July 27, 1971 D. C. CRONIN 3,595,745

WEB PICK-UP

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FIG. 1

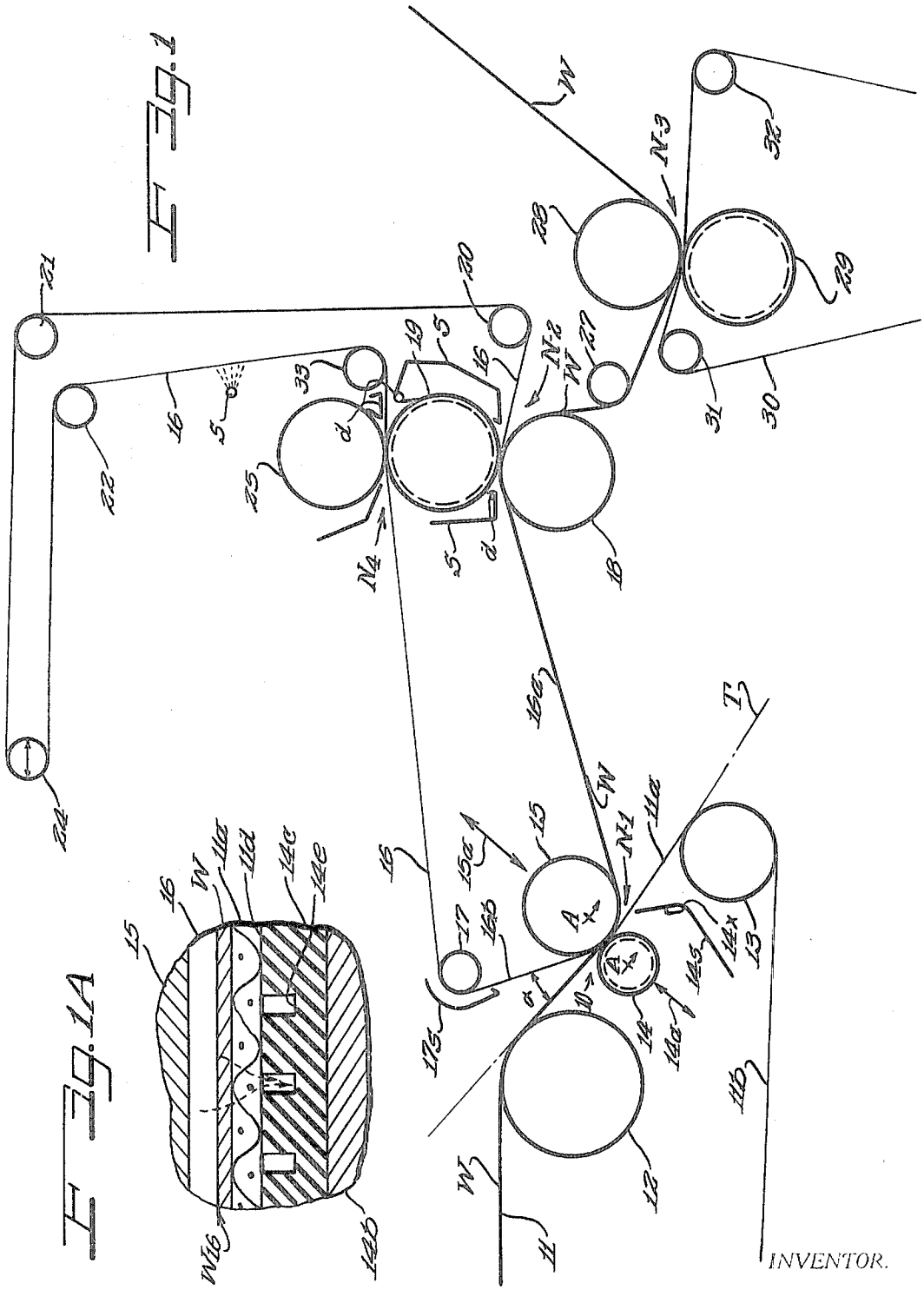


FIG. 1A

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FIG. 2A

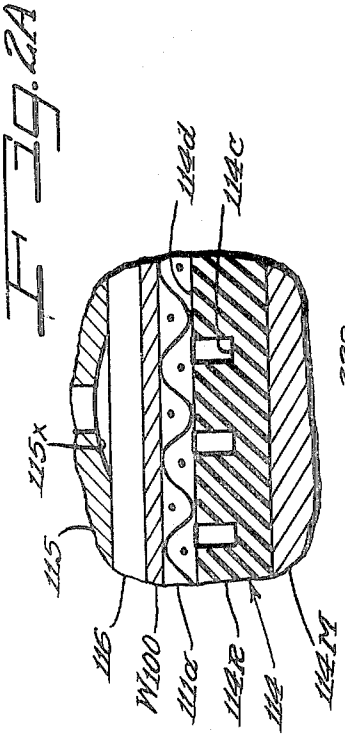


FIG. 2

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United States Patent Office 3,595,745 Patented July 27, 1971

3,595,745

WEB PICK-UP

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Filed Nov. 15, 1967, Ser. No. 683,168
Int. Cl. D21f 2/00
U.S. Cl. 162—306 10 Claims

ABSTRACT OF THE DISCLOSURE

This relates to the transfer of a moist paper web from one porous belt to another, specifically, from a paper machine forming wire to a pick-up felt. This is done by urging a pick-up felt (wrapping a pick-up roll) into contact with the web on the wire under press nip conditions which are afforded by the use of a grooved press roll backing the forming wire at the web pickup. In order to obtain the most favorable conditions for applying nip pressure and then carrying the web away from the wire on the pick-up felt the grooved roll used has a relatively small radius (and may be crowned to keep the wire spread).

This invention relates to the papermaking art, and more particularly, to the solution of certain problems arising in the papermaking art by virtue of the higher machine speeds that are desirable for production at the present time.

It is well known in the art that the moist fibrous web of paper is first formed by deposition of stock onto and with drainage of water from the stock through a so-called "forming wire" which may be a finely woven metallic screen-like or fabric porous belt, or it may be a finely woven plastic fabric defining a porous forming belt. While the moist newly formed web travels on the forming wire, it is in relatively delicate condition and it must be handled with a certain amount of care in order to avoid permanent damage to the resultant paper web. In this respect, it is usually difficult to effect a removal of the newly formed moist web from the forming wire under the relatively high speed conditions of present-day operation.

Web pick-up (from the forming wire) has been conducted in various ways heretofore; but in general, the procedure involves the use of a traveling porous belt usually called the pick-up felt, which wraps a pick-up roll that urges the traveling pick-up felt into contact with the moist web on the wire. As the pick-up roll rotates with the pickup felt wrapped thereabout, the pick-up felt is guided away from the forming wire and it carries the moist web with it away from the wire. The preferential attraction of the moist web for the pick-up felt may be helped considerably by the use of a suction area in a conventional suction roll structure used as the pick-up roll. Alternatively, a rather heavy wet felt may be used with a solid pick-up roll, and the relatively air impermeable moist felt wrapping the plain pick-up roll will tend to effect a pumping type of action for holding the web onto the underside of the felt at the off-running side of the web pickup station.

It will be appreciated that any pumping or vacuum-type of device tending to pull the web away from the forming wire (and cause it to adhere to the off-running pickup felt) will also have the tendency to cause a surge of water to flow from the underside of the forming wire back through the forming wire and in the direction of the web being picked up. This particular phenomenon is governed to a substantial extent by the rate of felt expansion at the off-running side of the web pickup. If the felt expansion is too slow, then the surge of water may be insufficient to free the fibers of the web tending to cling

to the wire. On the other hand, if too great a surge or too prolonged a surge of water travels through the wire and sprays against the web at the off-running side of the pickup station, then there is a tendency to cause other damage to the web. This latter situation may also occur in an undesirable manner if the web leaves the forming wire too gradually or at too close an angle, such as might result from pressing the pickup felt too hard against the web on the tensioned but yielding forming wire run.

The instant invention provides a solution for a number of problems just mentioned, particularly in connection with high speed operation. In the instant invention, there is provided a relatively small grooved press roll which is mounted against the back side of the forming wire at the web pickup station and which permits the development of relatively high nip pressures at the web pickup station. Because such grooved roll is provided with a press surface having a plurality of alternating circumferential lands and grooves, it readily permits the flow of water fore and aft through such grooves and avoids tendencies to build up water at a nip in the location of web pickup. On the other hand, the flow of water through the grooved roll is such that it will not preclude the presence of a desired amount of water at the immediate off-running side of the nip defined thereby in order to effect the requisite surging or flow of water to help release the web from the wire at the off-running side of the web pickup station.

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 attached hereto and made a part hereof.

On the drawings:

FIG. 1 is an essentially schematic elevational view of one embodiment of the instant invention;

FIG. 1A is a fragmentary enlarged detail sectional view taken substantially along the line A—A of FIG. 1;

FIG. 2 is an essentially schematic elevational view of another embodiment of the instant invention; and

FIG. 2A is a fragmentary enlarged detailed cross section taken substantially along the line A—A of FIG. 2.

As shown on the drawings:

In FIG. 1 there is shown a paper machine pickup area indicated generally by the reference numeral **10**, including a forming wire **11** traveling over a couch roll **12** through a downwardly inclined generally uniplanar run **11***a* around a turning roll **13** and back through a return run **11***b* to complete the loop of the forming wire **11**. The forming wire **11** carries a freshly formed moist paper web W over the couch roll **12** and down the downwardly inclined but generally uniplanar run **11***a* to a pickup nip N–1 that is defined between a grooved press roll **14** and a plain pickup roll **15** wrapped by a moist pickup felt **16**.

The pickup felt **16** is here shown traveling around an upper guide roll **17** and then around the pickup roll **15**, at which it picks up the web W along its underside at the pickup nip N–1 and carries the same to a first press nip N–2 which is defined by a bottom plain roll **18** and a top grooved roll **19**. The felt **16** travels from the press nip N–2 around a plurality of guide rolls **20**, **21**, **22** and **23** and a tension roll **24**, and in so traveling the felt **16** is exposed to water showers S and is pressed and reconditioned at a nip N–4 between a pair of grooved rolls **19** and **25** which serve to clean and recondition the felt **16** and prepare it to return around the guide roll **17** and pickup roll **15** to the pickup nip N–1.

The travel of the web W here involved includes travel along the underside of the felt run **16***a* from the pickup roll **15** to the first press nip N–2, where the web W is dewatered and tends to stick temporarily to the plain bottom press roll **18**, but the web W separates from the

down-running side of the press roll **18** and travels around a conventional guide roll **27** and into a second press nip N–3 defined by a top plain roll **28** and a bottom grooved roll **29** wrapped by a press felt **30** which is shown traveling over guide rolls **31** and **32**. At the second press nip N–3 the web W is further dewatered and again tends to follow temporarily the plain press roll **28** at the off-running side of the press nip N–3.

The grooved press rolls **19**, **25** and **29** just referred to in connection with the web press nips N–2 and N–3 and the felt reconditioning nip N–4 are press rolls which are described in considerable detail in E. J. Justus U.S. Pats. Nos. 3,198,693 –694, –695, –696 and –697, all of which issued on Aug. 3, 1965, and which are incorporated herein by reference. The same is true with respect to the conventional auxiliary equipment for such grooved rolls such as the saveall *s*, doctors *d* and wipers *w*; in fact, reference to the embodiment shown in FIG. 11 of Justus U.S. Pat. No. 3,198,696 shows a press arangement having a considerable amount of functional similarity to the arrangement for the press nips N–2, N–3 and N–4 of FIG. 1 (in that the nips, respectively, N–11, N–13 and N–12 of FIG. 11 of said patent will correspond substantially in operation and function to the nips N–2, N–3 and N–4 of the instant FIG. 1).

It will be seen that the instant pickup arrangement, however, differs considerably from the prior art. The felt **16** used in the pickup nip N–1 with the plain pickup roll **15** here shown is a comparatively heavy moist felt which has practically no air-permeability in its moist condition so that the felt **16** not only causes the web W to adhere to the underside thereof while it wraps the plain pickup roll **15** (and while it expands to create an internal partial vcauum at the immediate off-running side of the pressure area in the nip N–1), but the felt **16** carries the web adhered to the underside thereof for the comparatively short distance to the first press nip N–2, primarily by virtue of the fact that the subatmospheric pressure generated within the felt **16** and along the contiguous faces of the felt **16** and the web W is not lost sufficiently to permit the web to separate them from the felt **16** during the felt run **16***a* from the pickup roll **15** to the press nip N–2.

Another feature of the instant arrangement involves the positioning of the guide roll **17** generally upstream to the pickup roll **15** so that the guide roll **17** may feed a felt run **16***b* into the pickup nip N–1 with a minimum of travel approaching the nip N–1 in contact with the pickup roll **15** and in a run **16***b* which is generally at a relatively small angle to the downwardly inclined substantially uniplanar forming wire run **11***a*, which will be seen as being generally aligned with what might be considered a common tangent line T for the two nip-defining rolls **14** and **15**. The reason for the function and position of the guide roll **17** is that the moist essentially air-impremeable felt **16** is inclined to entrap a certain amount of air during its travel, and if such trapped air is rapidly expressed from the web felt (e.g. in the direction of the moist web) it may cause a damaging spray. Hence, an initial travel around the guide roll **17** to effect expulsion of whatever entrapped air might be in the felt in this region (into the saveall **17***s*) is helpful, followed by a compartively more gradual convergence between the moist felt and the moist web at the approach of the web pickup nip N–1, which is accomplished by the alignment of the felt **16** over the guide roll **17** along the upstream side of the pickup roll **15**, so as to effect convergence between the felt **16** and the web W through a relatively small acute angle α (e.g. here about 30°, and preferably not more than about 45°).

It will be appreciated that the small grooved roll **14** is provided with adjustable mounting means indicated diagrammatically at **14***a* by the double headed arrow for adjustably shifting the small grooved roll **14** toward and away from the pickup roll **15** at the nip N–1. The pickup roll **15** is, likewise, provided with adjustable mounting means **15***a* (again indicated diagrammatically by the double headed arrow), so that loading at the nip N–1 is readily controlled. It will be appreciated that the forming wire run **11***a* is under substantial tension (generally in the plane of the common tangent T) which is conventional for the forming wire operation. Nevertheless, in the absence of the backup grooved roll **14**, it is not difficult to effect a certain amount of deflection in the forming wire run **11***a* by urging the felt wrapped pickup roll **15** thereagainst, and this type of yielding deflection of the forming wire run **11***a* is generally not desirable because the web W tends to separate with greater difficulty and/or be damaged when it is separating from the forming wire run as it is carried away on the felt run **16***a*. The use of the grooved roll **14** serves to eliminate disadvantages of this type. Also, the grooved roll **14** has a substantialy smaller diameter than the conventional pickup roll **15**, e.g., here shown with about a diameter of ½ of that of the pickup roll **15**, but preferably the diameter of the grooved roll **14** will range from about ¼ to ⅔ of the diameter for the conventional pickup roll **15**. In this respect, it will be appreciated that the pickup roll **15** carries a considerable overall load with the tensioned felt wrapped thereabout and there are certain limitations as to the minimum diameter that is ordinarily permited for practical dynamic balance and deflection in the pickup roll **15**. Also, such diameter tends to form a comparatively unsatisfactory web pickup nip using a prior art arrangement involving merely the pickup roll wrapped by the pickup felt.

In contrast to the prior art arrangement, the small grooved roll will have, of course, a smaler radius and therefore a smaller "loaded nip" peripheral dimension at the nip N–1. In other words, the smaller roll **14** will actually govern the peripheral dimension of maximum pressure at the nip N–1; and because the radius of the roll **14** is comparatively small this peripheral dimension will be comparatively small. On the other hand, the pressure actually exerted is a function of the tension on the forming wire divided by the radius of the grooved roll, hence the smaller the radius for the grooved roll, the greater the pressure in pounds per square inch at the nip N–1 for a given nip pressure in terms of pounds per lineal inch. Additionally, and very important from the point of view of the practice of the instant invention, is the fact that this type of "small radius" nip will effect a maximum compression of the pickup felt **16** at the nip (e.g. as shown in FIG. 1A), with a very rapid release of such compression forces against the pickup felt **16** at the immediate off-running side of the nip N–1, so that the pickup felt **16** will expand rapidly, tending to rapidly create an internal partial vacuum which will not only effect an excellent retention of the web on the underside of the felt run **16***a* but will also effect a brief but substantial surge of water flow from the grooved roll side of the wire run **11***a* back through the wire run **11***a* to effectively lift from the wire run **11***a* the entire web W including any fibers tending to cling to the wire run **11***a*.

The desired type of water surge for effecting rapid lifting of the web W from the wire run **11***a* with minimum damage is achieved here, at least in part, by the advantage of having a relatively rapid pressure release at the off-running side of the nip N–1 so that substantial expansion of the felt **16** will occur rapidly. Such rapid expansion will also occur in the desired manner for the instant felt **16** because the felt **16** (with the web thereon) is not wrapped by any substantial portion of the forming wire run **11***a* (as might be the case in the absence of the backup grooved roll **14**, when the pickup roll **15** might be causing deflection of the run **11***a* of the forming wire). In other words, the backup grooved roll **14** serves to maintain the wire run **11***a* in substantially the common tangent plane for the rolls **14** and **15** at the nip N–1 and at its immediate off-running side. In this way there is no bending of the wire **11***a* so that it may follow the web and felt temporarily along the off-running side of the nip N–1 or the nip load

line thereof (which is along the line designated A–A in FIG. 1).

It will be appreciated that the grooved roll has the grooved roll structural already described and claimed in substantial detail in the aforesaid Justus U.S. patents. Such structure in this instance involves a metal water impermeable structural shell **14***b* (FIG. 1A) plus a rubber cover **14***c* on the outer periphery of the shell **14***b* with alternating circumferentially aligned lands **14***d* and grooves **14***e*. Although the land and groove ratios and the other parameters of the dimensions relating to the alternating lands and grooves on the grooved roll **14** are the same as those already described in considerable detail in the aforesaid Justus patents incorporated herein by reference, in the instant situation the axial dimensions of the land widths are 0.08 inch and the axial dimensions of the groove mouths are 0.02 inch, with the groove depths being 0.1 inch in the case of the roll **14**. In such situation these very fine grooves **14***e* will be bridged by the relatively strong structure of the forming wire run indicated in cross section schematically at **11***a* of FIG. 1A, but water may flow readily into these grooves **14***e* and may flow from them readily both fore and aft of the nip N–**1**, because there is nothing but the ambient atmosphere to afford any resistance to the flow of water fore and aft in the grooves **14***e*. Preferably a saveall **14***s* is mounted with the grooved roll **14** with a deflector blade **14***x* mounted for close-running skimming relation to the underside of the wire run **11***a*. But the excess of water to the underside of the forming wire run **11***a* at the immediate off-running side of the maximum pressure nip load line at the nip N–**1** is not interferred with, because a certain amount of surging of water at this instant is desirable for assuring a complete lifting of the web W from the wire run **11***a*.

Referring to FIG. 1A again, the web W is indicated therein as being in contact with the wire run **11***a* and the felt **16** is shown in substantial compression, lying between the web W and the plain pickup roll **15**. In the arrangement shown in FIG. 1A, which represents the maximum pressure nip load line, it will be appreciated that water will actually flow from the felt **16** as well as the web W through the wire **11***a* and into the grooves **14***e*, as indicated by the dashed line arrows leading into the middle groove in the view of FIG. 1A. On the other hand, immediately after the pressure at the nip load line is relieved, the felt **16** will spring back into its normal uncompressed thickness which will be perhaps twice the dimension suggested in FIG. 1A and in this instance a partial vacuum will be created in the body of the felt **16** (still backed against the plain roll **15**) and there will be a tendency for a complete reversal of the flow of water in directions substantially exactly opposite to those indicated by the dashed line arrows in FIG. 1A. At this instant a certain amount of water at the underside of the wire run **11***a* (on the grooved roll side) is desirable to effect the lifting of the web W without damage. The grooved roll will afford this water to some extent, because the grooves therein will afford an open area of perhaps 15 to 33⅓%, but the fact that the radius of the grooved roll **14** is considerably smaller than that for the pickup roll **15** will also help materially in this situation, because the lands **14***d* on the outer periphery of the grooved roll **14** will actually separate very rapidly from the underside of the wire **11***a* and this will afford a more complete access of the water to the underside of the wire **11***a* for the brief moment that such a surge of excess water is desirable. This surge of excess water will return under forces that are obviously no greater than ambient atmospheric pressure (absolute pressure), hence the use of nip load pressures of substantially greater than one atmosphere at the press transfer nip N–**1** will effectively result in a certain amount of dewatering of the moist web W (to an extent that the return surge of water will not completely replace the water expressed from the web in the felt at this nip N–**1**). This is a desirable result from the point of view of initiating dewatering of the web W as soon as is practical and also from the point of view of not completely refilling the voids in the wet felt **16** so that the same will retain a partial vacuum or subatmospheric pressure within its body and along the contiguous face W**16** of FIG. 1A between the web and the felt during the felt run **16***a*.

Still another feature of the instant invention provides for a nominal crowning of the grooved roll **14**. The actual crowning of the groved roll **14** involves such modest dimensions that it cannot be shown in the drawings; but such crowning will constitute something in the neighborhood of a slightly enlarged diameter for the middle portion of the roll **14**. Such slightly enlarged diameter will be in the neighborhood of perhaps an increase of 0.02 inch to 0.10 or 0.15 inch. Thus in the case of a 14 inch diameter for the grooved roll **14**, the rubber cover is machined down to have a dimension along the edges of the roll substantially 14.000 inch, but perhaps ¼ of the way toward the middle of the roll the diameter of the roll will show a slight crowning of 14.002 and at the middle of the roll the crown will have increased gradually to give a diameter of substantially 14.010 inch. The actual dimensions of the crowning will depend to a substantial extent upon the various other conditions and elements being employed, but it will be appreciated that there is a substantial amount of water entering into the nip N–**1**. Since a certain amount of pressing and dewatering at the nip N–**1** is now desired in the present arrangement there will be a slight tendency toward the buildup of a hydraulic wedge in the middle of the nip N–**1**, in spite of the availability of unrestricted passageways for the water to flow. Also, it is important not to deflect the forming wire **11***a* into a concave configuration, since this may lead to folding or creasing of the forming wire **11**. Hence, the crowning of the roll **14** will afford a spreading or convex transverse contour to the forming wire in the critical regions of the web pickup nip N–**1**. Although crowning is not particularly useful in many of the present-day high speed machines for the reason that a crowned roll (even having a crown of a few thousandths of an inch) will have a faster peripheral speed at its crown that it has at its edges and this type of arrangement may result in web damage at one of the final dewatering presses. On the other hand, in the present stage of the web formation, at the web pickup nip N–**1**, it is found that a nominal amount of crown is not damaging to the web W per se and it is found to be helpful in many instances with respect to the operation of the forming wire run **11***a* and also with respect to maintenance of a substantially uniform nip load transversely of the pickup nip N–**1** in spite of the substantial amounts of water that are being brought into this nip N–**1**.

Referring now to FIGS. 2 and 2A, it will be seen that the pickup station indicated generally by the reference numeral **100** is considerably different in structure from that shown in FIG. 1. For one thing the pickup roll **115** is a suction roll in this embodiment having a small high vacuum suction area **115***b* in the immediate vicinity of the pickup nip N–**100**, which suction area **115***b* is followed by a larger but lower vacuum suction area **115***c*. Instead of a plan pickup roll **15** with a comparatively heavy wet felt **16**, in the embodiment of FIG. 2 there is used a suction pickup roll **115** with a lightweight felt **116** trained about guide rolls **117** and **118** and a tension roll **119**, which pickup felt **116** is a comparatively lightweight felt or may even be a fabric which would function more or less merely as a power fabric in carrying the web W**100** the very short distance that the web is carried on this felt or fabric **116** from the nip N–**100** to substantially the end of the suction areas **15***b* ad **15***c*, so that the web W**100** is simply transferred from the underside of felt **116** to the top side of a press felt **130** wrapping a guide and suction roll **131** having a small suction area **131***a* positioned immediately downstream from and closely spaced from the off-running edge of the suction area **115***c*. The felts **116** and **130** need not even touch or even contact both

sides of the web W100 simultaneously. Instead, the web may be merely dropped from the upper felt 116 to the bottom felt 130, with an assist from the suction area 131*a*.

It will be appreciated that actual pressure involved in the web pickup nip N–100 is controllable and it need not be excessive. This fact, plus the fact that the felt 116 (or fabric if desired) does not pass through another press nip or a true high pressure press nip of any sort makes it possible to have a much longer wearing life for the felt 116. Additionally, the conventional cleaning and reconditioning devices ordinarily required for felts need not be employed in the case of the instant felt 116, or at least the cleaning and reconditioning means need not be as drastic or need not cause as much wear on the felt 116 as is the case for conventional press felts, because the materials which must be cleaned from the surface of the felt 116 are not pressed into the felt surface by any substantial press nip loads. This affords a very great advantage from a practical point of view and the guide roll here deignated 120 for the felt run 116*a* at the off-running side of the web pickup nip N–100 is mounted so that the felt run 116*a* will run very close to but without touching the top felt run 130*a* of the felt 130, and the transfer of the web W100 from the underside of the felt run 116*a* to the top side of the felt run 130*a* is readily accomplished in the manner just described herein. The press felt 130 will then convey the web W100 into the first actual press nip N–200 between a top plain roll 128 and a bottom grooved roll 129, from which the felt 130 exits passing over its guide roll 132 and the web W100 also exits following briefly the plain roll 128 until it is dropped onto a second press felt run 230*a* for a press felt 230 which is mounted on a plurality of guide rolls 231, 232, 233, 234 and 235 so as to ultimately lead the web W100 into a third press nip N–300 again defined by a top plain roll 228 and a bottom grooved roll 229. The web W100 travels out of the nip N–300 temporarily with the plain roll 228 and finally onto still another press felt run 330*a* (shown only partially mounted on guide rolls 331 and 333). The grooved rolls 129 and 229 have the same type of groove structure as that already described in connection with the grooved roll 29 at the second press nip N–3 in FIG. 1. In this respect, it will be noted that the initial transfer to a press felt occurs without the necessity of using a so-called transfer press in the embodiment of FIG. 2A, so that the actual dewatering of the web may take place to maximum advantage in the very first press nip N–200 in the embodiment of FIG. 2, which is still another distinct advantage in this arrangement.

It will also be noted from FIG. 2 that the newly formed web W–100 is brought to the web pickup station N–100 on the forming wire 111 traveling over a couch roll 112 and along a generally uniplanar but downwardly inclined forming wire run 111*a* which ultimately wraps the turning roll 113 and enters into the return run 111*b*. Again, the suction pickup roll 115 is mounted for movement toward and away from the web pickup nip N–100 by conventional means here represented only schematically at 115*a*. The grooved roll 114 which is the counterpart of the grooved roll 14 previously described is here shown acting against the underside of the wire run 111 and mounted for selective movement toward and away from the nip N–100 and for controlled application of pressure at the nip N–100 on a pivoted arm 114*b* actuated by pneumatic means such as an air spring indicated at 114*c*. An off-running saveall 114*s* is also employed substantially as previously discussed in connection with the saveall 14*s*.

With reference to the nip load line at substantially A—A of FIG. 2, attention is directed to FIG. 2A where it is shown that the grooved roll 114 is formed of a conventional structural water impervious metallic shell 114M with a machined rubber cover 114R having grooves 114*c* cut therein alternating with lands 114*d*, with the alternating generally circumferential land and groove structure being the same as that already discussed in connection with FIG. 1A. Also, the grooved roll 114 is preferably crowned in the manner previously described, so that the suction pickup roll shell may also be operated with a slight crown, if desired, to assist in its anti-deflection function. In any event, the slight crown of the grooved roll will assist in avoiding any folding or creasing of the wire run 111*a*. The felt or fabric 116, indicated schematically in FIG. 2A, is shown in the compressed or loaded condition in FIG. 2A, to represent the conditions at the nip load line, and it will be appreciated that in the case of the felt 116, such felt is preferably a comparatively lightweight felt or, as mentioned, a plastic wire or fabric, which will not necessarily expand to any great extent at the immediate release of the nip load pressure at the nip N–100, but, as indicated in FIG. 2A the pickup roll 115 will have the conventional suction roll perforations (only one of which is indicated at 115*x* in FIG. 2A) which afford fluid access to the back side of the felt 116 from the suction areas 115*b* and 115*c*, so that a subatmospheric pressure is maintained on the back of and actually substantially throughout the web 116 by the suction pickup roll 115 from the nip load line of the web pickup nip N–100 on around to the end of the low vacuum suction area 115*c*. In this way the web W100 is carried by such pressure differential on the underside of the felt 116 for the full peripheral dimension of these two suction areas 115*b* and 115*c* (and after this the web W100 can conveniently drop to the press felt run 130*a* in the manner already described). The substantially uniplanar run of the forming wire 111*a*, assisted by the backup of the preferably crowned grooved roll 114 makes a rapid separation from the forming wire run 111*a* possible. Such rapid separation will necessarily cause the return surge of water from the underside of the forming wire run 111*a* to assist in lifting the web W100 completely (with those fibers which may tend to cling to the wire) at the off-running side of the nip N–100 and the resultant pressure differential that is created and maintained in this run of the felt 116 with the web W100 thereon is accomplished under favorable conditions.

It will be appreciated that, particularly in the case of a suction pickup roll 115, the diameter of such a pickup roll should be relatively substantial, among other things, for the purpose of affording a reasonable amount of travel on its periphery over the two suction areas 115*b* and 115*c* so that there will be a reasonable amount of protected carrying of the web W100 away from the forming wire 111*a*. Thus, the minimum size for the suction pickup roll 115 is definitely limited and in this case it is substantially 34 inches. In contrast, the diameter of the grooved roll 114 is preferably 16 inches in this instance. It will be appreciated that the advantages of the present embodiment are also implemented by the arrangement which affords for the positioning of the suction guide roll 131 in very close running relation to the off-running side of the nip N–100 and to the forming wire 111*a* and in very close running relation beneath the pickup felt 116 while it is wrapping the suction pickup roll 115. By so positioning this suction guide roll 131 wrapped by the first press felt 130, it is possible to take the moist web W100 directly from the pickup station N–100 to a full pressure initial press nip N–200, which may operate at 300 pounds per lineal inch. The next press nip N–300 may then operate at perhaps 450 or somewhat higher pounds per lineal inch, and successive press nips (not shown) may be employed, if desired. The particular advantage here involves the minimum wear or rough use for the pickup felt 116 while at the same time involves minimum delay in bringing the web W100 to a full scale high pressure press nip. These advantages are apparent from the fact that this arrangement avoids the necessity for the use of a so-called transfer press, where the web is transferred from a pickup felt to a press felt in a press nip arrangement which involves all of the operational difficulties and expense of an ordinary press nip but which does not accomplish a great

deal of dewatering as compared to a full scale first press nip such as the nip N–200 here shown.

I claim as my invention:

1. In a web pick-up arrangement for a paper making machine, in combination, a pick-up roll having a given diameter, a groove roll having a diameter about ¼ to ⅔ of said given diameter, said grooved roll defining a nip with said pick-up roll, a first porous belt mounted between a couch roll and a turning roll and traveling substantially in a common tangent plane for said rolls and carrying a newly formed moist web into said nip, and a traveling second porous belt wrapping said pick-up roll and passing through said nip to receive the web from the first belt and carry the web away from the nip, said grooved roll being positioned within the loop of said first porous belt between said couch and said turning rolls, said grooved roll being loaded against the pick-up roll at such nip to effect dewatering of the web and said grooved roll having a peripheral surface defined by a plurality of generally circumferential alternating narrow grooves and lands, whereby such lands bridged by said first belt apply substantially uniform transversely aligned pressure to said nip.

2. The machine of claim 1 wherein said pick-up roll is a suction roll presenting to said nip a suction area for assisting in web transfer.

3. The machine of claim 2 wherein a second suction roll is mounted near the off-running side of said nip, and a traveling third porous belt is wrapped about said second suction roll and urged thereby into close-running relation to the pick-up felt to receive the web therefrom.

4. The machine of claim 1 wherein the grooved roll has from ¼ to ⅔ of the diameter of the pick-up roll.

5. The machine of claim 1 wherein said second belt is a pick-up felt and there is provided a pair of press rolls defining a pressing and dewatering nip receiving the pick-up felt with the web thereon.

6. The machine of claim 1 wherein the grooved roll is crowned to impart a transverse spreading effect to the forming wire at and after the nip.

7. In a web pick-up arrangement for papermaking machines, in combination,

a looped traveling forming wire positioned to receive a freshly formed moist paper web and carry said web over a portion of said loop,

a couch roll positioned within the loop of said wire for guiding said wire to a pick-up area,

a turning roll positioned within the loop of said wire for guiding said wire away from said pick-up area,

said turning roll being spaced a distance away and down from said couch roll so as to define a downwardly inclined generally uniplanar run path between said couch and said turning roll for travel by said wire,

a looped traveling pick-up felt positioned outside the loop of said wire and converging at a relatively small acute angle with said uniplanar run path to contact said web and aid in transferring said web from said wire to said felt,

a pick-up roll having a given diameter and being positioned within the loop of said felt at the area of contact between said felt and said wire, and

a grooved roll having a diameter about ¼ to ⅔ of said given diameter and being positioned within the loop of said wire generally opposite to said pick-up roll so as to define a pick-up nip therewith

said grooved roll being loaded against said pick-up nip to compress said felt at said nip and said grooved roll having a peripheral surface defined by a plurality of generally circumferentially alternating narrow grooves and lands whereby such lands bridged by said wire apply substantially uniformly transversely aligned pressure at said pick-up nip.

8. In a web pick-up arrangement as defined in claim 7 wherein the acute angle between the converging felt and the uniplanar run path is less than about 45°.

9. In a web pick-up arrangement as defined in claim 7 wherein the groove roll is loaded against the pick-up roll with a nip load pressure of substantially greater than one atmosphere.

10. In a web pick-up arrangement as defined in claim 7 wherein the grooved roll is crowned to have about 0.02 inch to 0.15 inch greater diameter along a middle portion thereof.

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U.S. Cl. X.R.

162—358