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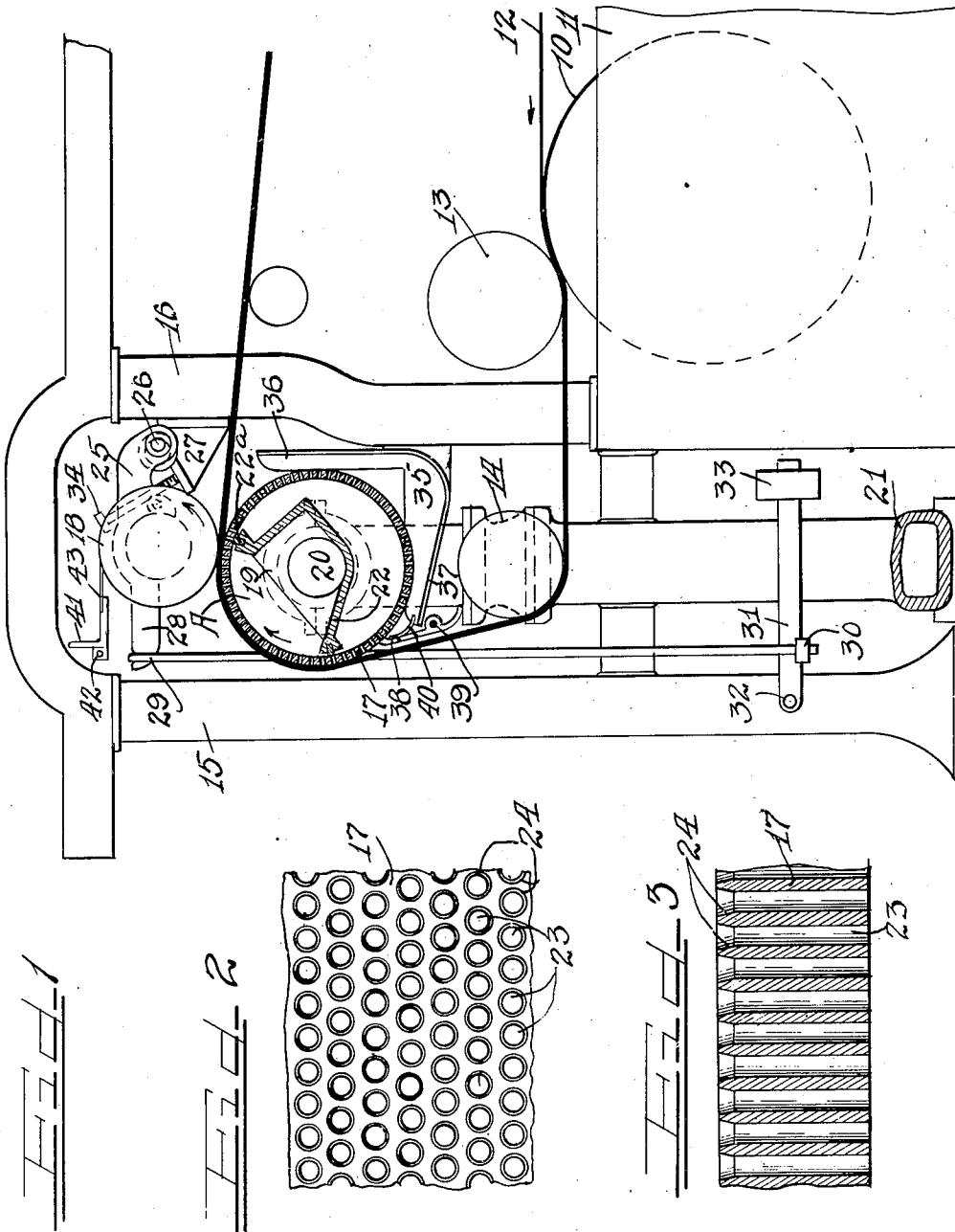
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2,083,817

WATER EXTRACTING DEVICE FOR PAPER MACHINES AND METHOD OF MAKING PAPER

Filed May 3, 1935

2 Sheets-Sheet 1



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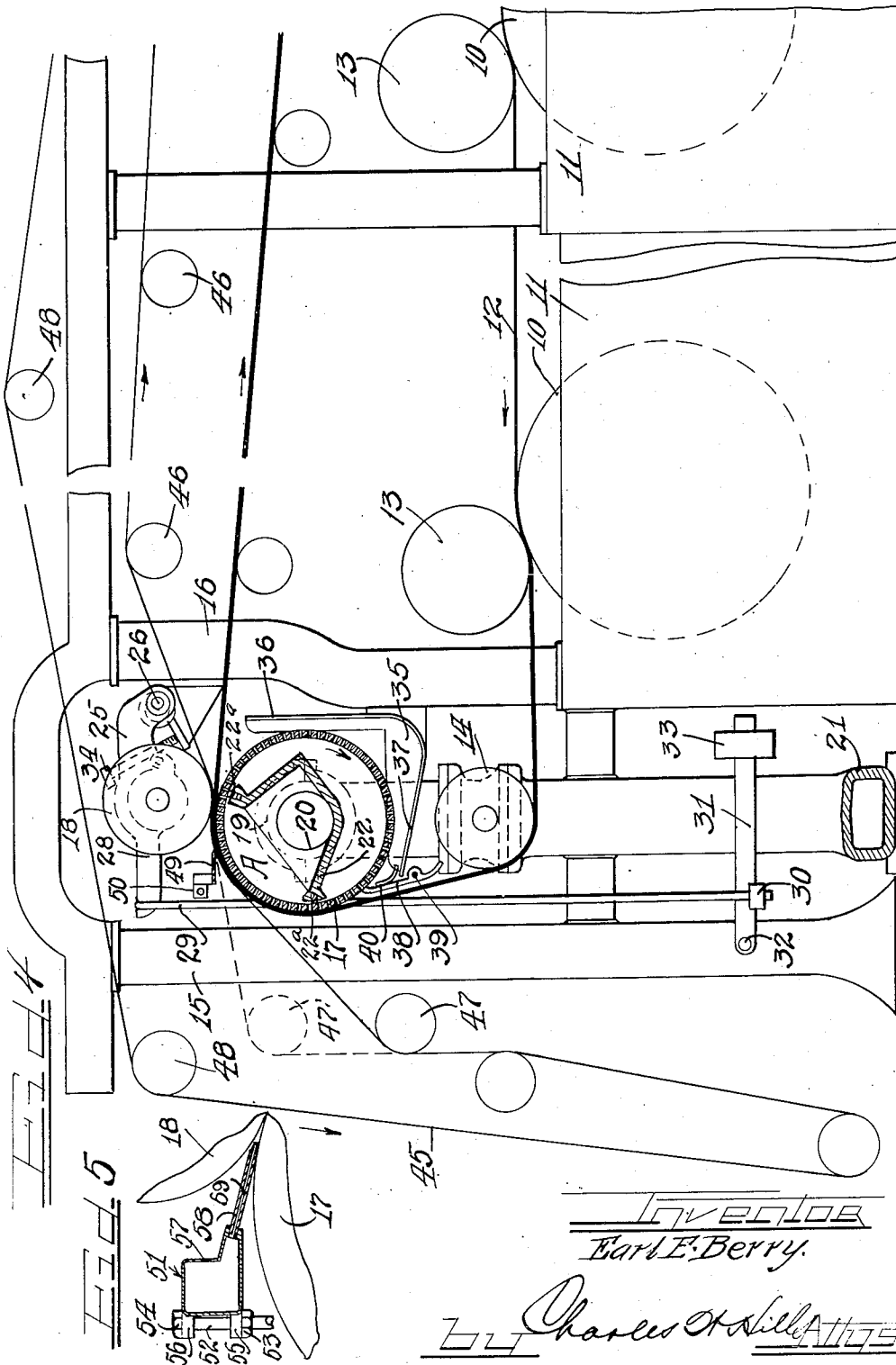
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UNITED STATES PATENT OFFICE

2,083,817

WATER EXTRACTING DEVICE FOR PAPER
MACHINES AND METHOD OF MAKING
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Application May 3, 1935, Serial No. 19,590

9 Claims. (Cl. 92—38)

This invention relates to a water extracting device for receiving the wet web of paper directly from the forming part of a paper machine.

More specifically this invention relates to an improved form of suction and extraction device for removing moisture from paper webs formed on a cylinder machine without the aid of the large number of primary or baby presses heretofore required on cylinder type paper machines. The invention also includes a process for removing water from cylinder formed paper webs.

In the conventional multi-cylinder type of paper machine, the pickup felt is contacted with the top portion of each cylinder mold to thereby remove the wet fibrous web from the revolving cylinder. A built-up fibrous web is thus caused to adhere to the under side of the pickup felt. After leaving the last cylinder mold, the web and felt is trained around a roll positioned at the rear of the machine and travel back over the cylinder molds. During its travel back over the molds, the fibrous web, which is now on the upper surface of the pickup felt is covered with a top felt and pressed while between the two felts by means of primary press rolls arranged in batteries to impart a gradually increasing pressure as the water is removed from the web and felt. It is essential that the primary pressing action be very gentle at first and gradually increased until the web is sufficiently dry so that it can be subjected to high pressures without severe crushing.

The heretofore considered necessary primary press rolls have many disadvantageous features, most objectionable of which may be listed as follows:

- (1) High initial expense to purchase and install required number of rolls.
- (2) High maintenance cost in keeping the rolls ground and in replacing worn rubber covers for some of the rolls.
- (3) High operating cost for power required to drive the required large number of rolls.
- (4) Complicated drive mechanism required to synchronize and drive the sets or batteries of rolls.
- (5) Passage of wet web through the large number of nips between the rolls tends to distort and spoil the fiber formation of the web.
- (6) Air often enters between the web and felts and punctures or "blows" the web during the pressing operation between the rolls.
- (7) Multi-ply webs often separate at the plies as they pass between the nips of the rolls be-

cause the web has to conform with the radius of the rolls.

I have now provided a water extracting device to replace the primary press rolls in cylinder type paper machines. My device removes large amounts of the water from the cylinder formed web by suction and thereafter presses the web against the suction device itself to remove further quantities of water so that the web may be subjected to high pressures without damage or may be directly passed to the driers.

In accordance with my invention, I provide a suction roll with small holes drilled through its periphery and spaced as close together as possible. The holes are so shaped and spaced, as will be hereinafter described, to reduce the resistance of entering air and water as much as possible. The suction roll is provided with the usual type of floating head suction manifold but is arranged so as to have a relatively wide suction area. A press roll is mounted above the suction roll so that the nip between the rolls occurs either inside the suction area or just at, or beyond the end of the suction area, as defined by the suction manifold within the perforated drum.

This combination suction drum and press roll is mounted after the last cylinder mold on the cylinder type paper machine and the pickup felt is trained around the suction roll and passes between the nip of the press roll and suction roll. Thus the web carried by the felt is first subjected to a relatively high degree of suction, whereby large amounts of water are removed from the webs through the felt and from the felt itself. The web and felt are then subjected to pressure between the press roll and suction roll to remove further quantities of water and sufficiently form the web so that it may be passed directly to heavy duty presses or to the drying cylinders. Since the felt is somewhat dried by the preceding suction treatment, it absorbs water which has been liberated from the web by pressure at the nip of the rolls, and thereby aids the drying of the web.

The suction roll must be provided with small diameter holes so that the web and felt are not sucked or pressed into the holes and thus damaged. The entry of the web and felt into the holes would also space the web and felt somewhat from the top press roll and thereby make the application of pressure less effective.

In my copending application entitled "Cylinder paper machine and method of making paper", Serial No. 19,591, filed of even date here-

with, 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 according to this invention and immediately thereafter transfers the so formed fibrous web to another felt or carrier before the web can reabsorb moisture from the pick-up felt.

10 In my copending application entitled "Cylinder paper machine and process of making paper", Serial No. 26,181, filed June 12, 1935, I have described and claimed a cylinder type of paper making machine having the pick-up felt traveling over the cylinder molds to remove the fibrous mats therefrom and carry the mats through a water extracting device according to this invention to form a fibrous web therefrom. The direction of travel of the web is reversed after passage through the water extracting device and the web is carried by another felt or carrier with the pick-up felt side of the web exposed.

It is therefore an object of this invention to provide a water removing device for cylinder formed webs which dispenses with the heretofore necessary primary presses, extractor rolls and the like, normally used on this type of paper machines.

Another object of this invention is to provide a water extracting device including a suction drum and co-operating press roll for removing water from the pickup felt and fibrous web formed on cylinder type paper machines.

A further object of this invention is to provide a suction roll with holes of a sufficiently small size and so closely spaced that a cylinder formed fibrous web may be subjected thereon, without damage, to suction of a high degree.

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

A further object of this invention is to provide a process for removing water from newly formed wet fibrous webs by suction and subsequent pressure on the suction device.

Other and further objects of this invention will be apparent from the following detailed description of the annexed sheets of drawings which disclose a preferred embodiment of the invention.

On the drawings:

Figure 1 is a fragmentary elevational view with parts in vertical cross section of a cylinder type paper machine showing the last cylinder mold and the water removing device of this invention.

Figure 2 is an enlarged plan view of the outside periphery of the suction roll drum used in this invention illustrating the manner in which the roll is perforated.

Figure 3 is a vertical cross sectional view of the suction roll drum showing the holes drilled therethrough.

Figure 4 is a broken elevational view with parts in vertical cross section of an alternative form of cylinder type paper machine embodying the water removing device of this invention and illustrating the manner in which a top felt may be used on the machine if desired.

Figure 5 is an enlarged fragmentary cross sectional view of a suction slice.

As shown on the drawings:

In Figures 1 and 4, the reference numeral 10 designates cylinder molds of the conventional type rotating in vats 11 containing the paper

stock. A pickup felt 12 is directed over the top of the cylinder molds 10 and is pressed against the periphery of the cylinder molds by coucher rolls 13 of the conventional type. The fibrous web formed on the cylinder molds 10 is thus transferred to the pickup felt 12 which travels toward the rear of the machine as indicated and around a roll 14.

The water extracting device of this invention is mounted above the roll 14 between the vertical legs 15 and 16 of a frame structure. The water removing device comprises a suction roll 17 and a co-operating press roll 18. The suction roll 17 is mounted at its ends in bearings 19 and is connected through a hollow trunnion 20 located in one or both ends of the roll to a drain pipe 21 which is connected with a suction pump (not shown). A suction box 22 is mounted within the roll 17 and carried by the trunnion 20. The suction box 22 is provided with a floating head 22a which rubs or bears against the inner periphery of this roll to define a suction area indicated generally at A. The suction roll may be of any suitable construction known to the art such as the roll described in my United States Patent No. 1,679,598. However, in the present installation, the floating head 22a defines a larger suction area than is customary in suction rolls. Furthermore, the holes 23 (Figs. 2 and 3) drilled through the roll 17 are of smaller diameter and are spaced closer together than in the customary suction roll. The holes 23 are countersunk for about an eighth of an inch as shown at 24. Whereas the holes of the customary suction roll average about $\frac{1}{8}$ of an inch in diameter and are countersunk on the surface to provide openings of $\frac{1}{2}$ inch to $\frac{3}{8}$ inch in diameter, the holes of the suction roll used in this invention are reduced to a diameter of about $\frac{3}{16}$ to $\frac{1}{4}$ inch with the largest diameter of the countersunk portion being about $\frac{1}{8}$ to $\frac{1}{4}$ inch. The holes are arranged so as to provide a minimum of solid surface on the roll. Because the holes are small and are close together, the countersinks 24 can be very gradual to eliminate the vortex draining effect produced by larger holes, spaced further apart and provided with flat countersinks to reduce the "land" area between the holes which reduces the resistance to drainage.

As shown in Fig. 2, the holes are arranged in horizontal rows extending axially across the roll and the rows are staggered so that the center of a hole in one row is positioned at a point mid-way between the holes in an adjacent row.

When holes having a diameter of $\frac{3}{16}$ inch are drilled in the suction drum, the centers of the holes in each row are spaced about .28 inch apart while the centers of the adjacent rows are spaced about .254 inch apart. The tops of the holes are then countersunk to have a surface diameter of about $\frac{1}{8}$ inch. This arrangement leaves a minimum of solid metal between each hole and at the same time provides a rigid structure. In this manner, all portions of the pickup felt and fibrous web passing over the suction area of the suction roll are subjected to suction. At the same time, the holes are of comparatively small diameter and the felt and web are not pressed away from the top press roll or damaged by being sucked into these holes.

If desired the suction roll 17 may be covered with a resilient covering or cushion which is perforated in the manner described and claimed in my United States Patent No. 1,947,636.

The press roll 18 is mounted above the suction roll 17 in horizontal bearing brackets 25 eccentrically pivoted at 26 on a supporting angle 27 carried by the vertical legs 16 of the frame structure. The roll 18 is thus adjustable horizontally relative to the suction roll 17 by a rotation of the eccentric pivot 26. The brackets 25 have an extending arm portion 28 thereon for receiving a link rod 29 which extends vertically toward the bottom of the machine and is secured at 30 to a horizontal arm 31 pivoted at 32 to the vertical leg 15 of the frame structure. The lever arm 31 may have weights 33 mounted thereon for holding the press roll 18 against the suction roll 17 with any desired pressure which may be regulated by a movement and/or replacement of the weight 33. It is obvious that other pressure adjusting devices may be used in place of the link arm arrangement shown.

For raising the roll 18, a device 34 is provided comprising bolts screwed through the bracket arms 25 and adapted to engage the supporting angle 27 as shown.

A save-all tray 35 is mounted around the lower portion of the suction roll 17 and is adapted to receive water removed from the web and felt by the pressing operation. This save-all tray is preferably V-shaped as shown having a vertical leg 36 extending behind the suction roll 17 and a horizontal leg 37 below the suction roll. Adjacent the end of the leg 37 is mounted a wiping device 38 adapted to scrape against the periphery of the suction roll. The wiping device 38 is pivoted at 39 and may be urged against the roll 17 by any suitable counterbalance or spring means. A thin metal strip 40 is carried by the wiping member 38 to direct any of the water removed from the periphery of the suction roll into the save-all tray 35.

An angle member 41 is mounted on journals 42 adjacent the top of the press roll 18. The horizontal leg of the angle 41 carries a flexible rubber or composition strip 43 which rests on top of the press roll to rub off any water carried by the roll. The angle 41 and the rubber strip 43 extend across the width of the roll 18 so that any water scraped therefrom may drop into the save-all tray 35, which also extends beyond the length of the suction roll 17.

In the arrangement shown in Figure 1, the water removing device is operated without the use of a top press felt. In Figure 4, however, a top press felt 45 is directed over the suction roll 17 and travels with the pickup felt 12 and fibrous web thereon between the nip of the suction and press rolls. It is then directed away from the fibrous web carried by the pickup felt 12 and over guide rolls 46. The top felt 45 may be guided by means of an adjustable guide roll 47 to meet the pickup felt and fibrous web thereon at varying points on the suction roll and vary the amount of wrap of this felt around the roll. Thus if the pickup felt follows the path indicated in solid line it contacts the fibrous web on the pickup felt 12 at a point about midway between the ends of the suction zone A. However, if the felt guide roll 47 is raised to the position indicated in dotted line the top felt 45 merely contacts the fibrous web on the pickup felt 12 at the top portion of the roll and travels with the web through the nip between the rolls.

It is desirable to vary the amount of wrap of the top felt around the suction roll depending upon the weight and porosity of the paper being produced. When light weight papers are run

over the suction area, the amount of wrap of the top felt around the suction roll should be increased to cover all or most of the suction area to seal the same, thereby permitting the pulling of a higher vacuum on the sheet to more thoroughly dry the sheet. When heavier and less porous papers are run over the suction area, however, the amount of wrap of the top felt may be reduced. The top felt therefore protects the exposed surface of the fibrous web on the pickup felt during the pressing operation and acts as a seal to prevent loss of suction. On the return run, the top felt 45 is guided over the machine by means of guide rolls 48.

Since water is pressed up through the top felt as it passes through the nip between the rolls, a resilient plain slice 49 may be positioned above the suction roll 17 to wipe against the felt 45. The plain slice 49 extends across the width of the felt and prevents the water from running back on the felt and being reabsorbed by the sheet. It directs this water over the edges of the felt and roll 17 so that the water drops into the save-all tray 35. The plain slice 49 may be carried by suitable journals 50 mounted at its ends in the frame structure.

A suction slice 51 (Figure 5) may be used in place of the plain slice 49. This slice 51 is vertically adjustable at each end on supports 52 by means of nuts 53 and 54 threaded on the supports 52 and engaging lugs 55 and 56 respectively extending from the suction manifold 57 of the slice. The supports 52 extend through the lugs 55 and 56 and are carried by the frame structure of the machine. A lip 58, having a passageway 59, or a plurality of such passageways extending therethrough is mounted at one end in the manifold 57, as shown, and projects into the space between the press roll 18 and the suction drum 17. This lip 58, like the plain slice 49, extends across the width of the top felt 45 but instead of merely directing the water on the top felt over the edges of the felt it draws the water through the passageways therein into the suction manifold 57. The manifold 57 is connected at one or both ends with a suction drain line (not shown).

From the above description, it will be understood that I have now provided a combination suction and press device for removing water from cylinder formed fibrous webs without crushing or distorting the web so that a sheet of maximum strength per unit weight is obtained. The small holes in the suction roll permit pressure to be exerted on the web as it passes over the roll for the removal of further quantities of water without damaging the web or felt. These small holes also prevent the web and felt from being drawn away from the top roll. The combination suction and press rolls therefore sufficiently remove the water from the wet web without damage and without the use of the large number of extractor rolls, primary press rolls and the like water removing means used heretofore.

The wet web emerging from the last cylinder mold of a cylinder type paper machine generally contains about 88% by weight of water, while the pickup felt may contain even higher amounts depending upon the pressure exerted by the coucher rolls. The suction roll part of this invention before the nip of the press part reduces the water content of the web about 10% to about 78% water. The pressure roll then squeezes out further quantities of water drying the web to

about 70% water or less depending upon the pressure exerted. The web is thus sufficiently dried and formed to be passed directly to the heavy duty presses or to the driers.

5 The suction roll as shown on the drawings has a very wide suction area defined by a floating head on the suction box. This construction makes it possible to pull a vacuum of 12 inches of mercury or more without deflecting the roll or locking the suction box against the roll. The high vacuum combined with the large suction area makes possible a very large extraction of water before the pressing operation.

15 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.

20 I claim as my invention:

1. In a cylinder type paper machine, in combination, a plurality of cylinder molds, a plurality of couch rolls cooperating with said cylinder molds, a pickup felt cooperating with said cylinder molds and couch rolls to receive the fibrous webs formed on the cylinder molds, a suction roll positioned after the last cylinder mold, a relatively wide floating head in said suction roll to define a wide suction area on the periphery of said roll, means for guiding said pickup felt with the fibrous web thereon over the suction area of the suction roll, said suction roll being perforated with closely spaced holes of small diameter so that the web and pickup felt will not be deformed as they pass over the suction area, a press roll above said suction roll, means for urging said press roll against the web on the pickup felt at a point on the suction roll near the end of the suction area thereof, means for adjusting the horizontal position of said press roll relative to said suction roll, means for adjusting the pressure between the rolls, a water collecting trough around the lower portion of said suction roll, an apron member extending axially across said press roll and beyond the ends of the press roll for removing water from the press roll and directing the same into the trough, a wiper device urged against the bottom of said suction roll for removing water therefrom and means associated with said wiper device for directing the water removed thereby into the trough.

55 2. The process of extracting water from wet fibrous webs just subsequent to their formation on a cylinder paper machine which comprises conveying a pick up felt carrying the newly formed wet web removed thereon directly from the cylinders away from the cylinders, wrapping the felt and web around the suction area of a suction roll, wrapping a top felt around the suction area of the roll to cover the wet web thereon, sucking water from the web and pick up felt as they pass over the suction area, and squeezing additional amounts of water therefrom.

70 3. In a cylinder paper machine including cylinder molds and a pick up felt for receiving a wet fibrous web therefrom, a suction drum located after the last cylinder mold in spaced relation therefrom, a press roll urged thereagainst, means for directing the pick up felt and web around said drum and between the nip of the roll and drum, a top felt and an adjustable top felt guide roll to wrap the top felt over the web around the

drum for a predetermined amount of travel thereover.

4. The process of extracting water from the wet, soggy, cylinder-formed fibrous mats removed from the cylinder molds on a pick-up felt which comprises conveying the mat on the felt away from the cylinder molds, wrapping the felt with the mat thereon around the suction area of a suction roll to remove water from the mat by suction, contacting the mat with a top felt, and pressing the two felts together with the mat therebetween to remove more water therefrom and thereby form a self-supporting fibrous web from the mat.

5. In a cylinder type paper making machine, a pick-up felt for directly receiving the wet, soggy, fibrous mats from the cylinder molds, a directing roll positioned after the last cylinder mold for receiving the pick-up felt therearound, a water extracting device above the directing roll for receiving thereover the mats and felt from the directing roll, a top felt for covering said mats on the pick-up felt as they pass over the water extracting device, and means for pressing the top felt and the pick-up felt together with the mats therebetween.

6. The process of removing water from the wet, soggy mats picked up by a felt from the cylinder molds of a cylinder type paper machine which comprises training the pick-up felt with the mats thereunder around a guide roll positioned after the last cylinder mold, directing the pick-up felt upwardly from the guide roll around a suction drum, covering the fibrous mats with a top felt as they pass around the suction drum, and extracting water from the fibrous mats through the pick-up felt by suction to form a fibrous web from the mats.

7. The process of extracting water from wet fibrous webs just subsequent to their formation on a paper machine which comprises picking up the wet fibrous web on a pick-up felt directly from the forming surface of the paper machine, conveying the web on the felt away from the forming surface, wrapping said pick-up felt with the web thereon around the suction area of a suction roll, wrapping a top felt around part of the suction roll to cover the wet web thereon, sucking water from the web and pick-up felt as they pass over the suction area of the roll, and squeezing additional amounts of water therefrom.

8. In a paper machine, a fibrous web forming part, a pick-up felt for receiving a wet fibrous web therefrom, a suction drum located after the fibrous web forming part of the machine, a press roll urged against said suction roll, means for directing the pick-up felt and web around said drum and between the nip of the roll and drum, a top felt for covering said web, and an adjustable top felt guide roll to wrap the top felt over the web around the drum for a predetermined amount of travel thereover.

9. In a paper machine having a fibrous web forming surface, a pick-up felt for receiving a wet, soggy web from the forming surface, a suction roll spaced from said forming surface, said suction roll having a wide suction head therein for defining a large suction area on the periphery of the roll, means for training the felt with the web thereon over said suction area, said suction roll being perforated with closely spaced holes of small diameter so that the web and pick-up felt will not be deformed as they

pass over the suction area, a press roll above
said suction roll, means for urging the press roll
against the web on the pick-up felt at a point
on the suction roll, means for adjusting the po-
5 sition of said press roll relative to the suction roll
to change the position of the nip between the

rolls relative to the suction area, means for ad-
justing the pressure between the rolls, and a
wiper device urged against the periphery of the
suction roll ahead of the suction area to remove
water therefrom.

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