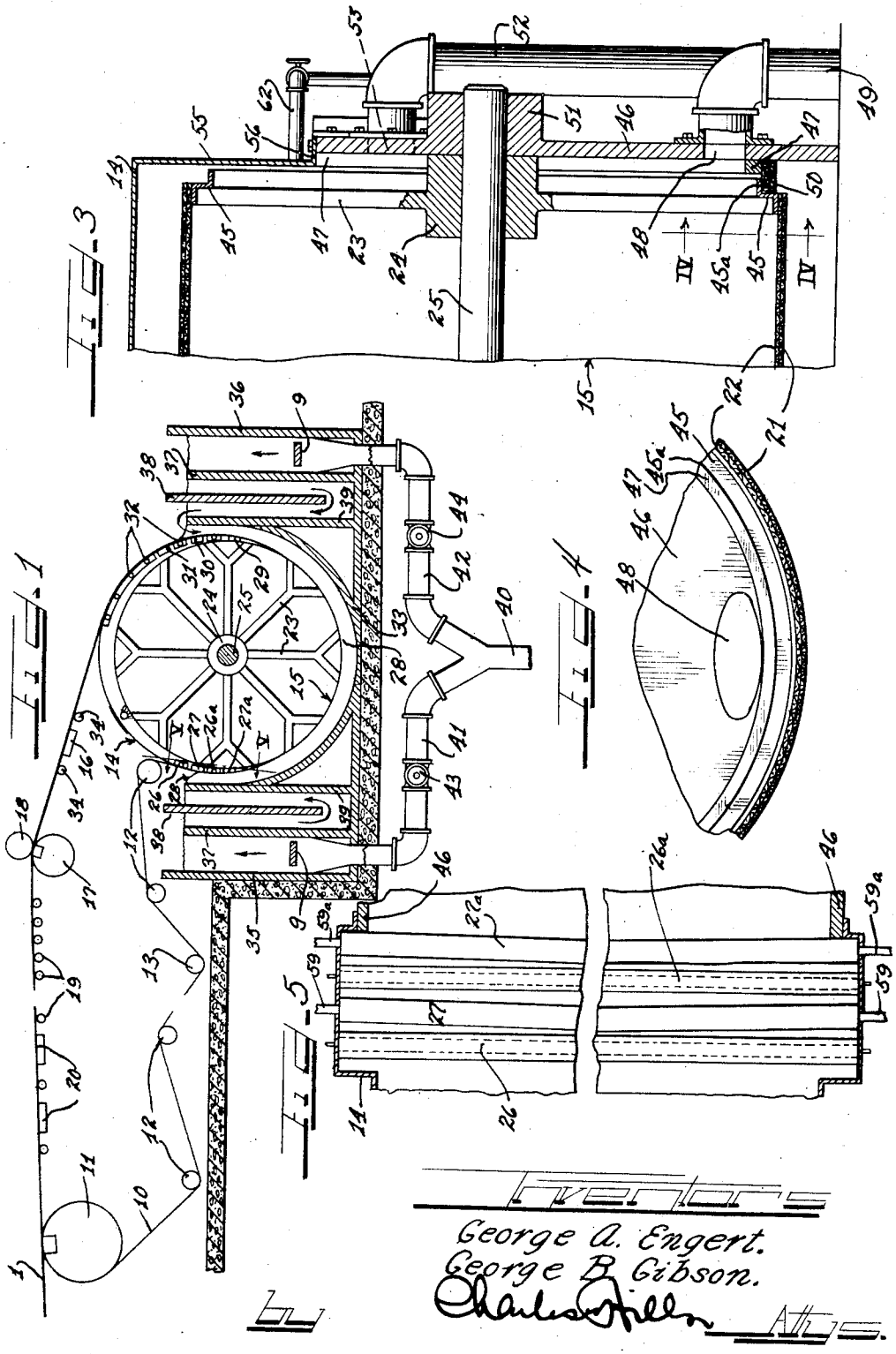
Aug. 29, 1933. G. A. ENGERT ET AL 1,924,154

PAPER MACHINE AND PROCESS OF MAKING PAPER

Filed May 9, 1932 2 Sheets-Sheet 1



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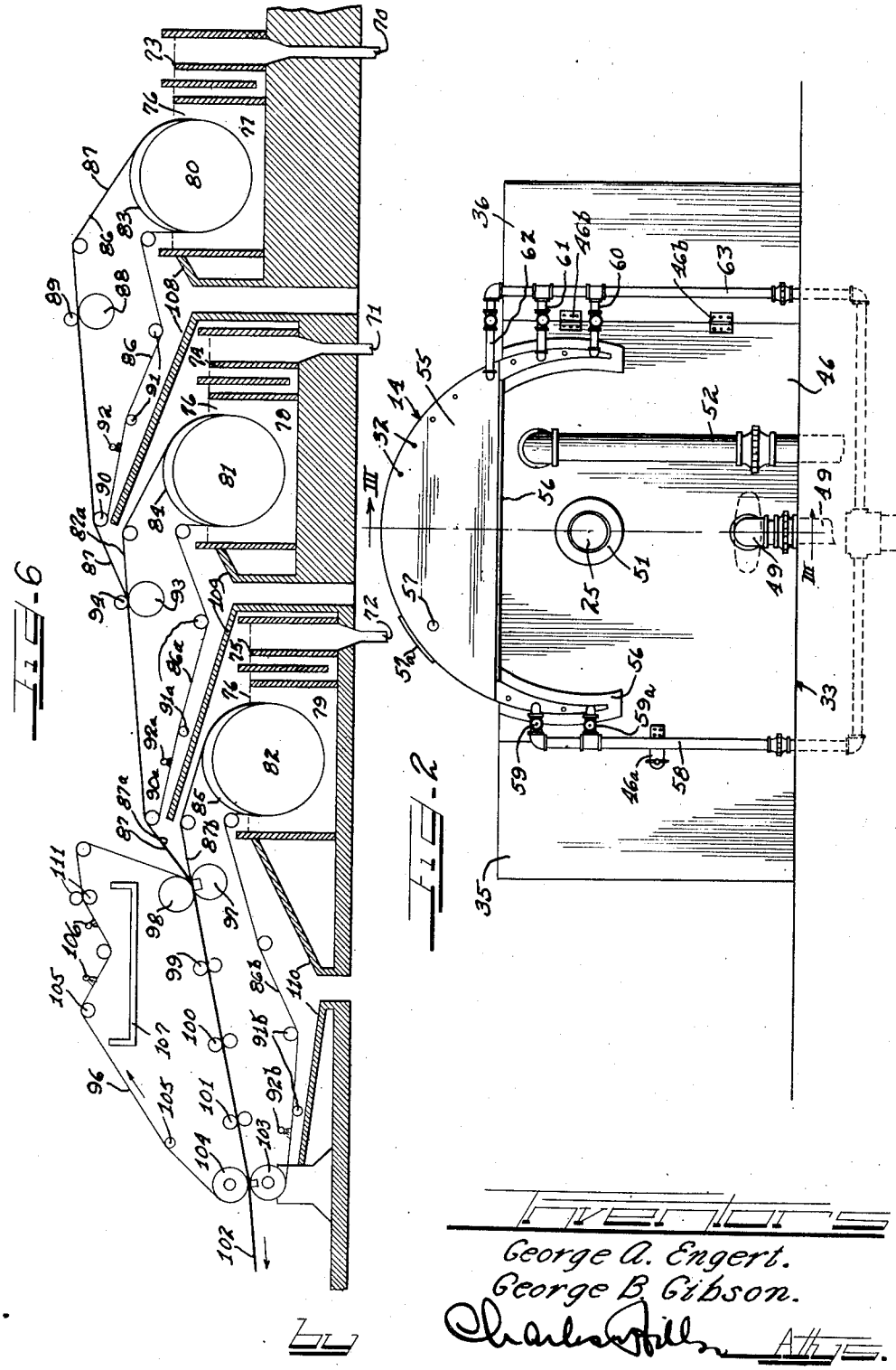

FIG. 1

FIG. 2

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UNITED STATES PATENT OFFICE

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PAPER MACHINE AND PROCESS OF MAKING PAPER

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Application May 9, 1932. Serial No. 610,004

28 Claims. (Cl. 92—39)

This invention relates to an improved paper making machine of the type wherein an endless forming wire travels through a pulp stock vat while entrained around a foraminous cylinder. The invention also includes a novel process for making high grade papers at high speed.

More specifically this invention relates to the wet end of a paper making machine wherein paper stock is deposited on an endless forming wire from a stock vat while said wire is entrained around a foraminous cylinder subject to continuous suction and vacuum and includes a novel suction sealing cap for said foraminous cylinder.

Modern paper making requires the production of uniform strong paper sheets at high speed. It has been recognized that subjecting the forming wire of a paper machine to a continuous suction from the time the fibers are initially deposited on the wire until a coherent web is formed greatly speeds up production and at the same time eliminates the necessity for long forming wires since the continuous suction quickly removes water from the fibers deposited on the wire to form a removable web.

We have now provided a novel wet end for a paper making machine of the Fourdrinier type wherein the paper fibers are deposited on a traveling wire as the wire is entrained around a foraminous cylinder the interior of which is maintained under a constant suction and vacuum. A well knit fibrous web is produced at high speed which is so well formed that it may be passed directly to the driers after a very light treatment in the presses. The sheet is sufficiently dry upon leaving the forming wire so that it requires only a brief treatment in the driers and hence speeds the capacity of the drying section.

Besides the demand for increased speed of production modern paper making is demanding an improvement in the quality of paper produced. Careful investigations in the art and extensive practical research in the trade have led up to believe that improved paper can be made without increasing cost only by the utilization of a longer fiber pulp and the formation of this long fiber pulp into better quality paper. The chemistry and mechanics of paper making have provided processes by which longer fiber stock is available at reduced cost. However, the difficulty experienced in the trade has been that the present paper making machine will not form a long fiber into the improved quality sheets which the trade demands except at low speed.

We have found that the use of our novel paper making machine, which combines the advantages of a cylinder machine and of a Fourdrinier type of machine and eliminates the disadvantages of both types, forms webs from long fiber stock to produce high quality sheets. The suction and vacuum formation utilized in our machine in which the fibers are sucked from an aqueous suspension produces a high quality uniform sheet at high speed. The sheet formed is, in fact, entirely novel in structure being free from "hill and valley" and streaked formations and yet being made from long fibered pulp.

It is therefore an object of this invention to provide a high speed paper making machine capable of producing improved quality sheets from long fibered stock.

It is therefore another object of this invention to provide a wet end of a paper making machine wherein pulp fibers are sucked onto a forming wire from an aqueous suspension as the forming wire passes around a foraminous cylinder rotating in a stock vat.

It is another object of this invention to provide a novel wet end of a Fourdrinier type of paper making machine yielding all of the advantages of a cylinder machine and being capable of forming a uniform well knit fibrous web at high speed without the necessity of agitating the forming wire.

It is a specific object of this invention to provide a suction sealing cap over a foraminous web forming cylinder.

It is another object of this invention to provide a novel wet end of a paper making machine wherein pulp fibres held in aqueous suspension in a stock vat are sucked onto a traveling wire passing around a rotating foraminous cylinder the entire interior of which is under constant suction and vacuum because of a super-imposed sealing cap operating at high speed without shaking or agitating the forming wire all under positive control.

Another object of this invention is to provide a process for manufacturing improved quality paper at high speed.

It is another object of this invention to provide a high speed paper making machine capable of producing improved quality paper from long fibered stock.

It is another object of this invention to provide a high speed paper making machine capable of producing any caliper of paper from thinnest commercial tissue to thickest commercial board.

Another object of this invention is to provide a high speed paper making machine capable of

producing improved quality paper of superior strength at lower cost.

Other and further objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a side cross-sectional view of the forming portion of a paper machine embodying the principles of our invention, shown more or less diagrammatically and with parts broken away.

Figure 2 is side elevational view of the stock vat and sealing cap which is shown in section in Fig. 1.

Figure 3 is an enlarged cross-sectional view, with parts in elevation, taken substantially along the line III—III of Fig. 2 showing the manner in which the foraminous cylinder is rotatably sealed at the ends in the stock vat.

Figure 4 is a fragmentary sectional view taken along the line IV—IV of Fig. 3 showing one of the white water suction drains at the bottom of the rotating cylinder.

Figure 5 is a broken sectional view taken along the line V—V of Fig. 1 showing the V-shaped suction boxes and the table rolls in the sealing cap.

Figure 6 is a cross-sectional, more or less diagrammatical view of a machine for making a multi-ply sheet showing three web forming mechanisms according to this invention, each of which cooperates to produce a single layer in the production of a three ply or three layer sheet.

As shown on the drawings:

In Figure 1, the reference numeral 10 indicates a removable forming wire of the Fourdrinier type. The forming wire 10 is entrained around a driven roll 11, guide rollers 12, tension roll 13, partially over a suction cap 14, around the lower portion of a revolving foraminous cylinder 15, up over the sealing cap 14 as shown, over a suction box 16, between a suction press roll 17 and a cooperating couch roll 18 and then onto the usual table rolls and suction boxes 19 and 20 respectively of a Fourdrinier paper machine.

The foraminous cylinder 15 comprises a fine mesh wire 21 sewed onto or otherwise secured to a coarser winding wire 22 (Figs. 3 and 4). The coarse wire 22 is supported by a plurality of forked spiders 23 radially disposed from a hub 24 which is keyed or otherwise secured to a supporting shaft 25 passing through the hub. A plurality of hubs 25 and spiders 23 are positioned at spaced intervals throughout the length of the foraminous cylinder to amply support the same.

The suction cap 14 is disposed around that portion of the rotating cylinder exposed above the paper pulp suspension in which it rotates and extends into the pulp about one to two feet. The cap 14 is provided with a plurality of table rolls 26 and 26*a* to carry the forming wire 10 over several suction boxes 27 and 27*a* also formed in the cap. The suction boxes are preferably V-shaped and suction applied thereto at both ends. A V-shaped suction box 27 is positioned at the point where the forming wire 10 first contacts stock 28 in a vat 33 in which the foraminous cylinder rotates. Another suction box 27*a* is preferably located below the stock level just before the wire contacts the foraminous rotating cylinder 15.

The forming wire upon leaving the vat is directed over an additional set of suction boxes 29, 30 and 31 respectively. Each of the suction boxes may be provided with varying degrees of vacuum at each end from an outside source of they may draw suction through slots in the bottom thereof (not shown) from the interior of the cylinder which is always maintained under vacuum. The suction may be varied if slots are used by regulating the size of the openings therein with slidable covers.

Table rolls 32 are provided in the sealing cap 14 between the suction boxes 29, 30 and 31 to carry the wire 10 over the said boxes and over the top of the sealing cap. From the last table roll 32 the wire 10 which now carries a web 1 is directed over the suction box 16 located between two table rolls 34, to the suction rolls 17 and couch roll 18. The wire 10 is driven by contact with the driven roll 11 and cylinder 15.

Feed boxes 35 and 36 are provided on each side of the vat 33. Said feed boxes are provided with usual vertical baffles 37, 38 and 39, and a horizontal baffle board 9 to effect an even quiet flow of stock into vat 33.

The aqueous suspension of pulp 28 is fed through a pipe 40 having branches 41 and 42 controlled by valves 43 and 44 respectively. The paper stock is fed from pipes 41 and 42 into the feed boxes 35 and 36 around boards 9, passes over baffle plates 37, under the baffle plates 38 and over the last baffles 39 whereupon it is fed to the vat 33 in a constant well-mixed even flow. As the wire contacts the paper stock 28 at the first suction box 27 an initial matrix of fibers is sucked onto the wire. As the forming wire advances on the cap 14 over the table roll 26*a* to the second suction box 27*a*, stock is continually sucked on the wire being greatly aided, of course, by the suction boxes. If desired, additional suction boxes may be provided.

The sealing cap 14 as shown extends below the surface of the stock 28 in the vat 33. As the forming wire 10 advances, leaving the sealing cap and contacting the foraminous cylinder wire 21 additional fibers are sucked onto the wire since, as will hereinafter be described, the interior of the foraminous cylinder is maintained under a constant suction and vacuum and is always drained practically dry so that no quiet water accumulates at the bottom of the interior of the cylinder.

Suction boxes 27, 27*a*, 29, 30 and 31 are integral with the sealing cap. As shown in Figure 5, they are preferably V shaped and drained at both ends by vacuum lines 58 and 63 through branch valved pipes 59, 59*a*, 60, 61 and 62 (see Figure 2). The table rolls 26, 26*a* and 32 are journalled in the sealing cap 14 so that they extend only slightly above the cap to carry the wire. The rolls are boxed or encased in compartments integral with the cap and sealed from the interior thereof so that no suction is lost to the atmosphere.

The web 1 emerging from the forming wire 10 as it passes over the driven roll 11 is entirely self-supporting and needs only a light treatment in the press and drier sections to produce a finished sheet.

The web formed is superior to sheets formed on prior art paper machines. It is well known that shaking in a Fourdrinier machine is necessary to criss-cross, settle and drain the water from the fibers. This causes the larger fibers to settle to the bottom thereby producing a two sided sheet. Agitation also causes streaked and hill and valley formations. Cylinder made paper is more uni-

form but it is well known that this type of paper does not have transverse strength because the fibers flowing onto the cylinder naturally flow "head on" like logs floating down stream. Attempts to prevent this by cross flow vats, agitating devices and the like are not successful because the quiet water in the interior of the cylinder deadens the flow causing a back wash current following the rotation of the cylinder. By forming a fibrous matrix on the wire before contacting the cylinder and by eliminating the quiet water in the cylinder, we produce a closely formed sheet free from streaked and hill and valley formations, light and dark spots; that has increased mullen and tensile strength, is just as strong transversely as it is longitudinally and is free from two sidedness. By our process a longer fibered stock can be used thereby eliminating Jordaning costs.

As best shown in Figures 3 and 4 the rotating foraminous cylinder is provided at its ends with a rigid annular Z shaped ring or chime 45 secured to the end of the inner wire 22. The vat 33 is provided with side walls 46 which form a seal below the stock level for the open ends of the rotating cylinder 15. Said side walls 46 are provided with a semi-annular ring portion 47 of the same diameter as the outside flange 45*a* of the Z shaped ring 45. The ring 47 extends only to the top of wall 46 above the level of the stock 28 in the vat 33. The side walls 46 are provided with openings 48 preferably of an oval shape as shown in Figure 4. The opening 48 extending through the wall 46 is connected with a pipe line 49 to a drain pump. A similar drain opening is provided at the other end of the cylinder to insure thorough draining.

Extending around the flanged portion 45*a* and the ring 47 there is disposed a belt 50 of packing material to seal that portion of the open end of the rotating cylinder which extends below the stock level. The belt 50 is secured to the ring 47 near the top thereof and is tightly drawn against the flanged portion 45*a* of ring 45 below the top of the side wall 46.

The side wall 46 is provided with an integral boss 51 forming a support for the rotating shaft 25 which is freely rotatable therein in bearings. A suction pipe line 52 is connected to the interior of the rotating cylinder through wall 46 and 53. The suction line 52 is connected with the interior of the rotating cylinder above its axis and cooperates with the suction drain pipe line 49 connected with the interior of the rotating cylinder near the bottom thereof to maintain the interior of the cylinder under diminished pressure. The drain pipe line quickly drains off any white water coming through the foraminous wire periphery of the cylinder.

Since the interior of the cylinder is sealed from the stock in the vat at all points except at the foraminous periphery it follows that only the water in which the pulp is suspended and a few of the fibers can pass to the interior. By maintaining the cylinder under continuous suction and vacuum and by maintaining a considerable head of stock in the vat a quick formation of fiber is effected. Because an initial matrix of fiber is made on the forming wire 10 as it passes over the suction boxes 27 and 27*a* before contacting with the foraminous cylinder 15 very small amounts of fiber are able to be sucked into the interior of the rotating cylinder and through the drain line 49. However, any small amount of fibers that are drawn through the drain line 49 are recoverable and may be returned to the system.

The vacuum seal or cap 14 provided with the table rolls and suction boxes as described above extends around the top portion of the rotating cylinder into the suspension of fibrous pulp in the vat 33 for a distance of about one to two feet. Side plates 55 of the sealing cap 14 (see Figure 2) are rigidly secured to the side walls 46 of the vat 33 at their flanged edges 56. The portion of the rotating cylinder above the level of the stock 28 in the vat 33 is thereby sealed from the atmosphere and a continuous vacuum within the entire interior of the rotating cylinder may be maintained.

The vacuum seal or cap is entirely novel with this invention and may be used in other types of cylinder and vat constructions in the paper making industry. The interior of the sealing cap 14 is preferably provided with a shower pipe 57 to wash the foraminous wires on the periphery of the rotating cylinder. An inspection plate 57*a* in air tight relation with the top of the sealing cap 14 is provided above the shower pipe 57.

The suction boxes 27 at the intake side of the sealing cap 14 are connected with a pipe line 58 (Figure 2) through valved pipes 59 and 59*a* to a suction pump (not shown). Likewise suction boxes 29, 30 and 31 at the exit end of the sealing cap are connected through valved pipes 60, 61 and 62 to a pipe line 63 which also connects with the suction pump. Suction boxes 29, 30 and 31 cooperate to hold the web 1 on the wire 10 as it emerges from the stock pond 33. The centrifugal force of the rotating cylinder tends to throw the newly formed web from the wire.

Variable degrees of suction may be maintained in the several suction boxes by manually setting the valves or by setting the slot covers in the bottom of the boxes if this type of box is used.

The forming wire 10 may be readily removed from the cylinder by detaching the sealing cap 14 from the vat 33 and opening the side wall 46 by loosening a hasp 46*a* and swinging the entire wall on hinges 46*b* (Figure 2).

As shown in Figure 6, the formation of a multi-ply sheet according to this invention may be carried out by feeding paper stock of the same or different furnish through pipes 70, 71 and 72 into the usual feed or head boxes 73, 74 and 75 containing the regulation baffles. Stock is fed from the feed boxes 73, 74 and 75 into vats 77, 78 and 79 wherein it assumes a level 76. Foraminous cylinders 80, 81 and 82 each equipped with a sealing cap 83, 84 and 85 rotate in the vats 77, 78 and 79 respectively. Each of the foraminous cylinders and sealing caps attached thereon are operated in the same manner as described above in connection with Figures 1 to 5 inclusive.

A forming wire 86 of the Fourdrinier type is entrained around the sealing cap 83 and rotating cylinder 80 and picks up a fibrous web of stock 87 as it passes through vat 77. The forming wire 86 with the web 87 thereon after emerging from the stock vat 77 is directed between a press roll 88 and a cooperating top roll 89. The forming wire and web separate at a driven roll 90 whereupon the forming wire returns over guide rollers 91 to the sealing cap 83 and rotating cylinder 80. A shower pipe 92 is provided to wash the wire before it returns to the stock vat 77.

The web 87 is directed between a roll 93 (a suction roll may be used if desired) and a cooperating top roll 94 wherein it is superimposed upon a web 87*a* formed on a forming wire 86*a*

in the same manner as the web 87 was formed. A shower pipe 92*a* and guide rollers 91*a* are provided to wash the wire 86*a* and direct it back to the stock vat 78 to receive a new web. The two fibrous webs are directed over a roll 90*a* where the forming wire 86*a* leaves the webs and returns to the stock vat 78. The two-ply web is now directed over a web 87*b* on a forming wire 86*b* which travels around the third rotating cylinder 82 in stock vat 79.

The webs 87, 87*a* and 87*b* on the forming wire 86*b* are directed under a top wire or felt 96 between a suction roll 97 and a cooperating top press roll 98. The three webs which are now between the forming wire 86*b* and the top wire or felt 96 are then directed between several pairs of light press rolls 99, 100, and 101, wherein they are well matted together to form a composite three-ply sheet 102 which is removed from the machine at the suction press roll 103. A top press roll 104 cooperates with the suction press 103. At the press roll end of the machine the forming wire 86*b* leaves the composite web 102 and is directed under a shower pipe 92*b* being directed by rollers 91*b* back to the stock vat and rotating cylinder 82. The top felt 96 is directed over a guide roll 105 under a shower pipe 106 and between a pair of wringer rolls 111 to dry the felt. If a wire is used the wringer rolls may be omitted. A trough or tank 107 is provided beneath the shower pipe 106 to prevent the wash water from flowing down onto the forming wire 86*b* and webs thereon.

Save-all trays or chutes 108, 109, and 110 are positioned beneath forming wires 86, 86*a* and 86*b* to recover any fibers that may be washed from the wire by shower pipes 92, 92*a* and 92*b*.

A collection trough (not shown) is provided to collect the wash water draining from each of the chutes and return it to the system.

From the above description it is apparent that a multi-ply sheet may be readily prepared by utilizing a plurality of the forming wires and rotating foraminous cylinders of this invention in series. While three of such forming wires are disclosed in Figure 6 it should be understood that any number may be used to produce a multi-ply sheet having any desired number of layers or plies. Composite sheets composed of different constituent layers may be prepared by merely furnishing the different stock vats with different types of pulp. The thickness of the constituent layers may be regulated to a nicety by controlled operation of the suction applied to the different forming cylinders and suction boxes in the sealing caps so that multi-ply sheets having a thick center ply and relatively thin outer plies or having a thin inside ply and thicker outer plies may be prepared by merely varying the suction in the different rotating cylinders.

A paper machine made according to our invention may be run at very high speeds compared to the usual type of cylinder machine wherein a pick-up felt removes a fibrous web from the forming cylinder. The rotating foraminous cylinders of our invention are well balanced and run freely in roller or ball bearings. The cylinders may be 8 feet, more or less, in diameter thereby producing 25 more or less feet of paper in one revolution.

Because the fibrous web in our machine is actually sucked on a traveling forming wire of the Fourdrinier type no pick-up felts are needed. The top felt 96 disclosed in Figure 5 may be dispensed with if desired although the utilization of such a felt does not increase cost of production because top felts have a comparatively much longer life than the usual pickup felt.

The elimination of the usual head box, breast roll and shaking mechanisms employed in the Fourdrinier machine totally eliminates the hill and valley and streaked formations in the paper sheets produced on our machine.

From the above description, it is evident that we have made improvements of tremendous importance in paper manufacturing, have provided a novel type of paper machine that is operative at high speed with low cost to produce a uniform quality of novel paper sheets.

We are 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 we, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

We claim as our invention:

1. A sealing cap for a foraminous rotatable cylinder adapted to be partially immersed in a pond of paper stock in a stock vat which comprises an air-tight member disposed around the entire unimmersed part of the cylinder to seal the same from the atmosphere and having side walls secured to the stock vat.

2. A sealing cap for a foraminous cylinder rotating in a pond of paper stock in a stock vat which comprises an air-tight member disposed around the unimmersed part of the periphery of said cylinder to seal the same from the atmosphere, and containing suction boxes integral therewith.

3. A sealing cap for a rotating foraminous cylinder subjected to suction which comprises an air-tight shield disposed around the unimmersed part of the cylinder having side walls secured to a stock vat in which the cylinder rotates and alternately arranged table rolls and suction boxes on the top surface of said shield.

4. A sealing cap for a rotating foraminous cylinder subjected to suction and vacuum which comprises an air tight shield disposed around the unimmersed part of the cylinder having side walls secured to a stock vat in which the cylinder rotates, V-shaped suction boxes integral with said shield disposed near the ends thereof and boxed table rolls arranged between said suction boxes, said rolls being journaled in the side walls of the shield.

5. In a sealing cap for a rotating foraminous cylinder, a plurality of V-shaped suction boxes integral therewith and suction draining means at both ends of each suction box.

6. In a paper machine including a forming wire entrained between a driven roll and a foraminous cylinder which rotates in a stock vat, a cap for sealing the interior of the cylinder from the atmosphere comprising an air tight member secured to the stock vat and disposed around the exterior part of the cylinder.

7. In a de-watering machine including a liquid pervious belt traveling between a driven roll and a vat over a foraminous cylinder rotating therein in a pond of solid materials in liquid suspension, means to provide suction to the entire interior of the cylinder, means to seal the cylinder from the atmosphere and means to quickly and completely drain the interior of the cylinder.

8. In a paper machine including a forming wire traveling between a driven roll and a stock vat

over a foraminous cylinder rotating therein in a pond of stock, means to provide suction to the entire interior of the cylinder, a sealing cap to preserve the suction comprising a semi-cylindrical air-tight member disposed around the upper part of the cylinder and suction drain pipes located near the bottom of the rotating cylinder on each end thereof to remove water from the interior of the cylinder.

9. A paper making machine comprising a stock vat, feed boxes to supply said vat with paper stock, a foraminous cylinder rotating in said vat, a driven roll, a forming wire entrained between said driven roll and said rotating cylinder, suction means to maintain the entire interior of said cylinder under reduced pressure, means to seal that part of the cylinder exposed above the paper stock from the atmosphere, and drain pipes located at each end of the rotating cylinder to quickly drain water from the interior of the cylinder.

10. A de-watering machine comprising a driven roll, a rotating foraminous cylinder, a water pervious belt entrained around said driven roll and cylinder, a vat in which the cylinder rotates, means for feeding an aqueous suspension of solid materials to said vat, a sealing cap disposed around the upper part of the rotating cylinder, suction means for maintaining the entire interior of the cylinder under reduced pressure, and draining means near the bottom of said rotating cylinder to remove substantially all of the water from the interior of the cylinder.

11. A wet end for a paper making machine comprising a stock vat, means for feeding paper stock thereto, a foraminous cylinder mounted in said stock vat, a sealing cap disposed around said foraminous cylinder, means for maintaining the interior of the cylinder under reduced pressure, means for draining the cylinder, suction boxes in said sealing cap, a forming wire, a guide roll for directing said forming wire around part of the sealing cap over the suction boxes, table rolls in said sealing cap to permit the forming wire to advance thereover and additional suction boxes in said sealing cap to extract further quantities of water from the fibrous web formed on the forming wire as it passes through the stock vat.

12. A wet end for a paper machine comprising a stock vat, means for feeding stock thereto in a constant, even flow, a foraminous cylinder rotating in said stock vat, a sealing cap secured to said stock vat and disposed around the top part of the rotating cylinder, suction boxes integral with said sealing cap, a driven roll, a forming wire entrained between said driven roll and rotating cylinder, means for maintaining the entire interior of the rotating cylinder under reduced pressure, means for thoroughly draining the interior of the rotating cylinder, and means for directing the web over the suction boxes in the sealing cap onto the foraminous cylinder.

13. A paper machine including a forming wire traveling between a driven roll and a stock vat over a foraminous cylinder rotatable therein in a pond of stock, means to provide suction to the entire interior of the cylinder, means to drain the cylinder, a sealing cap enclosing said cylinder and extending for a distance into the stock pond, suction boxes in said sealing cap at one end thereof positioned slightly below the level of the pond of stock, means for directing the forming wire over said suction boxes onto the foraminous cylinder, additional suction boxes in said sealing cap over which the wire passes as it leaves the stock vat and table rolls in said sealing cap to guide the forming wire over the suction boxes.

14. A wet end for a paper machine comprising a stock vat, means for feeding paper stock to said vat in a constant even flow, a foraminous cylinder rotating in said vat, a driven roll, a forming wire traveling between said driven roll and stock vat over said foraminous cylinder, a vacuum sealing cap disposed around said rotating cylinder to seal the same from the atmosphere, said cap extending for a distance into the stock pond, suction boxes integral with said sealing cap, individually operated means to supply each suction box with any desired degree of vacuum, table rolls in said sealing cap adjacent said suction boxes, a guide roller to guide the forming wire over the first of said suction boxes in said sealing cap as said wire leaves the stock vat carrying a web of paper thereon.

15. A paper machine for making a multi-ply sheet of paper which comprises a plurality of stock vats, a plurality of web forming means subjected to continuous suction rotating in said stock vats, air tight members sealing said forming means from the atmosphere and means for superimposing the constituent webs from their respective forming wires upon each other and compressing means for forming a single sheet from said webs.

16. A paper machine for making a multi-ply sheet which comprises a plurality of stock vats, means for maintaining paper stock in said vats, rotating cylinders in said vats subjected to continuous suction, sealing means to seal the interior of said cylinders from the atmosphere, a plurality of driven rolls, a plurality of forming wires entrained between their respective driven roll and rotating cylinder, means for superimposing the web formed on the first of said forming wires on the next forming wire and suction press roll means for forming a single sheet from the separately formed webs.

17. The process of making paper which comprises forming a web of paper on a forming wire as the wire advances through a pond of stock over a foraminous cylinder sealed from the atmosphere and having its entire interior subjected to continuous suction while holding the web formation on the wire by means of suction boxes arranged beneath the wire as it leaves the pond of stock.

18. The process of making paper which comprises forming a matrix of fibers on a forming wire as it passes over suction boxes upon entering a pond of stock before contacting a foraminous cylinder, superimposing additional fibers on the initially formed matrix to form a web as said wire passes through the pond of stock on the foraminous cylinder and holding the web formation by means of additional suction boxes as said wire leaves the pond of stock.

19. The process of forming a paper sheet on a forming wire as it passes through a pond of stock while entrained around a foraminous cylinder subjected to continuous suction which comprises sucking an initial matrix of fibers on the wire as it enters the stock before contacting the foraminous cylinder, superimposing additional fibers on said wire under increased differential pressure as it advances over the foraminous cylinder, and extracting water from the web while permitting additional fibers to be deposited

thereon and holding the original web formation as the wire leaves the pond.

20. The process of forming improved uniform paper at high speeds, which comprises initially sucking a matrix of fibers on a forming wire entering a pond of stock, sucking in a distinct operation under increased differential pressure additional fibers from said pond of stock onto the matrix to form a web and holding the web formed on the wire by suction as said wire leaves the stock pond.

21. In a paper making machine including a rotatable foraminous cylinder partly immersed in a pond of stock, an air tight member disposed above and around the unimmersed portion of the cylinder and extending into the stock pond to seal the interior of the cylinder from the atmosphere and side walls on said air tight member secured to the stock vat for sealing the interior of the cylinder from the atmosphere at the ends thereof.

22. The process of forming a fibrous web which comprises advancing a forming wire through a pond of stock around a revolving suction member to apply a constant substantially uninterrupted suction to the wire and web being formed thereon from the point of initial contact of the wire with the revolving member until the wire is removed from said revolving member.

23. The process of forming a fibrous web on a forming wire as it passes through a pond of stock which comprises subjecting said wire and web thereon to the action of a revolving suction member to impart thereto a constant substantially uninterrupted suction during the entire travel of the wire around said revolving member.

24. The process of forming a paper web which comprises sucking stock from a pond onto a wire as the wire advances through the pond entrained around a revolving suction member and supplying auxiliary stock in separately regulated amounts to the fibers already sucked on the wire as said wire emerges from the pond.

25. The process of forming a fibrous web which comprises sucking fibers from their position in aqueous suspension in a pond of stock radially onto a traveling forming wire as said wire advances through the pond around a rotating cylinder while applying a constant substantially uninterrupted suction to the wire and web being formed thereon from the point of initial contact of the wire with the cylinder until the wire is removed from the cylinder.

26. The process of de-liquefying a liquid suspension of solid materials, which comprises advancing a liquid pervious belt through a pond of said suspension around a revolving member to supply a substantially uninterrupted suction to the belt and mat being formed thereon from the point of initial contact of the belt with the revolving member until the belt is removed from the revolving member.

27. The process of de-watering aqueous suspensions of solid materials, which comprises forming a mat on a forming wire as it passes through a pond of said suspension subjected to the action of a revolving suction member to impart to the wire and mat thereon a constant substantially uninterrupted suction during the entire travel of the wire around said revolving suction member.

28. The process of forming a mat of solid materials which comprises sucking solid particles from their position in aqueous suspension in a pond of said suspension radially onto a traveling water pervious belt as said belt advances through the pond around a rotating cylinder while applying a constant substantially untinterrupted suction to the belt and mat being formed thereon from the point of initial contact of the wire with the cylinder until the belt is removed from the cylinder.

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