

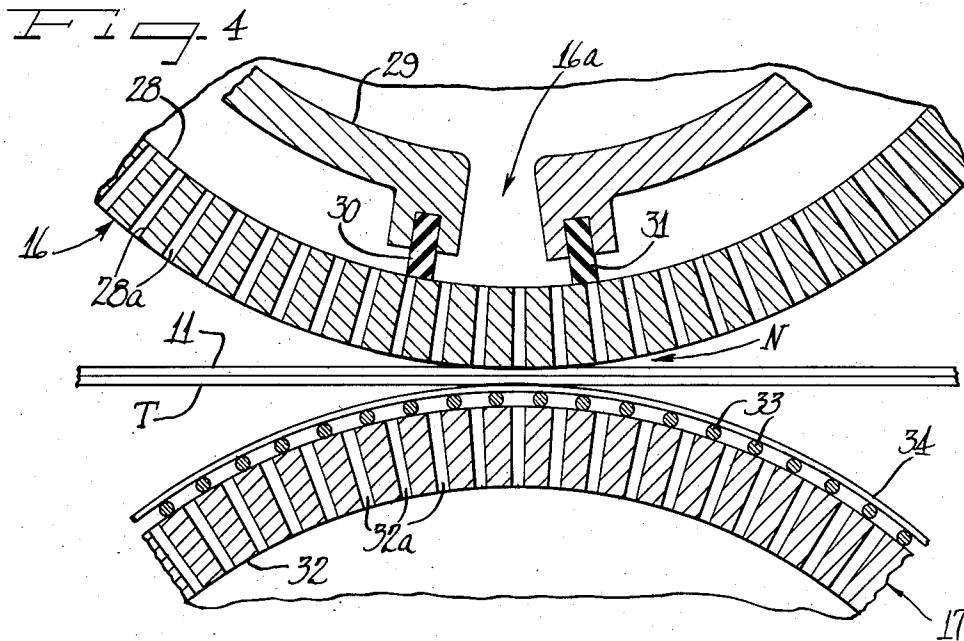
May 26, 1959

L. HORNOSTEL
SUCTION PRESS ASSEMBLY UTILIZING A PRESS
ROLL HAVING A WIRE MESH PERIPHERY

2,888,074

Filed Oct. 11, 1954

3 Sheets-Sheet 2



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FIG. 6

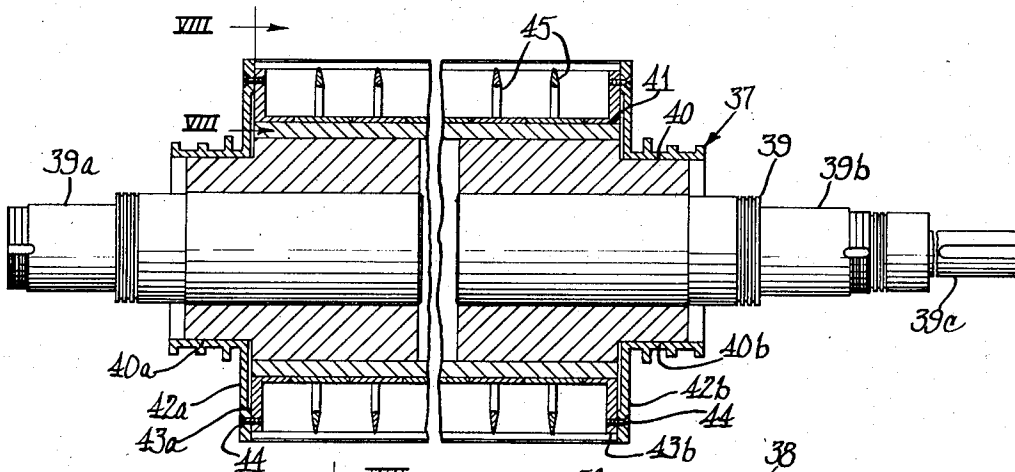


FIG. 7

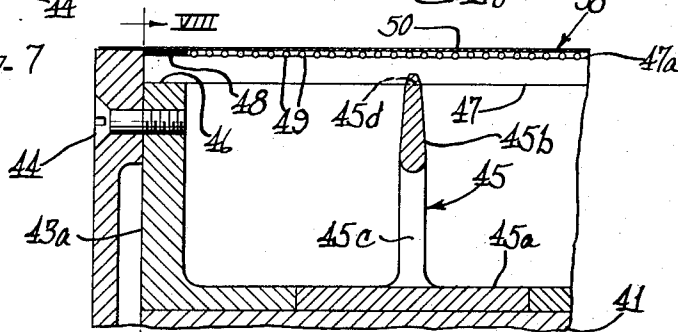
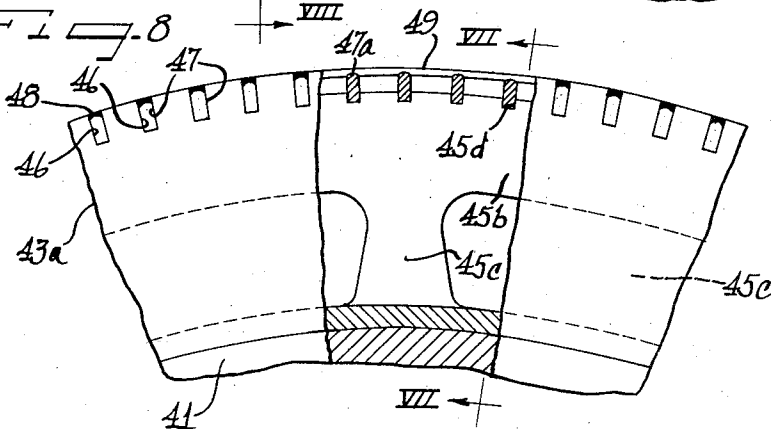


FIG. 8



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SUCTION PRESS ASSEMBLY UTILIZING A PRESS ROLL HAVING A WIRE MESH PERIPHERY

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2 Claims. (Cl. 162—306)

This invention relates to paper machines, and more particularly, to an improved press section for a paper machine, and an improved dewatering method.

As is well known, in the making of paper using the typical Fourdrinier type paper machine, the wet web is taken from the Fourdrinier machine forming wire and passed through a press section involving one or more presses wherein the water is squeezed out of the web. Also, such presses comprise press rolls in nip defining relationship wherein one such press roll may be a suction roll having an appropriately positioned suction gland to draw water out of the web by suction forces while at the same time pressing the web to squeeze water therefrom. In general, the suction area of a suction press roll is covered with a felt which separates the paper web from the perforate suction press roll shell and permits the drawing of water and/or air through the web and felt. Most plain rolls or plain surfaced rolls have a tendency to retain the web on the surface thereof at the exit of a press nip; and in a press defined by a plain roll and a felt covered suction roll the tendency is for the paper to adhere to the plain roll. This may not be desirable in certain cases using extremely thin webs, because such webs must ordinarily be supported by a felt at all times.

It has also been found desirable in the de-watering of wet webs to cause the traveling web to be separated from the felt lapping a suction area on both the on-coming and off-going sides of the press nip so that air may be drawn through the web alone by the suction gland on both the on-coming and off-going sides of the press nip, thereby effecting superior de-watering of the web at the nip. This, also, is not desirable with extremely light weight webs, because such webs must necessarily be supported on a felt at all times in the press section.

This invention relates to a press arrangement for very thin webs or tissues, whereby superior drying may be obtained. Such webs or tissues often are too delicate to be removed from a carrier felt during travel through the press section. Also, the use of felts on both sides of the tissue at a press nip materially reduces the de-watering effect thereat. In the instant invention, however, the tissue is carried on a felt which laps a suction roll and the second press roll, defining a press nip with the suction roll, is a wire mesh covered press roll which actually permits drawing of air through the wire mesh and then through the tissue and felt covering the suction gland. The open wire mesh will not cause adherence between the tissue and the press roll covered by such mesh and the tissue will thus continue to travel on the felt. Also, the combination of the very thin tissue plus the perforate wire mesh covered roll surface permits a substantial amount of suction de-watering to take place at the suction gland.

It is, therefore, an important object of the instant invention to provide an improved paper machine press section, and more particularly, an improved press sec-

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tion arrangement for light weight webs and tissues and an improved method for de-watering such webs.

It is a further object of the instant invention to provide an improved press section comprising a felt covered suction roll and a wire mesh covered press roll in press defining relation with the suction roll.

Other objects, features and advantages of the present invention will become apparent to those skilled in the art from the following detailed disclosure thereof and the drawings which show preferred embodiments hereof.

On the drawings:

Figure 1 is essentially a diagrammatic view showing a press section embodying the instant invention;

Figure 2 is another essentially diagrammatic view showing a different press section embodying the instant invention;

Figure 3 is an enlarged fragmentary top plan view of a wire mesh covered imperforate press roll shell used in the instant invention;

Figure 4 is a sectional elevational fragmentary view of a press, nip embodying the instant invention, using a wire mesh covered perforate press roll shell;

Figure 5 is a side elevational view of the wire mesh covered imperforate roll shell;

Figure 6 is a sectional elevational view of another wire mesh covered roll structure used in the present invention;

Figure 7 is an enlarged sectional elevational detail view of a portion of the roll of Figure 6 taken substantially along the line VII—VII of Figure 8; and

Figure 8 is an enlarged sectional elevational detail view of a portion of the roll of Figure 6 taken substantially along the line VIII—VIII of Figures 6 or 7, with parts broken away.

As shown on the drawings:

In Figure 1, the press section indicated generally by the reference numeral 10 includes a looped felt 11, a suction pick up roll 12 within the loop of felt 11 having a suction area 12a covered by the felt 11 and urging the felt 11 against a travelling surface which in this case is a forming wire W. The forming wire W passes over a bottom suction couch roll 13 with a suction area at 13a covered by the wire W, between the bottom suction couch roll 13 and a top couch roll 14 through a downwardly inclined reach W', around the turning roll 15 and back as the arrow indicates. The felt 11 urged by the suction pick up roll 12 picks the web or tissue T from the surface of the wire W' and carries the tissue T away from the wire W' on the under side of the felt 11. A suction press roll 16 is also positioned within the loop of the felt 11 and above the felt 11. Beneath the felt 11 is a wire mesh covered perforate press roll shell 17 suitably mounted for rotation and in press nip defining relation with the suction roll 16. The details of the wire mesh covered roll shell 17 will be described hereinafter. The suction press roll 16 has a suction gland 16a therein which straddles the press nip N and which is covered by the felt 11 at the nip N. The tissue on the bottom side of the felt 11 passes through the nip N and is not caused to adhere to the roll 17, because of the wire mesh covering thereon. Instead, the tissue remains on the under side of the felt 11 as the felt continues past the guide roll 18 and around a second suction roll 19 cooperating with a Yankee drier 20 to define a drier press nip D. The second suction roll 19 has a suction area 19a which straddles the drier press nip D, and it will be noted that the tissue T is transferred to the surface of the drier drum 20 at the drier nip D and the tissue T is pressed against the drier surface so as to effect initial smoothing of the tissue (if such may be necessary as a result of passing over the wire mesh covered roll 17).

As will be appreciated, the arrangement in Figure 1

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permits extremely effective de-watering of the tissue T at the press nip N, without causing the tissue to adhere to a roll which is not felt covered and without the necessity of employing felt coverings for both rolls. Because the tissue T is extremely thin little or no actual crushing of the web will take place (as might be the case in a thick web) and any relatively minor deformations which take place would be more in the nature of wrinkling than crushing and such wrinkling can be readily smoothed out on the drier surface. A relatively heavy sheet in place of the tissue T would not permit an appreciable (or at least not an extremely effective) amount of air to be pulled through both the web and the felt 11 for de-watering purposes, whereas the light weight tissue T (which may be marketed as facial tissue, for example) is relatively "open" and draw through of air can be readily accomplished. In this respect, the draw through of air is almost as effective as that obtained when heavier webs are actually separated from the felt just before and just after the press nip so that the suction gland can draw air through the felt alone.

In Figure 2, a combined couch and turning roll 21 carries a forming wire FW with a light weight web T' thereon. In this case the web T' is somewhat heavier than the tissue T of Figure 1 and it is capable of at least a short amount of unsupported travel as the tissue T' separates from the forming wire FW, passes underneath an initial guide roll 22 and is brought to rest on a traveling looped felt 23 which is guided by guide rolls 24 and 25 and which has within its loop a suction press roll 26. The felt 23 supports the tissue T' from beneath and carries the tissue through a press nip NN defined by the suction press roll 26 and a wire mesh covered perforate press roll shell 27 suitably mounted for rotation in press nip defining relation with suction roll 26. The felt 23 covers a suction area 26a straddling the press nip NN, but no felt is trained about the wire mesh covered roll 27. The advantage here obtained, among others of importance, is that a plain top press roll in place of the roll 27 would have a tendency to cause light weight webs such as the web T' to adhere thereto and would thus tend to alter the intended travel course for the light weight web T'. Heavier, more sturdy webs are less inclined to be altered in course by a plain press roll, since the weight of such webs plus their general resistance to turning or bending tends to overcome the inherent adherence between a plain roll and a paper web. Also, improved suction de-watering may be obtained because air can be drawn through the perforate press roll shell 27 (which ordinarily would be covered with a felt in the absence of the wire mesh).

Referring now to Figures 3 and 4 which show additional details of the structures here involved, it will be seen that the suction press roll structure of the roll 16 shown fragmentarily in Figure 4 is a standard suction press roll structure. This structure involves a perforate rotatable press roll shell 28 having a plurality of drilled perforations 28a therein and having sufficient thickness to withstand the pressures developed at the press nip N. The suction area 16a is defined by an interiorly positioned suction gland 29 (which will be connected through the shell trunnion to a suitable vacuum pump), which mounts peripherally spaced axially aligned sealing strips 30 and 31 which extend from the gland 29 to the interior surface of the rotary shell 28 for sealing engagement therewith. The felt 11 running in a generally horizontal direction serves to substantially cover the suction area 16a (or the outer peripheral portion of the shell 28 aligned with the suction area 16a), so that air entering the suction area 16a must pass substantially entirely through the felt 11. As here shown, the felt 11 is crushed appreciably at the nip N, but the relatively thin tissue T does not have sufficient thickness to undergo appreciable crushing other than that which takes

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place in the removal of the water retained in the tissue.

The wire mesh covered perforate press roll shell 17 also comprises the usual sturdy perforate press roll shell structure 32 which is comparable in structure and strength to the press roll shell 28. The shell 32 furnishes the principal support for the wire mesh and actually provides the structure for the roll 17 to function as a press roll for accomplishing pressing and de-watering of the tissue T. The perforations 32a in the roll shell 32 are also drilled and this shell is made of suitably sturdy material such as bronze or other metal. The roll shell 32 has a plurality of rigid axially extending peripherally spaced supports 33 which effectively carry the wire mesh covering 34 on the press roll shell 32. The supports 33 are preferably in the form of metal rods extending the full axial length of the shell 32 and having diameters of from about 1 to 2 times the diameters of the perforations 32a. The rods 33 are positioned generally intermediate the perforations 32a and their diameters are such as to effectively space the wire mesh 34 a sufficient distance away from the openings of the perforations 32a to permit adequate free flow of air through the entire peripheral structure of the roll 17. The rods 33 may be secured to the shell 32 by any suitable means, such as welding.

The wire mesh 34 which is secured to the outer surfaces of the rods 33 may, of course, have a number of different configurations or designs. Although a plain wire screen could be used, if the rods 33 are positioned very closely together and the screen has sufficient strength to resist crushing at its unsupported areas, it has been found preferable to employ spirally or helically wound wire or tape having greater strength than the individual fine wires ordinarily incorporated in the screen. In other words, the wire should have a cross sectional dimension of from about one-quarter to about one-tenth the cross sectional area of the shell perforations (and a tape should have a cross section corresponding thereto). As shown in Figure 3, the rods 33 and perforations 32a have approximately the same diameter and the wires or loops of helically wound wire 34a individually have diameters of approximately one-quarter of the perforation diameters and the wires 34a are axially spaced approximately a distance equal to a perforation diameter, whereas the rods 33 are spaced approximately twice the perforation diameter. The helically wound wires 34a, or any other form of wire mesh 34, which may be secured to and firmly supported by the rods 33 is preferably affixed thereto by welding or soldering adequate and ready communication between the underside of the mesh covering and the ambient atmosphere is thus provided.

An important aspect of the instant invention resides in the provision of a wire mesh covered roll 17 or 27 which has sufficient strength to define a press nip with a suction roll, and which also is capable of permitting fluid permeation radially outwardly through the mesh. In the embodiment of the roll 17 just described, the over all press nip defining strength is provided by the perforate rotatable shell and the wire mesh covering therefore is relatively closely spaced from the outer periphery of the shell 32 so as to obtain full benefit of the strength of the shell. The perforations 32a in the shell cooperate with the wire mesh covering (effected by the cooperation between the rods 33 and the wire 34) to permit the necessary amount of fluid permeation here contemplated and to avoid blocking off of the flow of air in a generally peripheral direction with respect to the roll. In other words, the roll 17 must have structure which permits free ingress or egress of air throughout the entire periphery of the roll and also which permits ingress of air at one point in the periphery and movement of the air within the periphery to another point spaced from the first. In this way air may enter the roll 17 at substantially all points along the periphery

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thereof except at the press nip, whereat air is drawn outwardly through the wire mesh, through the paper web and the felt and finally through the suction periphery and into the suction gland therein. In the embodiment of the roll 17 shown in Figures 3 to 5, substantially all of the movement of air from one peripheral location to another takes place inside the perforated shell 32. The limited spacing of the wire mesh from the outer periphery of the shell 32 (plus the blocking effect of the longitudinal rods 33) substantially prevents peripheral movement of air on the outside of the main support or shell 32 and beneath the wire mesh 34. In contrast, in the roll designated generally by the reference numeral 37 in Figures 6, 7 and 8, the peripheral movement of air is permitted immediately beneath the wire mesh indicated generally at 38 (in Figure 7).

Referring to Figures 6, 7 and 8 in detail, it will be seen that a through shaft 39 (Figure 6) having simple bearing surfaces at 39a and 39b and a suitable drive connection 39c at one end thereof is received axially by a substantially solid roll shell 40 which in turn mounts a peripherally disposed secondary supporting shell member 41. The shell members 40 and 41 fit together and on the through shaft 39 so as to prevent fluid permeation radially therethrough. The shell 40 is equipped with end annular flange members 42a and 42b secured to recessed end portions 40a and 40b, respectively, on the main shell 40 and the flange members 42a and 42b extend radially outwardly beyond the shell members 40 and 41 and are secured to annular clamping members 43a and 43b, respectively, by threaded bolts or screws 44. The annular clamping members 43a and 43b serve to clampingly retain a plurality of individual annular support elements 45. As shown in Figures 7 and 8, the support elements 45 comprise generally cylindrical sleeve portions 45a which closely surround the outer shell 41 and which have a relatively short axial dimension. The sleeves 45a are held against axial movement by the clamp members 43a and 43b. The support members 45 also have in each case a centrally positioned radially outwardly extending supporting rib member 45b which extends around the entire periphery of the sleeve member 45a but which contains a number of axially aligned apertures 45c therein to prevent axial movement of fluid therethrough.

The outer peripheries of the rib members 45b contain a plurality of notches 45d in peripherally spaced relationship and the annular clamping members or rings 43a contain axially aligned notches at 46 (Figure 8). The notches 45d and 46 receive axially aligned rods 47 which extend from one clamping member 43a to the other clamping member 43b over the tops of each of the supporting ribs 45b. The rods 47 have a generally rectangular cross section with the radially extending dimension being substantially greater than the peripheral dimension (with respect to the roll 37) and the rods 47 substantially fill the elongated notches 46 in the clamp members 43a and 43b, the notches 46 being completely filled by "fill" welds 48 along the top of each of the rods 47. The notches 45d are comparatively shallow so that the rods 47 extend outwardly therefrom and beyond the periphery of the supporting ribs 45b a slight but appreciable distance. The outermost surface (peripherally facing surface) of each of the rods 47 contains a plurality of axially spaced grooves therein, this peripheral surface being indicated at 47a in Figures 7 and 8 and the grooves being seen in Figure 7. The grooves on the outer rod surfaces 47a are filled with turns of a helically wound wire 49. The wire mesh covering provided by the helically wound wire 49 (in conjunction with the rods 47) thus provides a surface that is substantially the same as the wire mesh covering 34. Also, it will be noted that (as indicated in Figure 7) a fine screen may be wrapped over the periphery of the helically wound wire 49 and this screen, indicated at

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50, in Figure 7, may then be used to provide even a smoother wire mesh covering. In actual practice, the use of the screen 50 may not be necessary, except in the case of extremely light weight tissues. In general, the spacing between the rods 47 is substantially the same as the spacing between the rods 33 herein before described (which is based upon a shell perforation 32 in a standard press roll shell which is in the neighborhood of one fourth to one half inch in diameter). In the roll 37, however, the rods 47 have a rather substantial radially extending dimension which is about two and a half times the peripherally extending dimension of the rod 47 and about five times the diameter of the wire 49. In this way the wire mesh covering 49 is spaced 10 from the outer peripheral surface of the individual supporting ribs 45b a distance of two to three times the diameter of the wire 49 so as to permit ready axial movement of air immediately beneath the wire 49 as well as through the apertures 45c and the rib members 45b. The rather substantial radial dimension of the rib members 45b (being at least three or four times the radial dimension of the ribs 47) facilitates peripheral movement of air beneath the ribs 47.

It will thus be seen that the wire mesh covered roll 25 used in the practice of the instant invention has a supported wire mesh on the periphery thereof that is carried by suitable supporting means which afford ready fluid permeation radially outwardly through the mesh and also afford ready movement of fluid (or air) peripherally and axially of the roll beneath the wire mesh covering. The various supporting members define suitable apertures or passage ways which permit both axial and peripheral air movement beneath the wire mesh covering.

Another important aspect of the instant invention resides in the method and concept here involved. The instant method of de-watering a moist light weight paper web has a number of advantages because air is drawn through the web itself and the felt supporting the web at the press nip or line of pressure and also before and after this line of pressure. As will be appreciated, the compression of the felt and the web at the line of pressure results actually in a laterally extending area of pressure which has a very limited peripheral dimension of from as little as 5% of the suction area to as much as 25% of the suction area, the remainder of the suction area on each side of the pressure line or zone being at least more than the peripheral dimension of the pressure zone and preferably about as much as twice this dimension. In the instant process, the web or tissue is pressed between the travelling felt (backed by the suction press roll) and a rigid fluid-permeable surface (in the form of the wire mesh covering) and simultaneously a pressure differential is created across the system so as to draw air through the permeable surface, the web and the felt at the pressure line (whereat it is particularly effective in de-watering) and also on both sides of the pressure line throughout the entire suction area so as to effect "opening" of the felt pores as well as de-watering of the web.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. In a paper machine press section, in combination, a single looped felt, a suction pick up roll within the loop of said felt for picking up a paper web from a travelling surface, a suction press roll having a suction area within the loop of said felt, and a press roll below the suction press roll and having a wire mesh periphery in direct 70 contact with the web on the felt and in press nip defining relation with the suction area of said suction press roll.

2. In a paper machine press section, in combination, a single looped felt, a suction press roll within the loop of said felt, and a press roll in nip defining relation with the suction area of said suction press roll having a wire

mesh periphery in direct contact with the web on the felt, said press roll having a perforate rotatable shell, peripherally spaced rods secured to the outer surface of the shell and a helically wound wire covering secured to and firmly supported by said rods.

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