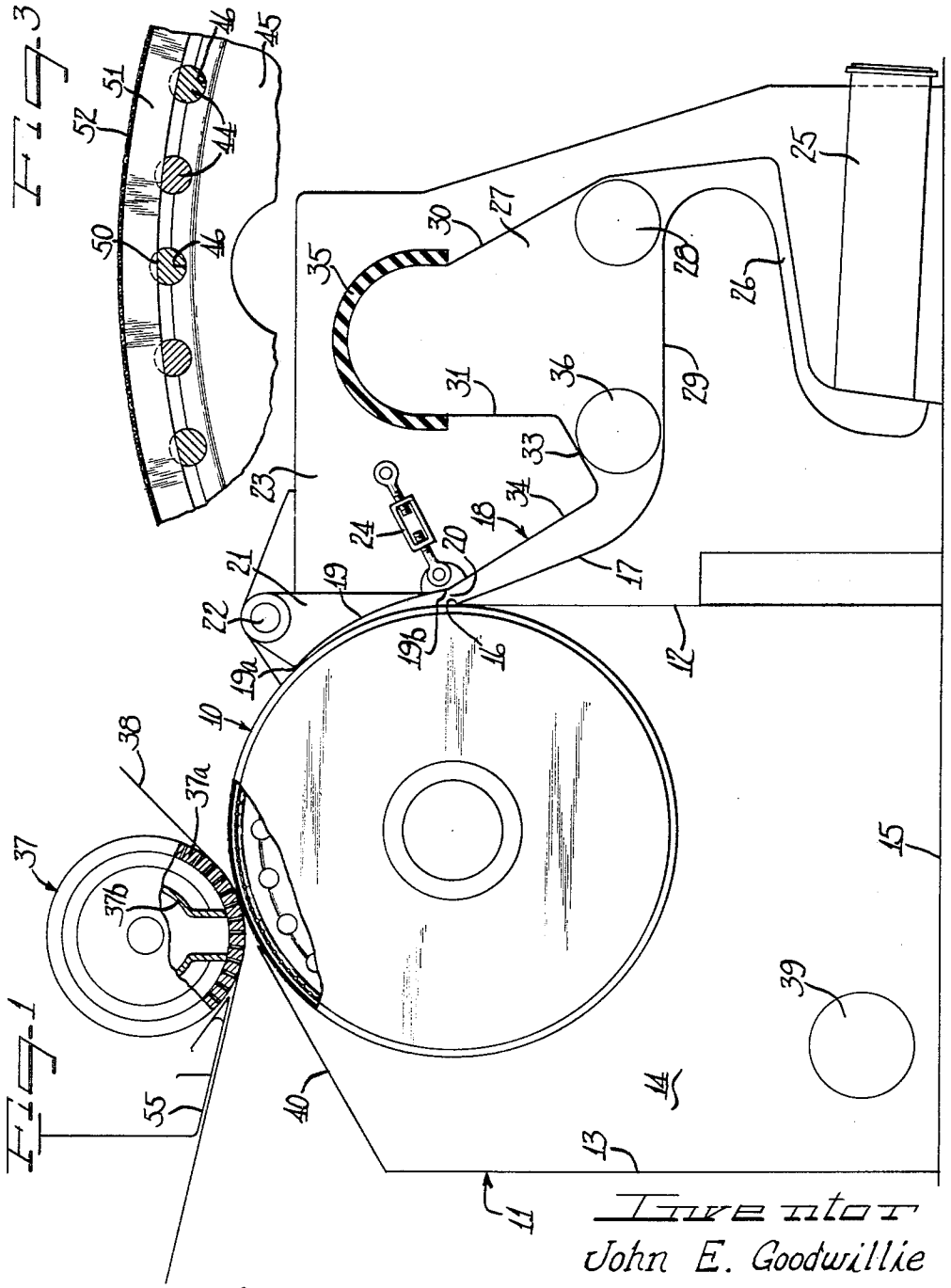
June 28, 1960 J. E. GOODWILLIE 2,942,662

CYLINDER TYPE PAPER MAKING MACHINE

Filed March 6, 1956 2 Sheets-Sheet 1

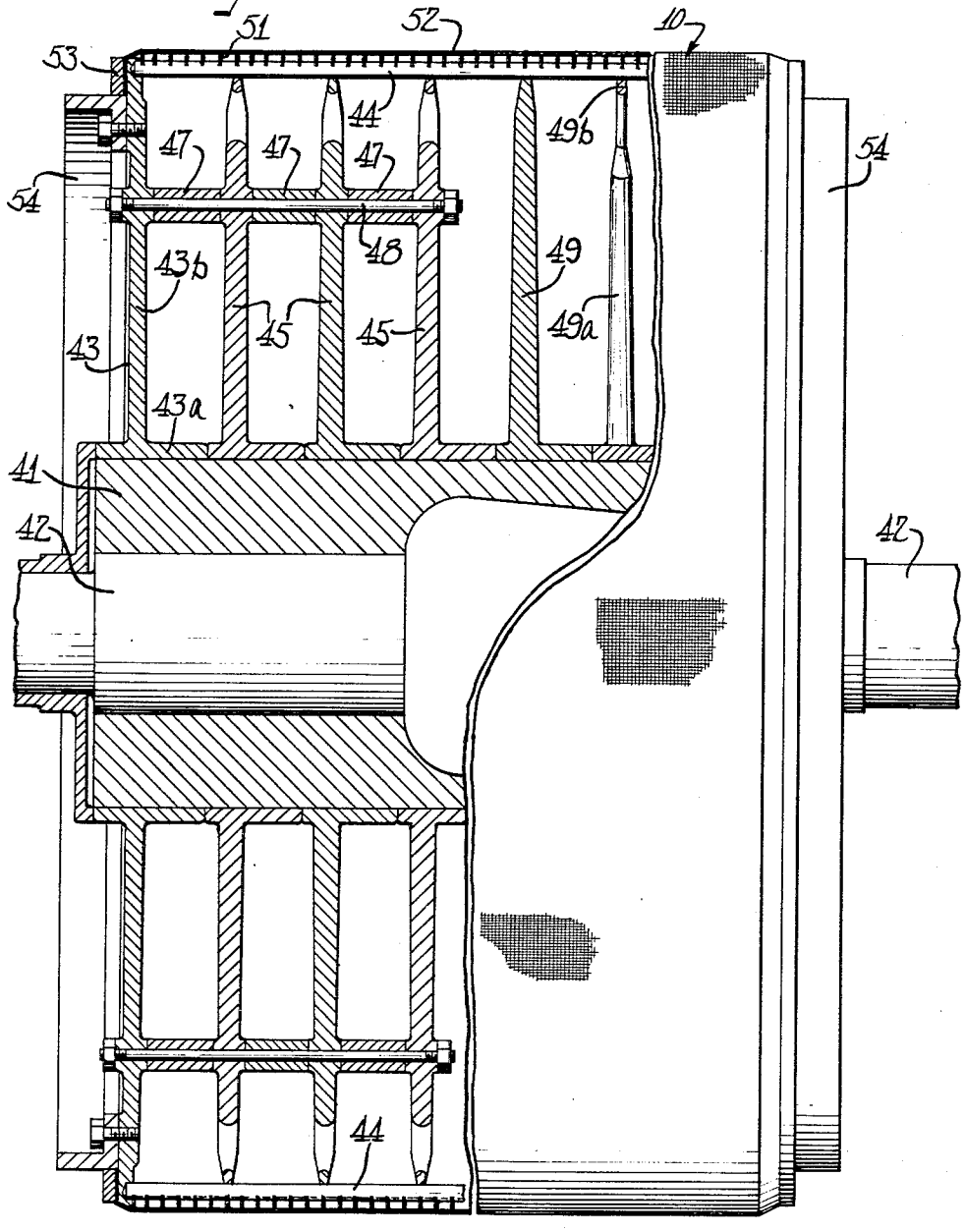


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CYLINDER TYPE PAPER MAKING MACHINE

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Fig. 2



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CYLINDER TYPE PAPER MAKING MACHINE

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9 Claims. (Cl. 162—317)

This invention relates generally to paper making machinery, and more particularly to cylinder paper machines capable of being efficiently operated at high speeds.

Heretofore, it has been difficult to operate cylinder paper machines having a cylinder mold roll at high speeds where a coucher roll and pick-up felt are employed to remove the paper web from the cylinder mold surface, since the nip defined between the coucher roll and the cylinder mold roll ran extremely wet to the point where the paper sheet crushed under the coucher and the pick-up was very uncertain. Hence, when desiring to run the cylinder mold roll at higher speeds, the problem encountered was to dry up the nip between the coucher and cylinder mold roll, and provide positive pick-up of the sheet.

In the present invention, a foraminous cylinder mold roll is suspended in an enclosure having an opening in the top thereof, wherein part of the mold forming surface projects through the opening. An adjustable duct means is provided for selectively delivering a variable stock flow to the cylinder mold forming surface. A pick-up or coucher roll having a felt trained thereover defines a nip with the cylinder mold forming surface.

In solving the above mentioned problem, the enclosure is subjected to a negative pressure thereby creating a pressure differential across the forming surface of a cylinder mold roll. This causes a stream of air to enter above a sealing blade of the enclosure coacting with the cylinder mold roll forming surface and below the pick-up which effectively blows the water entrained in the meshes of the wire back into the interior of a cylinder mold roll and doctors off from the undersurface of the wire that sheet of water which is carried on the undersurface by the combination of adhesion to the wire and centrifugal force.

Secondly, the construction of the cylinder mold roll is such that the covering wire is spaced at least one-quarter of an inch from the longitudinal supporting bars thereby allowing enough room for the air stream to come in on its almost tangential approach to doctor the water away from the underside of the wire.

Finally, in order to obtain a positive pick-up of the paper sheet from the cylinder mold roll forming surface and to further dry up the pick-up nip, a suction pick-up roll is trained thereover and defining the nip with the cylinder mold roll forming surface.

Accordingly, it is an object of this invention to provide a cylinder paper machine having a variable delivery duct for controlling the stock flow to the cylinder mold roll.

Another object of this invention is in the provision of a stock supply duct for a cylinder paper machine comprising an inner stationary wall and an outer pivotally mounted wall, wherein the walls coact to selectively control the stock flow to the cylinder.

A further object of the invention is to provide a cylinder paper making machine having a cylinder mold roll with a forming surface subjected to a pressure differential, wherein the machine is capable of operating at high speeds.

A still further object of this invention resides in the provision of a cylinder paper machine having a cylinder mold roll, wherein the forming surface of the mold roll is subjected to a suction pressure to enhance removal of water from the sheet formed on the roll.

Another object of this invention is to provide a cylinder paper making machine having a cylinder mold roll with an outer wire covering which is rotatably suspended in an enclosure that is under a negative pressure, wherein the paper sheet formed on the roll is taken off by a coucher and felt arrangement and the air stream entering the mold roll below the pick-up blows the water entrained in the wire meshes back into the interior of the mold and doctors off the sheet of water carried on the undersurface of the wire.

Another object of this invention resides in the provision of a pick-up arrangement for a cylinder paper machine operating at high speeds which provides a positive pick-up while maintaining the nip with the cylinder roll relatively dry.

A further object of this invention resides in the provision of a cylinder mold roll operating under a suction pressure and at high speeds, and a suction pick-up roll with a felt trained thereover defining a nip with the mold roll.

Another object of this invention is in the provision of a suction pick-up roll for a cylinder mold, wherein the suction area in the suction pick-up roll extends from the leaving side of the centerline between the pick-up roll and the mold roll to the point where the felt over the pick-up roll leaves the face thereof.

A further object of this invention is to provide a foraminous cylinder mold including a hub having a pair of axially spaced end head members, a plurality of circumferentially spaced and annularly arranged bars extending between the end head members, a tape set on end and spirally wound around the bars, and a wire covering supported by said tape and defining a stock forming surface, wherein the spacing between the bars and the wire covering is at least .250 inch.

Other objects, features, and advantages of the invention will be apparent from the following detailed disclosure, taken in conjunction with the accompanying sheets of drawings, wherein like reference numerals refer to like parts, in which, on the drawings:

Figure 1 is generally a diagrammatic elevational view, showing some parts broken away and other parts in section, of a cylinder paper machine according to the invention;

Figure 2 is a partially broken and fragmentary elevational view of a cylinder mold roll according to the invention, with some parts broken away and other parts in section for purposes of disclosing underlying parts; and

Figure 3 is an enlarged fragmentary view, taken along a radial plane through the cylinder mold of Figure 2 illustrating the manner in which the outer covering wire is supported on the longitudinal bars or rods.

As shown on the drawings:

In Figure 1, a foraminous cylinder mold roll, generally designated by numeral **10** is rotatably supported in an enclosure or tank **11** having a front wall **12**, a rear wall **13**, side walls **14, 14**, and a bottom **15**. The front wall **12** terminates at about the center of the mold roll **10** at an upper edge **16** in close proximity to the outer forming surface of the mold roll, this upper edge being common to an inner stationary wall **17** of a stock supply duct **18**.

The inner wall **17** of the stock supply duct **18** is angularly displaced relative to the enclosure front wall **12** and coacts with an outer wall **19** to control the stock flow to the cylinder forming surface. The outer wall **19** is arcuately formed and provided with a slice point

19a at its upper end in circumferentially spaced relation to the upper edge 16 of the inner wall 17 and in close proximity to the outer forming surface of the mold roll 10. A trailing edge 19b terminates the outer wall 19 and coacts with the upper edge 16 of the inner wall to define a throat 20.

A supporting arm 21 is attached to the outer wall 19 and pivoted at 22 to an upstanding wall member 23 thereby allowing pivotal movement of the outer wall 19 toward and away from the mold roll 10 to vary the size of throat 20 and control the stock flow to the mold roll. Means for effecting the selective adjustment of the outer wall 19, in the instant case, constitutes a turn buckle 24 pivotally attached at one end to the outer wall 19 and at the other end to the upstanding supporting member 23. Hence, regulation of the stock flow to the mold roll is accomplished by the variable flow stock duct 18.

Before entering the supply duct 18, the stock flows through an inlet conduit 25, changes direction and flows upwardly and rearwardly through a passageway 26 and again upwardly into an inlet chamber 27. Before entering the inlet chamber, the stock flows by a rectifier roll 28. The inlet chamber has a bottom wall 29 formed as a continuation from the inner duct wall 17 but angularly related thereto, a rear stationary wall 30, and a forward wall 31 that is rigidly connected to the outer duct wall 19 by an angularly related wall 33 and another angularly related wall 34. Connecting the front wall 31 and the rear wall 30 of the inlet chamber is a flexible sealing member 35, of inverted U-shape which permits movement of the front wall 31 and its associated parts during the movement of the outer duct wall 19. The sealing member 35 may be constructed of rubber or other equivalent material. A second rectifier roll 36 is positioned at the outlet of the inlet chamber 27 and the inlet of the stock delivery duct 18. On opposite sides of the inlet chamber 27, the supply duct 18 and the passageway 26 are sealingly enclosed by the parallel spaced supporting members 23, 23.

The sheet formed on the mold roll 10 is removed by a pick-up or coucher roll 37 having a pick-up felt 38 trained thereover which defines a nip with the mold roll 10 at the downgoing side thereof. Since this nip has a tendency to run extremely wet during high speed operation of a mold roll 10, a pressure differential is created on the forming surface of the roll by any suitable means such as connecting the enclosure 11 to a pressure source 39. Preferably, a negative pressure will be developed within the enclosure 11 thereby subjecting the mold to a suction pressure. A top cover member 40 extends from the upper edge of the rear enclosure wall 13 and in overlying and closely spaced relationship to the outer forming surface of the mold roll 10 at a point slightly spaced from the pick-up nip to facilitate pressure sealing of the mold roll within the enclosure. Side sealing means of the mold roll will of course be provided to enhance the sealing between the mold roll and the side walls 14 of the enclosure. It will be understood that the use of the sealing cover member 40 and negative pressurizing the cylinder mold may be applied to a conventional cylinder mold to improve its load carrying capacity and to remove the present speed limitation which definitely exists on a conventional arrangement.

The stream of air which enters into the enclosure 11 around the cylinder mold 10 through the opening below the pick-up nip and above the free end of the sealing blade or cover member 40 strikes the wire facing of the mold at such a velocity that it has the effect of removing the water entrained in the meshes of the wire back into the interior of the cylinder mold, and of doctoring off from the undersurface of the wire that sheet of water which is carried on the undersurface by the combination of adhesion to the wire and centrifugal force.

In the construction of the cylinder mold roll 10, as seen most clearly in Figure 2, the mold roll includes an elongated hollow hub 41 having stub shafts 42, 42 projecting from each end thereof. Axially spaced end heads 43, 43 (only one shown) are carried on the opposite ends of the hub, and include a central cylindrical spacing portion 43 surrounding the hub and a radially extending annular disk portion 43b. Blind holes are provided on the inner faces of each end head near the outer periphery thereof to receive between the end head a plurality of circumferentially spaced and annularly arranged rods or bars 44. To additionally support the bars 44 in spaced relationship from the hub 41, a plurality of axially spaced disk-shaped members 45 are provided adjacent each end head on the hub. The outer peripheries of these members are notched at 46 as seen in Figure 3 to receive the bars 44. Additionally, spacer members 47 are provided between the supporting members 45 and connected by an elongated nut and bolt assembly 48.

To further support the intermediate portions of the bars or rods 44, a plurality of axially spaced spider members 49, each of which include radially arranged spiders 49a connected at their outer ends by an annulus 49b, are carried on the hub 41. These members are also notched to seat the bars 44. While each of the spider members 49 are provided with an equal number of spiders 49a, the adjacent spiders are angularly displaced so that a spider 49a of one member 49 is circumferentially displaced from a corresponding spider 49a of an adjacent spider member 49. Spacing flanges are provided for the disk-shaped member 45 and the spider members 49 which surround the hub and prevent the members from moving axially relative to each other.

The bars or rods 44 are slotted at the outer periphery in a spiral or helical fashion to seat a formed tape 51 set on edge and spirally wound around the annularly arranged bars 44. A covering wire 52 of any suitable type is then wrapped around the outer periphery of the tape 51 and secured at its lateral edges to the end heads 43 by clamping rings 53.

In order to allow the air stream entering the mold roll below the pick-up nip to attain an almost tangential approach and doctor the water away from the underside of the wire, it was found necessary to space the covering wire 52 at least .250 inch from the bars 44. Laterally projecting flanges 54 are attached to the outside of each end head 43 for coaction with deckle or sealing straps in sealing the mold roll within the enclosure 11.

The paper sheet is removed from the surface or wire of the mold roll 10 by the pick-up roll 37 and its associated pick-up felt 38. This pick-up roll is of a suction variety and defines a nip with the mold roll 10 at a point spaced slightly above the free end of the enclosure cover member 40. In order to obtain a more positive pick-up of the sheet from the cylinder mold and to further dry up the pick-up nip, it was found that a suction pick-up roll was necessary for operations at the higher rates of speeds. The vacuum in this pick-up roll need not be too large, but it is necessary to overcome the resistance of the sheet to be removed away from the cylinder mold roll surface which is also running under vacuum high enough to cause the required air stream velocity to enter at the pick-up point.

The pick-up roll 37 includes a perforated shell 37a rotatable around a stationary suction box 37b. In the suction pick-up roll the suction area extends from the leaving side of the centerline between the pick-up roll and the mold roll 10 to the point where the felt 38 leaves the face of the pick-up roll. The positioning of this suction area is rather critical in that when the vacuum effects from the pick-up roll acts through the felt at this common single line or in advance thereof, more water is lifted with the sheet from the face of the mold than can be properly handled by the suction roll action,

resulting in a sheet and felt leaving the suction pick-up roll in a very wet and somewhat unevenly wet condition. Also, if the vacuum action of the roll does not continue to the point where the felt leaves the face of the pick-up roll, part of the water drawn into the perforations of the roll shell passes back into the felt and re-wets the sheet. A save-all **55** is provided behind the pick-up roll, and it will be understood that the action of the vacuum area is to hold the water in the perforations so that when it releases, the water is thrown into this save-all. While the running of the felt **38** away from the suction pick-up roll is shown as rising, it is generally preferred to have a down-running felt in order to facilitate directing the water into the save-all, particularly at lower speed operation.

From the foregoing, it is seen that the present invention provides a cylinder mold roll arrangement which gives better control at higher operational speeds, while providing a simple and rugged arrangement. In operation, control of the stock flow may be adjusted by selective movement of the outer movable wall **19** of the supply duct **18**. In subjecting the mold roll **10** to a vacuum or suction pressure, the opening between the upper free edge of the cover member **40** and the pick-up nip serves as an inlet for the inrushing stream of air which has the apparent effect of removing the water that is held under the wire covering from the wire to further dry up the pick-up nip. Actually, the air stream effectively blows the water entrained in the meshes of the wire covering back into the interior of the cylinder mold roll and doctors off that sheet of water carried on the undersurface of the wire by a combination of adhesion and centrifugal force. And in order to provide a more positive pick-up of the sheet from the cylinder mold and to further dry up the pick-up nip, a suction pick-up roll is provided at the nip which allows higher speed operation of the cylinder mold roll.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention, but it is understood that this application is to be limited only by the scope of the appended claims.

I claim as my invention:

1. In a paper machine, an enclosure having front and back walls, side walls, and a bottom, a hub rotatably mounted in said enclosure, axially spaced end heads carried at opposite ends of said hub, circumferentially spaced and annularly arranged bars extending between said end heads, axially spaced supporting members between the end heads and the hub and bars, slots formed in said bars in a spiral pattern, formed tape spirally wound around said bars and seated in said bar slots, a covering wire overlying said tape and defining a paper forming surface for a cylinder mold, said cylinder mold being positioned within said enclosure so the upgoing side of the wire forming surface is spaced in close proximity to the upper edge of the front wall, means above said upper edge of said front wall for delivering stock to the forming surface, a cover member extending from the top edge of the back wall and having a free end terminating in overlying close proximity to the down-going side of the wire forming surface, a suction pickup roll having a felt trained thereover and defining a nip with said wire forming surface a short distance above the free end of said cover member, and means for creating a negative pressure in said enclosure whereby a tangential flow of air will be created through the wire above the free end of the cover member for acting on the forming surface and removing the water entrained in the wire meshes and carried on the undersurface of said wire.

2. In a paper machine, an enclosure having an opening in the top thereof, a foraminous cylinder rotatably suspended in said enclosure, said cylinder having a cylindrical forming surface, said surface partially projecting through said opening, a pick-up roll having a felt trained thereover defining a nip with said forming surface with the roll located to form the nip at a location leaving a portion of said projecting surface exposed below the nip, means for delivering stock to said surface, and means for creating a pressure differential on the forming surface whereby a tangential flow of air will be cerated through said exposed surface to dry the surface at said nip for improved pickup of stock from the surface to the felt.

3. In a paper machine, an enclosure having an opening in the top thereof, a foraminous cylinder rotatably suspended in said enclosure and having a cylindrical forming surface projecting partially through said opening, a suction pickup roll having a felt trained thereover and defining a nip with said forming surface located to leave an exposed projecting cylinder area after said nip, duct means capable of delivering a stock flow to the forming surface, and means for creating a negative pressure within said enclosure to cause a tangential flow of air into said exposed area to dry the cylinder at the nip.

4. In a paper machine, an enclosure having front and back walls, side walls, and a bottom, a foraminous cylinder rotatably mounted in said enclosure and having a cylindrical wire forming surface, said surface being spaced in close proximity on its up-going side with the upper edge of the front wall, duct means above the upper edge of the front wall capable of selectively delivering a stock flow to the forming surface, a cover member extending from the top edge of the back wall and having a free end terminating in overlying close proximity to the down-going side of the forming surface, a suction pickup roll having a felt trained thereover and defining a nip with the forming surface a short distance above the free end of said cover member, and means creating a pressure differential on said forming surface whereby a tangential inward flow of air through said surface will be created between nip and said free end of said cover member to aid the pickup of stock from the surface by the felt.

5. In a paper machine, an enclosure having front and back walls, side walls, and a bottom, a foraminous cylinder rotatably mounted in said enclosure and having a cylindrical wire forming surface, said surface being spaced in close proximity on its upgoing side with the upper edge of the front wall, duct means above the upper edge of the front wall capable of selectively delivering a stock flow to the forming surface, a cover member extending from the top edge of the back wall and having a free end terminating in overlying close proximity to the down-going side of the forming surface, a suction pickup roll having a felt trained thereover and defining a nip with the forming surface a short distance above the free end of said cover member, and suction means connected to said enclosure for creating a substantially tangential flow through the cylinder area between the nip and said top edge of the back wall whereby water will be doctored from the cylinder inner surface and the cylinder dried at the nip.

6. In a paper machine, a foraminous cylinder rotatably mounted and having a cylindrical forming surface, a suction pickup roll having a felt trained thereover defining a nip with said forming surface, a flat surfaced sealing blade extending substantially tangential to the cylinder and overlying the cylinder surface in close proximity a short distance after said nip, means for delivering stock to said surface, and means for creating a flow of air through the forming surface between said nip and said sealing blade to cause a tangential air flow over the flat sealing blade to transfer the stock and dry the nip.

7. In a paper machine, a cylinder rotatably suspended in an enclosure and having means defining a foraminous movable paper forming surface, means forming a suction pickup surface having a felt trained thereover and meeting the forming surface in substantially line contact transverse of the direction of movement thereby defining a nip with said forming surface, said enclo-

sure spaced from said nip on the downrunning side of the forming surface, duct means positioned to deliver a stock flow to the forming surface, and means for causing a substantial tangential flow of air through said forming surface at said nip in the space between the enclosure and nip against the direction of movement of the surface to dry the forming surface at the nip and to aid the transfer of stock from the forming surface to the pickup felt wherein removal of water entrained in said foraminous surface and carried on the underside of said surface is effected.

8. In a cylinder paper machine, a rotatable cylinder mold comprising a hub, axially spaced end heads carried at opposite ends of said hub, circumferentially spaced and annularly arranged bars extending between said end heads, axially spaced supporting members between the end heads and the hub and bars, slots formed in said bars in a spiral pattern, formed tape spirally wound around said bars and seated in said bar slots to project above the surface of said bars, a covering wire overlying said tape and defining a paper forming surface spaced outwardly from said bars to form an air flow space therebetween, means for depositing a layer of paper stock on the screen, a suction pickup roll carrying a pickup felt and positioned to define a pickup nip with the covering wire, and means for causing a pressure differential behind the nip to cause a tangential drying flow of air inwardly through the screen underneath the paper stock to dry the screen at the nip and aid in transferring the web to the felt.

9. A paper making machine comprising a broad surfaced paper forming foraminous screen, means for moving the screen, means for depositing paper stock on the screen, means for supporting the screen leaving air flow areas therebeneath, a suction pickup member carrying a pickup felt and engaging the screen to define a pickup nip, and means for directing a tangential flow of drying air beneath the paper stock web against the direction of screen movement and through the screen at the nip to enhance the web pickup.

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