

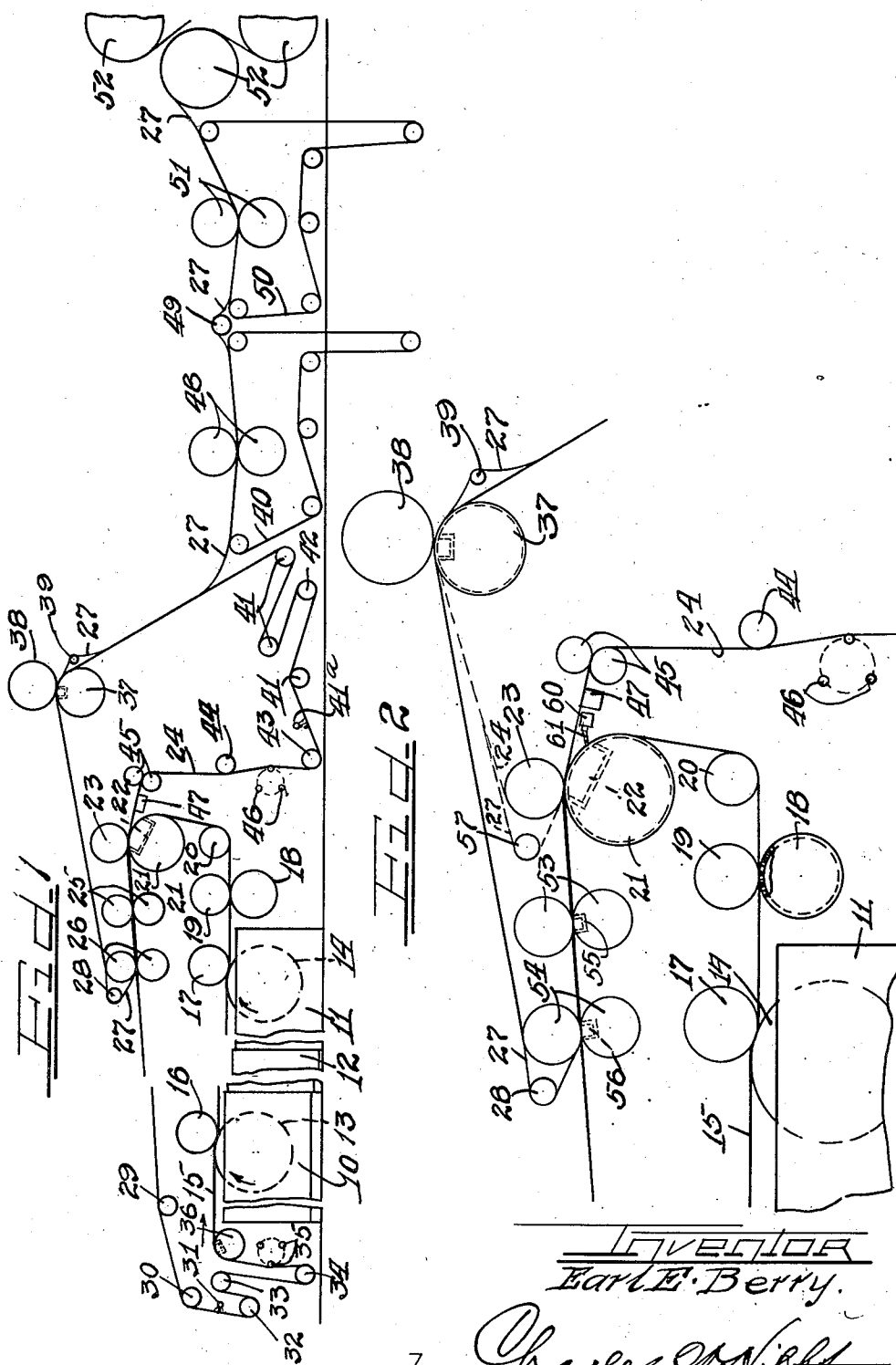
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CYLINDER PAPER MACHINE AND PROCESS OF MAKING PAPER

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CYLINDER PAPER MACHINE AND PROCESS
OF MAKING PAPEREarl E. Berry, Beloit, Wis., assignor to Beloit Iron
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19 Claims. (Cl. 92-43)

This invention relates to a cylinder paper machine of the type having the cylinder molds rotating toward the drier section which is provided with water extracting means in the space normally occupied by the primary presses.

More specifically this invention relates to a cylinder paper machine of the type having the cylinder molds rotating toward the drier drum and provided with a water extracting device for removing water from the paper web being formed without undue compaction and distortion of the fibers in the web. The invention also includes a process of forming paper on this machine.

In the customary straight-line cylinder paper machine the cylinder molds rotate toward the drier section of the machine and the web formed on these molds is picked up by a carrier felt traveling toward the drier section. After the carrier felt passes over the last cylinder mold the web thereon is passed through a primary press roll section of the machine to squeeze water from the web and sufficiently form the web to render it self-supporting. It is customary to cover the web with another felt as it passes through the primary presses so that the web is protected between this felt and the pick-up felt. The installation of this primary press roll section of the machine represents a high initial cost and a comparatively high operating expense to drive the rolls. Furthermore the press rolls tend to compact the web being treated since the water is removed by a squeezing action only. Because the web must be supported by one or two felts, this squeezing action also distorts the fibers of the web and any defect in the surfaces of the felt is pressed into the surfaces of the web.

I have now provided a cylinder type paper machine in which the cylinder molds rotate toward the drier section that can be operated without the use of primary press rolls, extractor rolls and the like. In the machine of my invention the pick-up felt, having the newly formed web thereon, is trained around a water extracting device acting through the pick-up felt to suck water from the web and felt without crushing the web. Immediately following this extraction the web is removed from the pick-up felt and carried by another felt with the surface of the web that was exposed on the pick-up felt contacting the new felt so that the other surface of the web is exposed. This felt carries the web through a suction press and into additional press rolls of either the plane or suction type. The felt preferably passes through the water-extracting device

vice together with the pick-up felt and thus covers the web on the pick-up felt. The water-extracting means of this invention may conveniently be located in the space normally occupied by the primary presses.

In my copending application entitled "Water extracting device for paper machines and method of making paper", Serial No. 19,590, filed May 3, 1935, I have described and claimed a water extracting device such as may be used in the present invention. In said application, however, the water extracting device is claimed in combination with a conventional cylinder type of paper making machine in which the cylinder molds rotate in a direction away from the drier section of the machine, and the pick-up felt conveys the fibrous web back across the top of the cylinder molds toward the drier section.

In my copending application entitled "Cylinder paper machine and method of making paper", Serial No. 19,591, filed May 3, 1935, I have described and claimed a cylinder type of paper making machine in which a pick-up felt removes the fibrous mats from the cylinder molds, carries the mats through a water extracting device, and immediately thereafter transfers the formed fibrous web to another felt or carrier before the web can reabsorb moisture from the pick-up felt. In this application, however, the pick-up felt side of the web contacts the second carrier whereas in the present application the pick-up felt side of the web is exposed.

It is therefore an object of this invention to provide a water-extracting apparatus for cylinder paper machines having the cylinder molds rotating toward the drier drum section which does not unduly compact the newly formed web.

It is a further object of this invention to provide a water-extracting apparatus for cylinder paper machines of the type having the cylinder molds rotating toward the drier drum section of the machine which can be conveniently mounted in the space normally occupied by the primary press rolls of such machines.

A further object of this invention is to provide a cylinder paper machine in which the forming molds rotate toward the drier section with a water extracting means acting upon the newly formed web to remove water therefrom without distorting and disrupting the fibers of the web.

A further object of this invention is to provide a process for removing water from cylinder formed webs without the aid of customary primary press rolls.

A further object of this invention is to provide

a process for forming fibrous webs having a desired caliper per given weight by regulating the pressing of the newly formed web as water is removed therefrom.

5 Other and further objects of this invention will become apparent from the following detailed description of the annexed sheet of drawings which form a part of this specification.

It will be understood, however, that the illustrated description of this invention represents a preferred modification only and that many changes may be made without departing from the scope of this invention.

On the drawing:

15 Figure 1 is a broken diagrammatical side elevational view of a cylinder paper machine according to this invention.

Figure 2 is an enlarged fragmentary diagrammatic view of the water extracting apparatus of 20 this invention.

As shown on the drawing:

In Figure 1 the reference numerals 10 and 11 indicate the first and last stock vats respectively of the machine. It is obvious that additional 25 stock vats such as 12 may be interposed between the first and last stock vats. One or any number more than one of the stock vats may be used. The stock vats 10 and 11 have forming molds 13 and 14 rotating therein in a direction toward the 30 drier section of the machine as indicated. A pick-up felt or carrier 15 travels along its lower run as indicated toward the drier section of the machine over the cylinder molds 13 and 14 and is pressed into contact with the top peripheries 35 of the molds by means of couch rolls 16 and 17. In this manner the fibrous webs on the cylinder molds are picked up onto the pick-up felt.

After the pick-up felt 15 passes over the last cylinder mold 14, it is directed over a screen 40 faced extractor roll 18 and gently pressed against this roll by a top press roll 19. Any number of extractor rolls 18 and top press rolls 19 may be used. Furthermore these rolls may be entirely 45 dispensed with if desired. They merely serve to remove excess quantities of water from the web and pick-up felt without crushing the web. It is obvious, of course, that these screen faced extractor rolls will not remove a sufficient amount 50 supporting unless undue pressures are used. High pressures are not desired because the fibers in the web become unduly compacted and distorted.

After passing over the extractor roll 18 the pick-up felt and web thereon are trained around 55 a guide roll 20. After passing around the guide roll 20 the pick-up felt and web are directed around a perforated drum 21 having a suction head 22 therein defining a suction area over which the felt and web must pass. As shown, the 60 direction of the felt is thus reversed and it passes back over the top of the cylinder molds. A press roll or squeeze roll 23 is urged against the drum 21 preferably at a point within the suction area defined by the head 22. At this point or at a 65 point ahead of this point the web on the pick-up felt is covered with a top felt 24 so that the web is between two felts as it passes under the press roll 23.

The two felts with the web therebetween are 70 then directed between one or more pairs of press rolls 25 and 26 of either the plain or suction type. After passing between the last pair of press rolls 26 the top felt 24 is entrained around the top roll of this pair. The web 27 is removed from the 75 pick-up felt 15 and directed over a guide roll 28

from which it again contacts the felt 24. In this manner the surface of the web 27 which was in contact with the pick-up felt is exposed and becomes the top surface while the surface of the web which was exposed while on the pick-up 5 felt contacts the felt 24.

The pick-up felt 15 after having the web 27 removed therefrom, travels over guide rolls 29 and 30 in front of a shower pipe 31 which sprays water against the felt to open up the fibers thereof and to wash the felt. The washed felt then 10 travels over a guide roll 32 and around a pair of tightening rolls 33 and 34 which maintain the felt in a taut condition. The felt is then directed up from the roll 34 in front of a plurality of beaters 35 which whip the felt to fluff up the fibers thereof. The pick-up felt 15 then passes over a suction roll 36 located in front of the first cylinder mold 10. The suction roll 36 removes moisture 15 from the web to render it readily receptive to the fibrous webs from the cylinder molds.

The felt 24 with the web 27 thereon conveys the web through a suction press consisting of a suction roll 37 and a top press roll 38. After 25 passing through the suction press the web 27 is preferably directed away from the felt 24 over a guide roll 39 to loosen the web from the felt. The web then is directed onto another carrier 40 and the felt 24 is trained over guide rolls 41 and a tightening roll 42. The felt 24 next passes around 30 another guide roll 43 and over a guide roll 44. A shower pipe 41a is directed against the felt as it passes between one of the guide rolls 41 and the roll 43 to spray water against the felt for washing the same. Between the guide rolls 43 and 44 a plurality of paddles 46 are positioned to whip the felt in the same manner in which the pick-up 35 felt 15 is treated. The felt 24 then passes between a pair of wringer rolls 45 and over a suction box 47 for drying the felt. From the suction box 47 the felt contacts the web 27 as pointed out above. 40

The web 27 on the carrier 40 is directed through a pair of press rolls 48 of either the plain or suction type for removing further quantities of water 45 from the web. The web next passes over a guide roll 49 onto another carrier 50 which directs the web through another pair of press rolls 51. After passing between the press rolls 51 the carrier 50 directs the web into the drier section of the machine over drier drums 52. 50

As shown in Figure 2, the top felt 24, after passing over the suction drum 21, may be directed between pairs of press rolls 53 and 54 together with the pick-up felt and the web thereon. The pairs of rolls 53 and 54 as illustrated 55 in Figure 2 include suction heads 55 and 56 in the lower roll of each pair. These lower rolls are, of course, perforated. The pairs of rolls 53 and 54 are positioned immediately after the suction drum 21 so that the web on the pick-up felt 60 is immediately subjected to further water extracting and the web is thereafter immediately removed from the pick-up felt before it can reabsorb water from the felt. The pairs of press rolls such as 25 and 26 or 53 and 54 are provided 65 for further drying the web but at the same time these rolls also compact the web. If it is desired to form a very light sheet having a high caliper the use of these rolls may be dispensed with and as shown in Figure 2 the felt 24 may be 70 directed around the top press roll 23 instead of between the pairs of press rolls 53 and 54. The web 27 is removed from the pick-up felt and directed around a guide roll 57 onto the top of the felt 24. 75

This flexibility of operation makes possible the compacting of the web to any desired degree or the removal of water from the web without compaction. After passing over the guide roll 57 onto the felt 24 the web is directed through the remaining portion of the machine in the identical manner illustrated in Figure 1.

When starting up the machine the pick-up felt 15 is driven around the suction drum 21 until a web composed of webs from all of the cylinder molds reaches this point of the machine. The preceding portion of the web is then cut away by a squirt device 60 mounted adjacent to the suction drum 21 for directing a jet of water 15 through a nozzle 61 against the web of paper on the pick-up felt. The nozzle 61 is disposed over the suction area of the drum 21 and water therefrom is immediately sucked through the web. This force of water acts as a knife and cuts the web from the portion which has passed over the suction drum. In operation the squirt device 60 is slidably mounted on a support so that it may be moved across the full width of the web. Since the web and pick-up felt are moving this effects a diagonal cut across the web. When the web then reaches the last pair of presses 26 or 54 it is picked up and threaded over the guide roll 28 onto the felt 24. The portion of the web cut off is allowed to remain on the pick-up felt 30 and is washed therefrom by the shower from the pipe 31. This device permits the threading of a completely finished web through the remaining portion of the machine instead of the complete threading of the web through the machine 35 wherein the weak portions thereof formed from only one cylinder mold are apt to break away and require a rethreading of the machine. It is to be understood, however, that the squirt device is used only when starting up the operation of 40 the machine.

From the above description it should be understood that this invention provides for the use of a suction drum water extracting device on a cylinder paper machine having the cylinders rotating toward the drier section so that the water 45 from the web is first removed through the pick-up felt without damaging the web. The water extracting device provides for the removal of water from the web with the minimum amount of pressing on the pick-up felt, thereby eliminating felt marks on the paper. The web is removed from the pick-up felt before it re-absorbs water therefrom.

The suction drum extracting device can be followed by one or more sets of primary presses of either the plain or suction type and the use of these presses depends upon the weight and type of paper being made. When the presses are used a more compact sheet is produced. When the presses are out of use as illustrated in Figure 2 60 in dotted lines, the sheet can be increased in caliper considerably for a given weight.

By removing the paper from the pick-up felt in the manner shown, the side of the paper in contact with the felt is reversed so that it can be directly contacted with the smooth top rolls of the subsequent presses. This provides for a better finish on the side of the sheet which in other types of cylinder machines is always in 70 contact with the web.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent granted

hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. A cylinder type paper machine having cylinder molds rotating in a direction toward the drier section of the machine, a pick-up felt for receiving fibrous webs from the cylinder molds, a suction drum spaced from the cylinder molds, a press roll cooperating therewith, means for training the pick-up felt with the web thereon over the suction area of the suction roll and through the nip of the suction roll and press roll, a top felt for covering the web as it passes through said nip, means for reversing the direction of said top felt, means adjacent said suction drum for removing the web from the pick-up felt and directing it on top of the top felt whereby the surface of the web which contacts the pick-up felt is exposed and means for removing further quantities of water from the web. 20

2. A cylinder paper machine of the type having the cylinder molds therein rotating toward the drier section, a pick-up felt for receiving the fibrous web from said cylinder molds, a suction roll spaced from the cylinder molds, a press roll cooperating therewith within the suction area thereof, means for training the pick-up felt with the web thereon over the suction area of the suction roll and through the nip of the suction roll and press roll, a top felt for covering the web as it passes through said nip, means for reversing the direction of travel of said top felt after passing through said nip and means for removing the web from the pick-up felt to be carried on the top felt. 35

3. In a cylinder type paper machine, a fibrous web forming part, a carrier for receiving the fibrous web directly from the forming part, a suction roll removed from the forming surface of the forming part, a press roll cooperating therewith, means for training the carrier with the web thereon over the suction area of the suction roll and through the nip of the suction roll and press roll, a top felt for covering said web as it passes through said nip, a roll adjacent said suction roll for reversing the direction of said top felt and means adjacent said roll for removing the web from the carrier and directing it on top of the top felt. 45

4. A cylinder type paper machine comprising a fibrous web forming part, a drier section, a carrier for receiving a fibrous web from the forming part and transmitting the web toward the drier section, a suction press removed from the forming surface of the forming part and acting through the carrier for extracting water from the web thereon, a top felt for covering said web as it passes through the suction press, means for reversing the direction of said top felt after it passes through the suction press, means adjacent the suction press for removing the web from the carrier and placing it on top of the top felt and means in web receiving position adjacent the top felt for conveying the web toward the drier section. 65

5. A cylinder type paper machine comprising a plurality of cylinder molds, a looped pick-up felt trained around rolls located respectively before the first cylinder mold and after the last cylinder mold, coucher rolls for directing the lower run of the looped felt against the cylinder molds to receive the fibrous web therefrom, a suction press for receiving the pick-up felt and web thereon, a top felt trained through said suction press for covering the web on the pick-up felt, press rolls 75

adjacent said suction press for squeezing additional amounts of water from the web between said felts, means for reversing the direction of said top felt, means located immediately after said press rolls for removing the web from the pick-up felt and directing it on top of the top felt and additional press rolls for receiving the top felt and web to remove further amounts of water from the web.

6. In a cylinder paper machine of the type having the cylinder molds rotating toward the drier section of the machine, a looped pick-up felt for receiving the web from the cylinder molds, water extracting means spaced from the cylinder molds in the space between the cylinder molds and drier section normally occupied by the primary press rolls of said machine comprising a suction roll within the loop of said pick-up felt having a suction area contacting the felt, a top press roll urged against said suction roll within the suction area thereof, a top felt directed through the nip of said rolls to cover the web on the pick-up felt, means adjacent said suction roll for reversing the direction of said top felt and means for removing the web from the pick-up felt and directing it on top of the top felt.

7. In a cylinder type paper machine having a plurality of cylinder molds and a drier section in spaced relation from the cylinder molds, an endless pick-up felt looped over said cylinder molds for receiving the web therefrom on the outside of the loop, a suction roll within the loop of said pick-up felt having a suction area contacting the felt, a second endless felt looped adjacent to the cylinder molds in the space between the cylinder molds and drier section normally occupied by the primary presses of cylinder paper machines, means for directing said second felt over the web on the pick-up felt as it passes over the suction roll, means for reversing the direction of said second felt after its passage over the suction roll, and means for removing the web from the pick-up felt and reversing its direction to follow the second felt.

8. In a cylinder paper machine, a plurality of cylinder molds, an endless carrier looped above said molds, a suction roll before the first cylinder mold contacting the pick-up felt along the lower run thereof, an extractor roll after the last cylinder mold contacting the web on the pick-up felt, a suction drum within the loop of the pick-up felt for extracting water from the felt and web thereon, a second felt trained over said suction drum to cover the web thereon, means for reversing the direction of said second felt after it passes over the suction drum and means for removing the web from the pick-up felt and directing it on top of said second felt.

9. A cylinder paper machine comprising a plurality of cylinder molds, a pick-up felt traveling over said molds for receiving webs formed thereon, extractor rolls contacting the web on the pick-up felt after it leaves the last cylinder mold, top press rolls cooperating with said extractor rolls to press the web and felt thereagainst, a suction drum, a top press roll urged thereagainst, means for directing the pick-up felt and web thereon through the nip of said drum and roll, a top felt trained through said nip for covering the web on the pick-up felt, a pair of press rolls located immediately after said suction drum for extracting further quantities of water from the web between the felts, means for reversing the direction of said top felt, means for removing the web from the pick-up felt to travel with the top

felt, a suction roll acting through said top felt to further dry the web thereon, press rolls for squeezing water from said web, conveyors for directing the web through said press rolls and drier drums for receiving the web from the last conveyor.

10. The process of making paper which comprises forming a fibrous web on a cylinder mold, picking up said web on a carrier felt on the under side thereof, conveying the web on the felt away from the cylinder mold, directing said felt and web around the suction area of a suction roll, applying suction through the felt to remove water from the felt and web, covering the web with a top felt, applying pressure to the web between the felts to squeeze out further quantities of water therefrom and removing the web from the pick-up felt to travel with the top felt.

11. The process of removing water from a fibrous web built up on the under side of a pick-up felt which comprises applying suction through the felt to suck out water from the web and felt, covering the web with a top felt, pressing the felts together with the web therebetween while applying suction to squeeze and suck out additional amounts of water from the web, further pressing the felts together outside of the suction area, reversing the direction of the top felt, removing the web from the pick-up felt, reversing the direction of travel of said web and directing the web on top of the top felt to travel therewith with the pick-up felt side of the web exposed to the atmosphere.

12. The process of removing water from a fibrous web on a pick-up felt which comprises passing the pick-up felt with the web thereunder over extractor rolls, pressing the web and felt against said extractor rolls, directing the web and felt over the suction area of a suction roll, covering the web with a top felt, pressing the two felts together to remove further quantities of water, reversing the direction of travel of said top felt, removing the web from the pick-up felt, reversing the direction of travel of the web and directing the web on the top felt to travel therewith with the pick-up felt side of the web exposed to the atmosphere.

13. The process of making paper which comprises causing webs of paper from forming molds to adhere to a pick-up felt, conveying the web on the felt away from the forming molds, passing said felt with the web thereon over a suction roll to suck water from the web and felt, covering the web with a top felt as it passes over said roll, pressing the web between the felts to compact the web to any desired degree while squeezing additional amounts of water therefrom, reversing the direction of travel of said top felt, removing the web from the pick-up felt before it re-absorbs water therefrom and directing the web onto the top felt to travel therewith with the pick-up felt side thereof exposed to the atmosphere.

14. A cylinder paper machine comprising a fibrous web forming part, a drier section, a carrier traveling toward said drier section over the forming part for receiving a web therefrom, a suction drum acting through said pick-up felt to suck water from the web thereon, a top felt for covering said web, means for sucking water from said top felt before it contacts the web, means to squeeze the web while between the felts, means for reversing the direction of said top felt, means for conveying the web from the pick-up felt onto the top web to travel therewith in its reversed

direction, and a squirt disposed in front of said suction drum to act against the web as it passes over the suction area of the drum to cut the web.

15. In a cylinder type paper machine comprising a fibrous web forming cylinder, a carrier for receiving the fibrous web directly from the cylinder, a suction drum removed from the cylinder acting through the carrier to suck water from the web thereon, a top carrier for covering said web and means for removing water from said top carrier before it contacts the web.

16. In a cylinder type paper machine comprising a plurality of fibrous mat-forming cylinders, a pick-up felt for receiving the mats directly from the cylinders, a suction drum spaced from the cylinders acting through said pick-up felt to suck water from the mats thereon and form a web therefrom, a top felt for covering said web, means for washing said top felt and means for drying the washed top felt before it contacts the web.

17. In a cylinder type paper machine comprising a fibrous mat-forming cylinder mold, a pick-up felt for directly receiving the fibrous mat from the cylinder mold, a suction drum spaced from the cylinder mold acting through said pick-up felt to suck water from the mat thereon and form a web therefrom, a top felt for covering said web, a pair of wringer rolls for drying the top felt before it contacts the web and means for

squeezing the felts together to extract more water from the web therebetween.

18. The process of removing water from a fibrous web built up on the underside of a pick-up felt which comprises applying suction through the felt to suck out water from the web and felt, covering the web with a top felt, thereafter pressing the web between the felts at a point not subject to said suction to squeeze further quantities of water from the web, immediately thereafter separating the web from the pick-up felt, and directing the web over the top felt to travel therewith.

19. The process of removing water from a fibrous web built up on the underside of a pick-up felt which comprises passing the felt over the suction area of a suction roll spaced from the fibrous web forming surface to suck out water from the web and felt, covering the web with a top felt, pressing the felts together with the web therebetween at a point remote from the suction area of the suction roll for squeezing out additional amounts of water from the web, reversing the direction of the top felt, removing the web from the pick-up felt, reversing the direction of travel of said web and directing the web on top of the top felt to travel therewith with the pick-up felt side of the web exposed to the atmosphere.

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