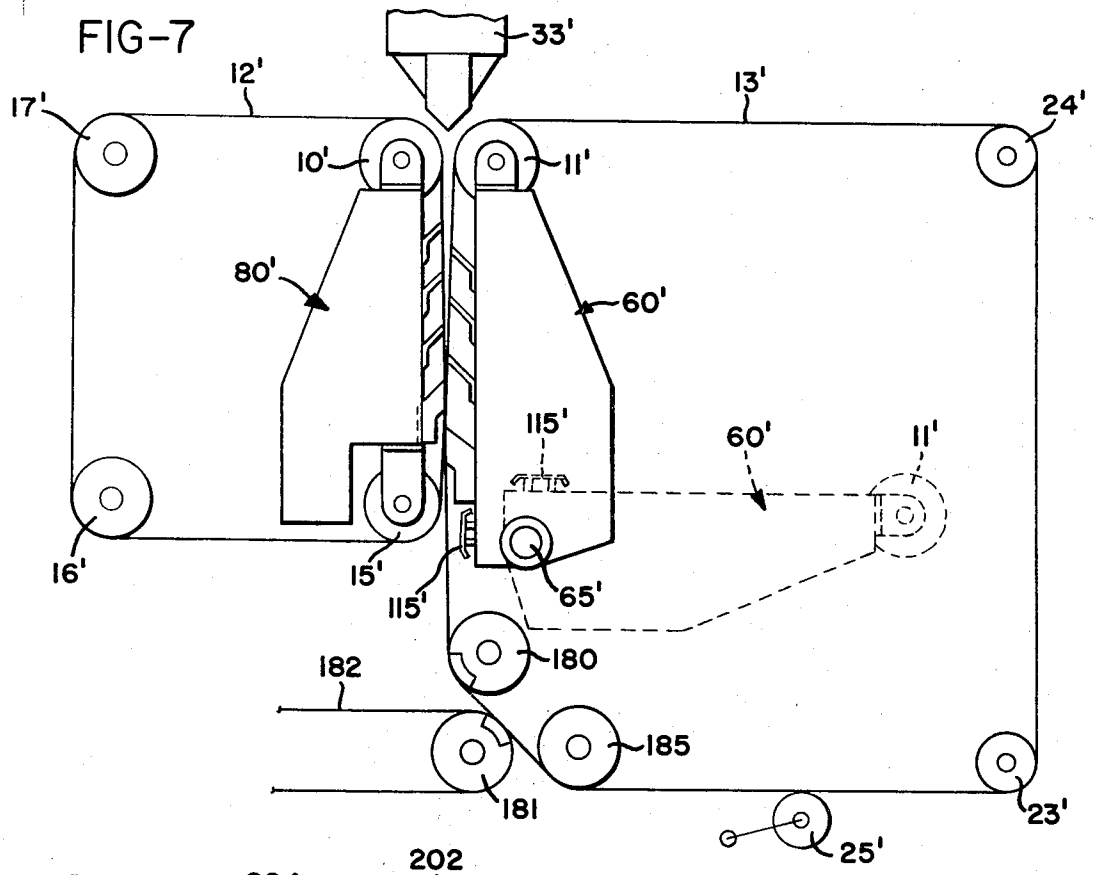


FIG-7


33'
12'
13'
17'
24'
10'
11'
80'
60'
115'
60'
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16'
15'
115'
65'
180
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185
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23'
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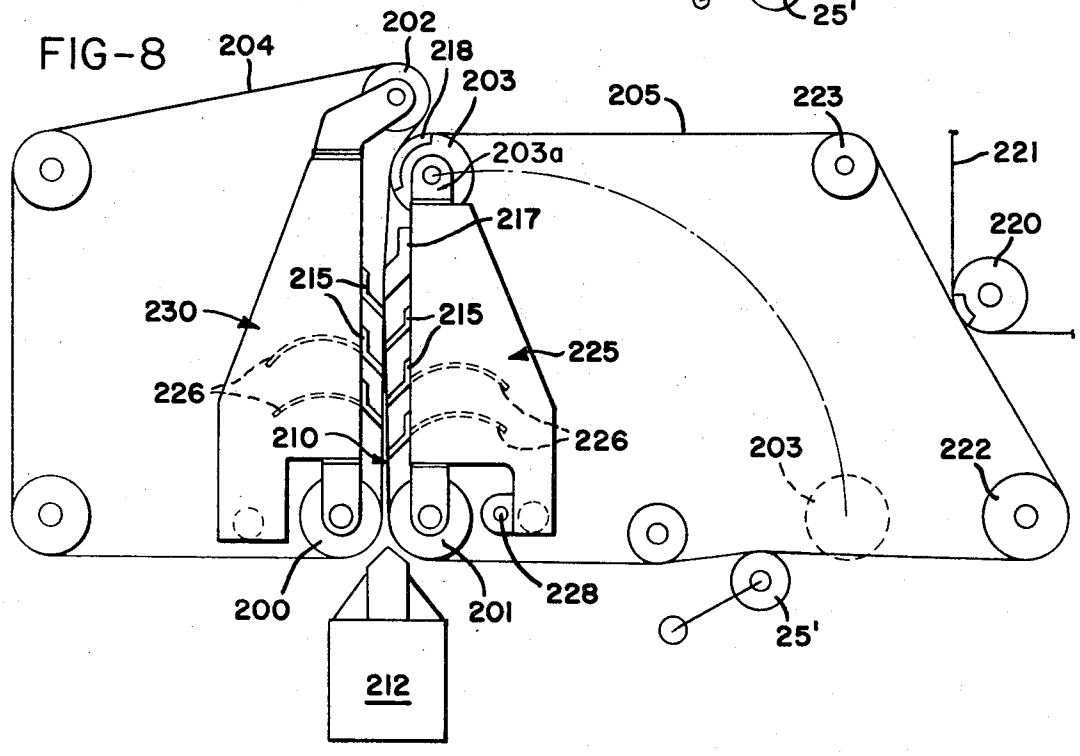
FIG-8


202
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PIVOTAL MOUNTING STRUCTURES FOR VERTICAL TWIN-WIRE PAPERMAKING MACHINE

REFERENCE TO COPENDING APPLICATIONS

Ser. No. 703,299 — Filed Feb. 6, 1968 Notbohm et al U.S. Pat. No. 3,578,560

Ser. No. 755,602 — Filed Aug. 27, 1968 Notbohm et al U.S. Pat. No. 3,578,556

Ser. No. 768,284 — Oct. 17, 1968 Notbohm U.S. Pat. No. 3,573,161

Ser. No. 771,888 — Oct. 30, 1968 Notbohm et al U.S. Pat. No. 3,597,315

BACKGROUND OF THE INVENTION

The invention relates to paper making machines generally of the type shown in Baxter U.S. Pat. No. Re. 25,333, and characterized by the incorporation of a pair of endless forming wires arranged to wrap a corresponding pair of horizontally spaced breast rolls in such manner as to provide a pair of opposed reaches which travel generally vertically from the breast rolls in closely spaced converging relation to create the zone wherein the paper sheet is formed. The invention also relates to the similar vertical paper machines shown in Baxter et al U.S. Pat. No. 3,215,594 and characterized by the provision of multiple deflectors which support the traveling wires in the desired converging relation wherein they define the forming zone. The above copending applications relate to improvements in vertical paper machines generally of the type shown in the Baxter and Baxter et al patents which may be incorporated in a vertical paper machine in accordance with the present invention.

Vertical paper machines of the type to which the present invention relates offer a variety of important advantages over conventional Fourdrinier paper machines, including economy of both initial construction and maintenance, and especially the production of paper of better quality from the standpoint of both squareness and uniform surface characteristics on both sides of the sheet. Another outstanding advantage lies in the ease with which a vertical forming section can be installed in place of an existing Fourdrinier section and adapted to operate in combination with the press and other sections of the existing machine as part of a rebuilding program on an old machine.

It is especially important in a vertical two-wire paper machine that the wire reaches defining the forming zone be properly guided, and this requires accurate placement of the several deflectors or other guide means which support these wire reaches. It is also important that such guide means be capable of retaining their proper positions under their working loads, and particularly of resisting the sagging which is an increasing problem as the width of such paper machines increases. This is a special problem when deflectors are used which are supported only at the ends of the paper machine, since this requires that the deflector assemblies be of relatively heavy and rigid construction, thereby in turn increasing their requirements for space in the direction of wire travel and thus the length of the forming zone itself. The present invention is particularly directed to improvement of these conditions.

SUMMARY OF THE INVENTION

In a twin-wire paper machine in accordance with the present invention, the rolls and the deflector assemblies or other guide means for supporting the reaches of each wire which define the forming zone are mounted on an essentially unitary frame member or module supported for pivotal movement toward and away from the complementary frame member for the guide means for the other wire. Each of these frame members is of strong and rigid construction, and the deflectors for the associated wire are mounted thereon by mountings which are in reinforced relation with the structure of the frame members such that they are more than capable of withstanding all normal loads tending to cause deflection. The individual deflectors can therefore be relatively thin, and they can be arranged in as closely spaced relation as is needed to establish the desired length and configuration of the forming zone.

The provision of pivotally mounted frame members has additional advantages especially when the arrangement is such that one frame member can move to a substantially horizontal retracted position, which is also the preferred position for wire changing. With the wires removed, the working surfaces of both sets of deflectors are exposed for ready access for adjustment, replacement or other maintenance purposes. Such maintenance operations are facilitated in accordance with the invention by providing the individual deflector assemblies with mounting connections which are easily accessible from the exposed working surface of the deflectors for removal or adjustment purposes.

These advantageous features of the invention are also important in facilitating maintenance of the proper configuration of the forming zone. Thus since the deflectors for each wire can be fixedly secured to the associated frame member in the proper alignment with each other while the frame members are retracted, both sets of deflectors will maintain these alignments when the frame members are returned to their operative positions. Additionally, these predetermined alignments are maintained throughout a wire changing operation, because they are not disturbed unless adjustment or replacement is required in order to change the configuration of the forming zone, which is a servicing operation readily performed in the course of wire changing.

It is a primary object of the present invention to provide a twin-wire paper machine which will have the features and advantages outlined above. Additional objects and advantages will be apparent from the following description, the accompanying drawings and the appended claims.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic view in side elevation showing a vertical paper machine constructed in accordance with the invention and with all of the parts in operative position;

FIG. 2 is a view similar to FIG. 1 but showing the positions of the parts during wire changing;

FIG. 3 illustrates somewhat diagrammatically the storage condition of the apparatus for changing the carrying wire in FIG. 2;

FIG. 4 is a perspective view of the frame member for carrying the breast roll and guide means for the carrying wire, the frame member being shown with all guide means removed;

FIG. 5 is a view partly in elevation and partly broken in section on the line 5—5 of FIG. 6 illustrating details

of the construction and mounting of one of the deflector assemblies;

FIG. 6 is a fragmentary plan view of the deflector assembly shown in FIG. 5; and

FIGS. 7 and 8 are diagrammatic views illustrating the application of the invention to other designs of vertical paper machine.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The vertical paper machine illustrated in FIGS. 1–2 is generally of the design shown in U.S. Pat. No. 3,573,161 and it includes a pair of breast rolls 10 and 11 supported in horizontally spaced relation. A pair of forming wires 12 and 13 are looped around the respective breast rolls 10 and 11 and are brought together partially around a single roll 15 mounted by a bracket or support means 15a in the position of a couch roll below and generally in line with the lefthand breast roll 10, but roll 15 is solid and is therefore more properly termed a turning roll for the wires 12–13, the term "wires" being used generically as including foraminous forming webs of any suitable material. The remainder of the loop of the lefthand or backing wire 12 is supported by a turning roll 16 and an adjustable guide roll 17. The righthand or conveying wire 13 is similarly supported by a suction roll 20, a turning roll 21, return rolls 22 and 23, an adjustable guide roll 24, and a tensioning roll 25. The rolls 11 and 20, and preferably also the turning roll 21, are provided with adjustable drive means (not shown) to cause the wires to travel downwardly from the breast rolls 10–11 in desired speed relation, which is preferably essentially synchronous.

The reaches of the wires 12 and 13 directly below the breast rolls 10 and 11 are guided so that they converge to define therebetween a forming zone 30 of generally triangular section open at its larger end to the gap 31 between the breast rolls to receive stock from the headbox 33, which is represented diagrammatically and is preferably of the construction shown in application Ser. No. 703,299, now U.S. Pat. No. 3,578,560. The wire reaches defining the forming zone are guided by deflector assemblies 35 which engage the inner surfaces of these wire reaches in supporting relation, and which also serve to skim off water expressed through the wires and to guide this water away from the wires. The upper edge of a suction box 37 mounted below the lowermost of the deflectors 35 within the loop of the carrying wire 13 also acts as a deflector, and the lowermost deflector within the loop of the backing wire 12 may be similarly combined with a suction box 38.

The spacing and arrangements of the deflectors 35 with respect to each other and to the gap 31 above the forming zone are determined in accordance with the principles described in application Ser. No. 755,602, now U.S. Pat. No. 3,578,556, so that the stock is delivered as a sheet-like jet to the upper end of the forming zone by the headbox 33 and impinges on the wires 12–13 below the level at which the pumping action of the breast rolls 10–11 would tend to draw liquid through the wires, i.e., substantially below the line of tangency of each wire with its associated breast roll. The stock is progressively dewatered as it travels downwardly with the forming wires until at the level of the suction box 37, the major volume of free water has been expressed through the wires, and the fibers remaining between the wires have been compacted and felted into a mat or sheet which provides a bridging structure between the wires.

After the two wires with the sheet therebetween pass the suction box 37, they partially wrap the turning roll 15 and proceed laterally toward the suction roll 20. Just beyond the roll 15, there is located a fixed suction box 40 over which the two wires pass, but the turning roll 16 for the backing wire 12 is so located beyond the suction box 40 as to cause wire 12 to diverge from wire 13 as the two wires pass across the suction box 40. The action of the suction box 40 will therefore hold the sheet on the generally horizontal run of the conveying wire 13 while wire 12 diverges therefrom toward its turning roll 16.

The sheet travels beyond suction box 40 on the upper surface of the horizontal run of wire 13 toward the suction roll 20, and additional suction boxes 41 may be located between suction box 40 and roll 20 if desired. A suction pickup roll 44 and cooperating felt 45 are located to pick the sheet up from wire 13 as it travels from roll 20 to roll 21, this arrangement being essentially the same as a conventional suction pickup from a Fourdrinier machine having a suction couch roll and a wire drive roll in the positions of rolls 20–21.

The invention is especially concerned with the provision of supporting structure for the operative parts of the paper forming section as outlined above which will contribute to the simplicity of the construction, mounting and maintenance of the deflectors 35, and which will also contribute to the ease of changing the forming wires. As is customary, the fixed base structure is permanently mounted at the back side of the machine. It includes sole plates 50 and the overhead framework comprising vertical beams 51 and 52 and the longitudinal beams 53 which support the headbox 33. Cantilever beams 55, 56 and 57 are also permanently mounted at the back of the machine, and the usual removable blocks are provided to support the front ends of these beams, as indicated by such blocks 58.

The main support for the breast roll 11 and its associated deflector assemblies 35 is an essentially unitary frame member 60 of generally tub-like structure so that it also forms the receptacle for the liquid removed by the deflectors which engage the wire 13. Baffles 61 extend the full width of the machine internally of the member 60 and act both as reinforcing ribs and to guide the liquid received from the deflectors 35. This accumulated liquid may be removed at the machine by any convenient piping from the discharge outlet indicated at 62. The frame member 60 also forms the support for the turning roll 23 and guide roll 24.

The frame member 60 is mounted on the fixed base structure by a pivoted mounting 65 on brackets 66 which extend from the ends of the side rails 67 of the main frame. The frame member 60 is movable on this pivotal mounting between its generally vertical operative position shown in FIG. 1 and its generally horizontal retracted position shown in FIG. 2. Means for effecting this movement are shown as comprising one of a pair of cables 70 running from a reel (not shown) around pulleys 71 on the stationary framework and over a pair of capstans 72 at opposite sides of the frame member 60 to fixed points of attachment 73.

The main support for the breast roll 10 and its associated deflectors 35 is a second essentially unitary frame member 80 which also serves as the support for the couch roll 12. The frame member 80 is similarly of

tub-like structure and includes interior reinforcing ribs or baffles 81 and a discharge outlet 82 at the back side of the machine. The frame member 80 is provided with a pivotal mounting 85 on the cantilever beam 55, and a screw jack 88 connected between the beam 55 and member 80 causes controlled movement of member 80 about pivot 85 between its generally vertical operating position shown in FIG. 1 and the retracted position shown in FIG. 2 for changing of the wire 12.

A third frame member 90 shares the pivotal mounting 85 with its frame member 60 and forms the main support for the other supporting rolls within the loop of wire 12, such as the rolls 16–17. Movement of frame member 90 on pivot 85 is primarily for controlling the tension of wire 12 as well as for wire changing, and such movement is effected and controlled by means such as a bellows diaphragm 91 connected between the beam 55 and member 90 through a bracket 92. The wire guide roll 17 is shown as mounted on the upper end of member 90 by a lever arm 93 pivoted on member 90 at 94 and controlled by a pressure diaphragm 95, which may be actuated in any conventional way to move one end of roll 17 as required to maintain the wire 12 running straight.

It will be apparent that the vertical alignment and configuration of the forming zone 30 are determined by the operative positions of the frame members 60 and 80. Accordingly, the operative position of the frame member 80 is preferably fixed by means such as an adjustable stop nut in the screw jack 88. The operative position of the frame member 60 is then similarly readily established by means such as the latch mechanism 100 for locking the two frame members 60 and 80 together, preferably at both the front and back of the machine. Adjustable stop nuts 101 on this latch mechanism provide for adjustment of the operative position of the frame member 60.

In accordance with the invention, the frame members 60 and 80 are constructed to contribute major advantages of strength and rigidity to the deflectors 35 and their mountings, together with significant advantages of ease of maintenance and replacement of deflector assemblies. Another advantage derived from these structural features is the ability to establish the forming zone with its length very short in the direction of wire travel even in a very wide paper machine, with resulting convenience and economy of over-all construction. Since the frame members 60 and 80 are of generally the same basic construction from the standpoint of these features, the details of only frame member 60 are shown in the drawings.

Referring to FIG. 4, the frame member 60 is preferably constructed as a unitized weldment, composed of end walls 110 connected by the back wall 111 and the baffles or reinforcing ribs 61. Additional reinforcement is provided by multiple ribs 112 arranged parallel with the direction of wire travel at appropriately spaced positions across the width of the machine. Also a walkway 115 may advantageously be provided, preferably by a permanent mounting, to extend between the end walls 110 at a position between the suction box 37 and the pivotal mounting 65 for use in the horizontal position of member 60.

The construction of the frame member 60, and similarly of the frame member 80, provides a very strong and rigid base mounting for any suitable deflector, and FIGS. 5–6 show a preferred construction of deflector assembly which includes a deflector blade 120 of any material, such as Micarta, found satisfactory for the purpose. The main support for the blade 120 is a bar 121 of obtuse angular section such that the leg 121*a* which supports the blade 120 will extend in generally the desired angular relation with the direction of wire travel therepast. The other leg 121*b* is rigidly secured to the frame member 120, for example by bolting at its ends to the end walls 110 as indicated at 122. In addition, this leg 121*b* is preferably secured for further bracing to the adjacent edge of each of the reinforcing ribs 112, as indicated by the bracket assemblies 123.

Provision is also made for effecting some angular adjustment of the legs 121*a* and 121*b* for corresponding adjustment of the angular relation of the associated blade 120 with the adjacent portion of the wire. A slot 124 at the junction of the two legs of bar 121 provides for resilient movement of leg 121*a* with respect to leg 121*b*. A smaller bar 125 complementary in section to bar 121 has its upper leg welded or otherwise secured to the leg 121*a*, and its other leg depends in spaced relation with the leg 121*b*. A series of jack screws 127 are threaded into the leg 121*b*, and each of these jack screws has a conical point 128 engaging a conical recess in the opposed face of the bar 125. Means are provided for rotating all of the jack screws 127 together, such as the pulley 130 on each screw 127 and cable 131 forming a driving connection between all of the pulleys 130 which is accessible from one end of bar 121, so that as the jack screws are threaded out of the bar leg 121*b*, they will thrust the bar 124 in clockwise direction in FIG. 5 and thereby cause the bar leg 121*a* to move upwardly against its natural resilience and the downward load applied thereon by the engagement of the associated wire and deflector blade 120.

Provision is made for mounting the blade 120 on the bar 121 in such manner that it can be moved toward and away from the wire while the machine is running. A plate 134 is welded or otherwise secured on top of the leg 121*a* and projects beyond the outer edge of this leg toward the wire. The blade support body 135 has its forward edge shaped to a resilient hook 136 which engages over the projecting edge of the plate 134. A plurality of links 140 have their forward ends pivoted at 139 to the bar leg 121*a*, and their rearward ends are pivoted at 141 to the rearward portion of the blade support body 135 so that swinging movement of these links will cause the body 135 to move on the plate 134 toward and away from the adjacent forming wire.

The deflector blade 120 is retained on the support body 135 by an elongated clamp 144 having a hooked forward edge 145 for engaging a complementary groove in the upper surface of the blade 120. The clamp 144 is secured by a row of screws 146 to a bar 147 welded on the body 135. A similar bar 148 is also welded on body 135 in spaced relation with bar 147 to form therewith a space receiving a resilient tube 149 connected to a source of pressure air. When pressure is applied to this tube, it will expand sufficiently to tilt the clamp 144 in counterclockwise direction as viewed in FIG. 5 and thereby to cause the forward edge of clamp 144 to force the deflector blade 120 against the support body 135. When the air pressure is released, the blade 120 is easily withdrawn lengthwise and similarly replaced.

It will be seen that this deflector assembly will make it possible to move the deflector blade 120 toward and

away from the associated forming wire by moving the blade support body 135 through swinging movement of the links 140. This movement can be accomplished while the machine is running by the push-pull drive shown in FIG. 5. A link 150 is pivoted to one end of the body 135, and its other end is pivotally connected to a screw 151 threaded through bracket 152 mounted on the end of the bar leg 121*a* for access from outside the machine. Threaded movement of the screw 151 will produce the desired movement of the deflector assembly, which can be locked in any desired position by the lock nuts 153 on screw 151. The part 155 in FIG. 5 is a shield of sheet metal or the like for deflecting spray and other free water.

The construction of the frame member 80 and the arrangement for mounting the deflector assemblies which it carries are essentially the same as described for the frame member 60, the only differences between these two frame members being in over-all configuration and dimensions as dictated by the different functions which they perform in the machine. The construction of the deflector assemblies and their cooperative relation with the over-all structure of the frame members 60 and 80 provide significant practical advantages. In particular, the mounting bars 121 and 125 are readily made of sufficiently heavy stock to produce substantial inherent rigidity, and they are further braced and stiffened by their connections to the walls and reinforcing ribs of the associated frame member. It is therefore not necessary to design rigidity and resistance to deflection into the deflector blades or their associated parts in each deflector assembly, and this in turn makes it possible to construct each deflector assembly with a relatively short dimension in the direction of wire travel. Width of the paper machine is also not a factor in establishing this dimension, and it is therefore possible even in a very wide machine to utilize a total of eight individual deflectors as shown in FIG. 1 and still to keep the over-all length of the forming zone as short as approximately four feet.

It is also a significant advantage provided by the invention that when the frame member 60 is in its retracted position shown in FIG. 2 and the wires are removed, the working surface of the entire set of deflector assemblies on each of the frame members 60 and 80 is readily available for inspection, and for replacement or other servicing of the individual deflector assemblies as may be necessary, such for example as adding, removing, or changing the spacing of deflector assemblies by unbolting and/or bolting the appropriate bars 121. The walkway 115 contributes to this advantage in the horizontal retracted position of the member 60 by providing access for maintenance personnel to both sets of deflector assemblies, since with the forming zone dimensioned as just described, a man standing on the walkway 115 can easily reach any of the deflector assemblies on the frame member 80 while also easily reaching any of those on the frame member 60. On the other hand, if the deflector assemblies require no servicing at the time of a wire change, it is a feature of the invention that the entire set of deflector assemblies for each wire will remain in fixed relation with each other and with the associated breast roll throughout the entire wire changing procedure.

As already noted, FIG. 2 shows the forming members 60 and 80 in their respective positions for the changing of both wires, and it also illustrates wire changing apparatus designed for use with this paper machine. The wire stringing apparatus for the conveying wire 13 comprises only two main components, namely a pair of frames 160 and 161 shown in FIG. 3 in their storage position in which they may be nested together along with the wire-carrying poles 162 and the coiled new wire 163. In use, the two frames 160 and 161 are stationed sufficiently apart so that they can be moved laterally of the machine past the turning roll 21 and the breast roll 11 in its lowered position. Prior to this movement, the wire is strung as shown in FIG. 2 on the poles 162, and the entire assembly is then moved to locate the wire on the machine in the usual way for a Fourdrinier paper machine as represented in FIG. 2.

The wire changing apparatus for the backing wire 12 comprises a generally A-shaped frame 170 having a cross brace 171 at its front end and having mountings 172 at its rear end for support on tracks 173 suspended from the longitudinal beams 53. The frame 170 is constructed to carry the usual removable poles 175, and with the wire strung thereon while the frame is in the aisle in front of the machine, it can then be moved laterally to drape the wire over the four rolls 10, 12, 16 and 17. It will be understood that for changing operations, the appropriate blocks 58 at the front side of the machine are removed to leave the necessary section or sections of the machine supported by cantilever beams are required to provide space for receiving the wires.

In addition to the other advantages offered by the invention as described above, it should be noted that it provides a two-wire paper machine construction which is especially well adapted for use in converting an existing Fourdrinier machine to two-wire operation. Thus the base and frame structure may comprise the corresponding portion at the dry end of a Fourdrinier section, the roll 20 may be the suction couch roll of a Fourdrinier machine, and the rolls 21, 22 and 24 may be similarly adapted from an existing machine along with the suction boxes 40 and 41. The forming zone in accordance with the invention can be so short that even in the retracted position of the frame member 60, the breast roll 11 will be closer to the roll 20 than the breast roll of the corresponding Fourdrinier section, and this is a substantial saving in space requirements while still providing ample space for the necessary movement of the frame member 60.

FIG. 7 illustrates diagrammatically the application of the invention to a vertical two-wire paper machine utilizing a pair of couch or turning rolls similarly to the machines disclosed in some of the above noted patents and applications. The arrangement of parts for supporting and guiding the backing wire 12′ are essentially the same in construction and arrangement as in FIG. 1, and they have accordingly been identified as 10′, 12′ and so forth. Some of the parts for supporting and guiding the conveying wire 13′ are similarly of the same construction and arrangement as in FIG. 1, and they also have been identified as 11′, 25′ and so forth. The additional couch roll 180 for the conveying wire 13′ is a suction roll mounted below the breast roll 11′ and at a level below that of the turning roll 15′, and a pickup roll 181 and pickup felt 182 are arranged to pick up the sheet from the reach of wire 13′ between couch roll 180 and the adjacent turning roll 185.

As illustrated by dotted lines in FIG. 7, the frame member 60′ can pivot about its pivotal mounting 65′ to a retracted horizontal position essentially the same as

that of the frame member **60** in FIG. **2.** This is the position for wire changing, and it will be understood that the couch roll **180** will have a cantilevered mounting at the front side of the machine in the usual way. It will be apparent that in the retracted position of the frame member **60'**, the working surfaces of the deflectors on each of the frame members **60'** and **80'** will be exposed for ready access for the purposes already described. It will also be understood that the wire **13'** can be guided in many other patterns by suitably located rolls without the loss of any of the advantages of the invention.

FIG. **8** shows the application of the invention to a two-wire vertical paper machine wherein the wires are arranged to travel upwardly as they define the forming zone, substantially as shown in the above application Ser. No. 771,888, now U.S. Pat. No. 3,597,315. The breast rolls **200** and **201** are each provided with an associated turning or couch roll **202** and **203,** and the wires **204** and **205** travel upwardly from the breast rolls to the couch rolls in converging relation defining the forming zone **210** which receives stock jetted upwardly from the headbox **212** as described in application Ser. No. 771,888. The arrangement of deflectors **215** is similar to that shown in FIG. **1** except that the lower surface of each deflector is inclined upwardly away from the adjacent inner surface of the associated wire, and the uppermost deflector for the conveying wire **205** is combined with a suction box **217** to assure that the sheet adhere to the wire **205** as it wraps the couch roll **203,** which is shown as a suction roll mounted by a bracket or support means **203***a* and having a suction box **218** for additional dewatering of the sheet. The suction pickup roll **220** and felt **221** pick up the sheet from the wire run between the rolls **222** and **223.**

The suction couch roll **203** and the deflectors **215** for the conveying wire are mounted on a frame member **225** which has essentially the same structural features as the frame member **60** but may be of somewhat different overall dimensions and configuration as may be required, such as the internal reinforcing baffles **226.** The frame member **225** is provided with a pivotal mounting **228** on which it can be moved to a substantially horizontal retracted position, represented by the dotted line showing of the couch roll **203,** for wire changing and servicing of the deflectors. The frame member **230** which carries the couch roll **202** and the associated deflectors **215** is of essentially the same basic construction as the frame members **80** and **225,** as well as of very similar configuration. The operation of these parts correspond to those of the similar parts already described, and the same advantages are provided by the cooperative supporting and bracing action of each of the frame members with respect to the deflectors carried thereby as well as with respect to the ease of servicing of the deflectors when the frame members are in their retracted positions.

It will be apparent that while the invention has been described in connection with twin-wire paper machines wherein the length of the forming zone is substantially vertical, this is not a limitation on the use of the invention. On the contrary, the principles of the invention can be applied to twin-wire paper machines wherein the length of the forming zone extends in any direction between horizontal and vertical, as is easily visualized by considering any of the illustrated paper machines with the drawing turned through 90°, in which event the arrangement would preferably be such that the movement of the upper frame member would be through substantially 90° so that the lower frame member would be in exposed horizontal position affording access to the working surfaces of both guide means in substantially the same manner as shown in FIG. **2.** It is also not essential that it be the frame member associated with the conveying wire which is movable through 90°, but this is usually the case as a matter of convenience because it is usually the conveying wire which is the longer of the two wires and therefore provides the greater space in which the associated frame member can move without interference with fixed wire rolls.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made therein without departing from the scope of the invention.

What is claimed is:

1. Apparatus for forming a paper sheet between a pair of looped forming wires and including a base structure, a pair of breast rolls cooperating to support a pair of reaches of said wires in opposed relation defining a generally vertically extending forming zone having a mouth for receiving paper making stock therethrough, a turning roll located at the opposite end of said forming zone from said mouth, guide means arranged within the loop of each of said wires to engage and guide said reaches in generally vertically converging relation from the respective said breast rolls to said turning roll and thereby to cause said wires to exert pressure on stock within said forming zone forcing the liquid therein to be extruded through said wires while the fibers remaining therein form a paper sheet, guide roll means positioned within the loop of each of said wires to cause said wires to wrap an angular portion of said turning roll and thereafter to separate from each other, and means for causing said sheet to adhere to one of said wires as the other said wire diverges therefrom said apparatus further comprising:

a. an essentially unitary first frame member located within the loop of one of said wires and forming the common support for said guide means within said wire loop and for one of said breast rolls,

b. a second frame member located within the loop of the other of said wires and forming the common support for said guide means within said other wire loop and for the other of said breast rolls,

c. means forming a pivotal mounting on said base structure for said first frame member having its axis parallel with said rolls,

d. means supporting said turning roll in predetermined spaced relation with said pivotal mounting,

e. means for causing pivotal movement of said first frame member about said pivotal mounting between the operating position thereof wherein said rolls and guide means support said one wire in operative relation with said other wire and a position retracted from said operating position providing ready access to the space between said guide means and thereby to the wire engaging surfaces of both of said guide means, and

f. said predetermined spaced relation between said pivotal mounting and said turning roll being such that movement of said frame member to said retracted position unwraps said one wire from said

turning roll and thereby provides sufficient slack for changing said wire.

2. Apparatus as defined in claim 1 wherein said breast rolls and said guide means support said wire reaches in downwardly converging relation with said mouth located at the upper end of said forming zone to receive stock therethrough from above, wherein said supporting means support said turning roll on said second frame member, and wherein said pivotal mounting is positioned to locate the axis thereof at a level below the level of said turning roll.

3. Apparatus as defined in claim 2 further comprising means establishing a substantially vertical operative position for said first frame member and a substantially horizontal retracted position therefor with said guide means thereon facing upwardly.

4. Apparatus as defined in claim 1 wherein said breast rolls and said guide means support said wire reaches in upwardly converging relation with said mouth located at the lower end of said forming zone to receive stock therethrough from below, wherein said supporting means support said turning roll adjacent the top of said first frame member, and wherein said pivotal mounting is positioned to locate the axis thereof adjacent the lower end of said first frame member.

5. Apparatus as defined in claim 4 further comprising means establishing a substantially vertical operative position for said first frame member and a substantially horizontal retracted position therefor with said guide means thereon facing upwardly.

6. Apparatus as defined in claim 4 wherein said turning roll is a suction roll having a suction box located in the portion thereof wrapped by said wires.

7. Apparatus as defined in claim 1 wherein said guide means include a plurality of individual deflector assemblies each including a deflector blade for engaging the inner surface of the associated said wire to remove the extruded liquid therefrom, and wherein said first frame member includes internal reinforcing means cooperating with said deflector assemblies to support and brace said deflector blades against deflection.

8. Apparatus as defined in claim 7 wherein said first frame member includes at least one internal rib extending generally parallel with the length of said forming zone and spaced from the ends of said forming zone, and wherein each said deflector assembly includes a bar extending substantially the full width of said forming zone, and further comprising means securing said bar to each said rib and to opposite end portions of said said frame member.

9. Apparatus as defined in claim 8 wherein said securing means are accessible from the wire engaging surfaces of said guide means when the associated wire is removed to facilitate servicing of said deflector assemblies.

10. Apparatus as defined in claim 1 wherein said guide means include a plurality of deflector blades for engaging the inner surfaces of the associated said wires to remove the extruded liquid therefrom, supporting means for said deflector blades including a substantially rigid bar for each said deflector, reinforcing means for supporting said bar in rigidly braced relation with said frame member, and means forming removable connections between each said bar and said frame members at locations accessible from the working surface of said guide members in the retracted position of said first frame member when the associated said wire is removed.

11. Apparatus as defined in claim 1 further comprising a walkway secured on said first frame member at a location below the level of said guide means mounted thereon, and means establishing a substantial vertically operative position for said frame member and a retracted position therefore wherein said walkway is substantially horizontal to facilitate access to all of said guide means in said retracted position of said frame member.

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