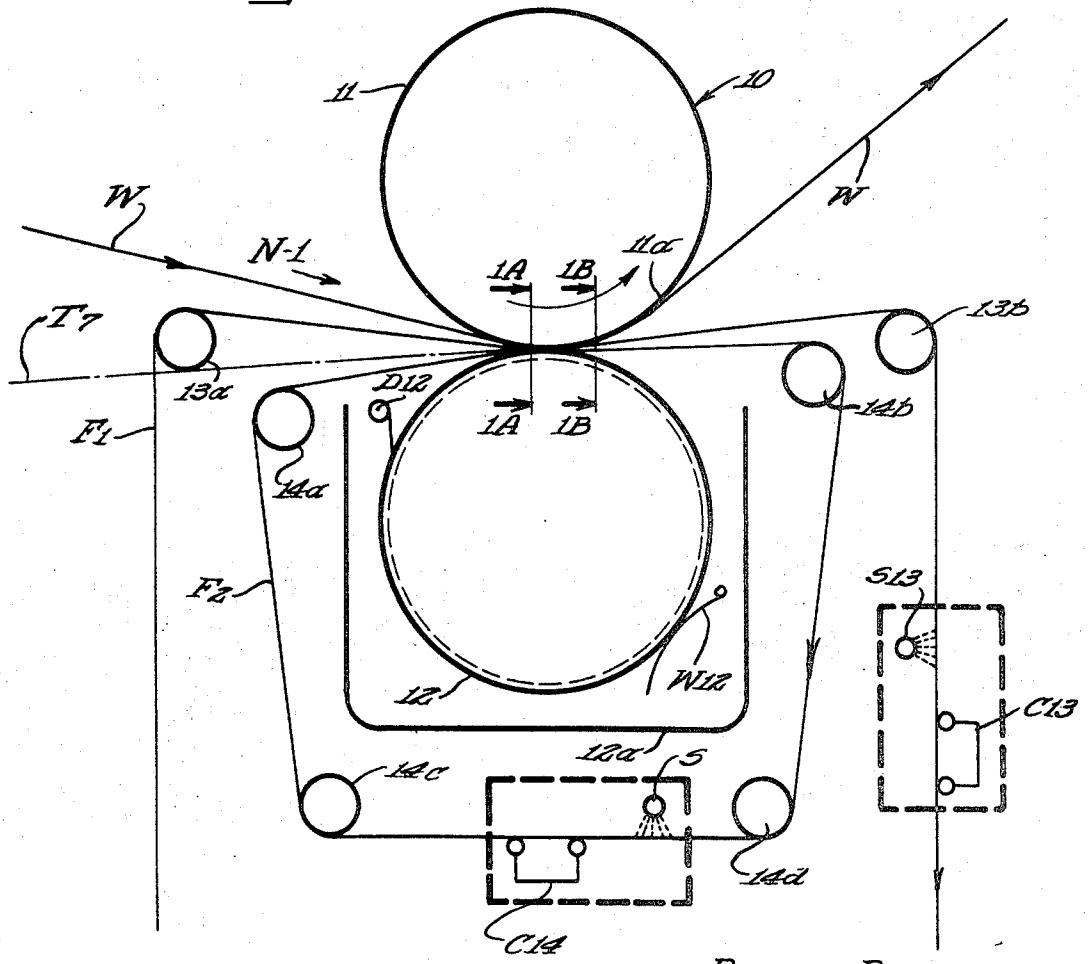
Jan. 19, 1971 D. C. CRONIN 3,556,940

PRESS ASSEMBLY

Filed April 8, 1968

Fig. 1



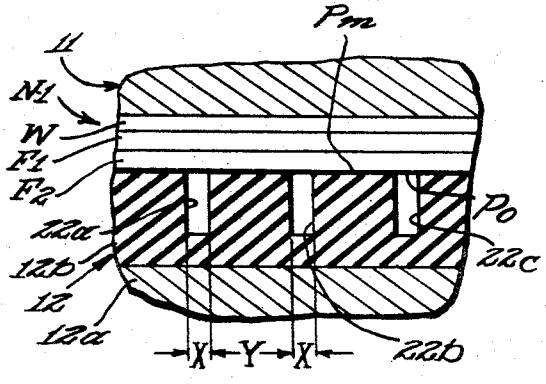


Fig. 1A

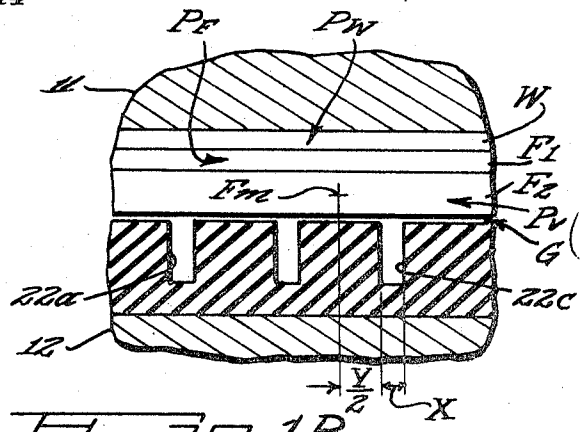


Fig. 1B

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United States Patent Office 3,556,940 Patented Jan. 19, 1971

3,556,940

PRESS ASSEMBLY

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Int. Cl. D21f 3/00
U.S. Cl. 162—358 10 Claims

ABSTRACT OF THE DISCLOSURE

This relates to a press arrangement for expressing liquid from a liquid-bearing fibrous web, such as a moist paper web. The press nip is defined between a pair of press rolls, at least one of which is equipped to receive and carry away liquid, e.g., a grooved roll or a suction roll, which roll is wrapped by a pair of felts. The felt immediately adjacent such roll has high liquid permeability and high expansibility at the off-running side of the nip. The second felt is interposed between the first felt and the web and such second felt has low liquid-permeability and low expansibility, such that it permits expression of liquid under the high nip pressures but functions as a barrier to rewetting of the web at the off-running side of the nip.

This invention relates to an improved press arrangement for expressing liquid from a liquid-bearing fibrous web, and more particularly, an improved paper machine press arrangement.

Although the invention may have utility in other fields involving the removal of liquid from liquid-bearing fibrous web materials, the invention is particularly useful in the field of papermaking and will be described primarily in connection therewith. In press arrangements or assemblies in the papermaking field, it is recognized that a so-called press "nip" is defined between a pair of press rolls which receive the moist paper web in such nip, where the web is subjected to substantial pressures along a "nip load line" between such press rolls, and this pressure serves to remove water from the moist web. Rather than have substantial quantities of water building up at the oncoming side of the press nip (which may often lead to undesirable results), the skilled workers in the art have devised other methods to assist removal of the water at the nip. For example, suction rolls are used, in the form of rolls defined by a perforate press roll shell having an interior suction gland for receiving water from the press nip via such perforations in the shell. More recently certain grooved press rolls have been found to be unusually successful, and such grooved press rolls are described in considerable detail in U.S. Pats. Nos. 3,198,693, -4, -5, -6 and -7, issued on Aug. 3, 1965 to E. J. Justus.

Whether or not the recesses in such press rolls are in the form of generally circumferential grooves, or perforations in a suction roll shell, or other structures, it is recognized in the art that the recesses in such press rolls will to a greater or lesser extent tend to retain a certain amount of water at or near the outer periphery thereof at the off-running side of the press nip. This water tends to be reabsorbed by the expanding fibrous members which have passed through the press nip and are undergoing expansion as they are relieved from the high pressures of the press nip and pass into the relatively low ambient atmospheric pressure. It is known to use traveling water-permeable belts or felts to cover the recesses on such recessed press rolls in order to minimize tendencies to mark the web at the nip which result from the presence of the various recesses just mentioned on the periphery of the press rolls. Also, the felts used have a certain amount of compressibility and water-permeability, such that they may tend to be rewet by water from the press rolls at the off-

running side of the nip, and such felts may then, in turn, rewet the paper web at the off-running side of the nip. In the instant invention, a felt arrangement is used which is designed specifically to afford maximum dewatering at the press nip while at the same time minimum rewetting at the off-running side of the press nip. The instant invention provides this advantage, although it will be recognized that the apparent functions of affording maximum dewatering at the nip and minimum rewetting at the off-running side of the nip would appear to be so contradictory in the basic phenomena involved that it might at first be thought that any felt or felt conbination which might be used for accomplishing one purpose would necessarily defeat the other.

The instant invention is based upon certain practical and certain theoretical considerations which will be discussed in greater detail hereinafter, but which essentially serve to afford the advantages hereinbefore mentioned without causing the expected disadvantages in the operation of a press nip.

Other and further 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 side elevational view of a press arrangement embodying the instant invention; and

FIGS. 1A and 1B are essentially enlarged fragmentary detail views in cross section taken substantially along the lines A—A and B—B, respectively, of FIG. 1.

As shown on the drawings:

The press arrangement indicated generally by the reference numeral **10** in FIG. 1 includes a top plain press roll **11** and a bottom grooved roll **12** defining therebetween a press nip N–1. A moist fibrous web W passes through the nip N–1, in this instance in contact with the smooth plain surface of the plain roll **11**, to which it adheres temporarily and briefly in the region of the off-running side of the press nip N–1 (at **11***a*), after which the web continues on in the paper machine, as indicated by the arrowheads.

In the nip N–1 the web W is contacted with an outside felt F1, which in turn contacts an inside felt F2 that is in contact with the grooved roll **12**. The outside felt F1 is carried in conventional manner on a plurality of guide rolls including the rolls **13***a* and **13***b* which serve to guide the felt F1 above the common tangent line T for the two rolls **11** and **12** (i.e., on the plain roll side of the tangent line T), particularly at the off-running side of the nip by virture of the guide roll designated **13***b*. Additionally, a shower S–13 and a dewatering and containing device C13 acting on the active or outer face of the felt F1 serve in conventional manner to clean and recondition the felt F1 as it travels about its generally looped configuration (only a portion of the loop being shown here).

The inside felt F2 is within the loop of the felt F1 and is also carried and guided by a plurality of guide rolls **14***a* through **14***d*; and is provided with a shower S14 and a dewatering and conditioning device C14, for conventional cleaning and reconditioning of the felt F2 in the course of its travel about its loop.

The roll **12**, provided with water-receiving recesses, in the present embodiment is shown to be a grooved roll having essentially the structure actually described in considerable detail in the aforesaid Justus U.S. Pat. 3,198,693 through 3,198,697, all of which are incorporated herein by reference. Such grooved roll **12** is provided with a conventional saveall indicated schematically at **12***a* and a wiper W12 along the down-running side for pumping liquid out of the grooves thereof; and a doctor D12 for re-

moving droplets of water from the lands on the grooved roll **12** at the immediate on-coming side of the press nip N–1.

The felts F1 and F2 are, however, considerably different in their overall structure and function. The so-called outside felt, felt F1, is preferably formed of a hard dense relatively incompressible structure or fabric with a smooth outer surface and with comparatively high flow resistance, i.e., comparatively low liquid or water-permeability. This felt F1 may be formed of cotton, silk or linen or it may be formed of a thin sheet of perforate or woven fabric, but in any case the felt F1 has a very close weave or a very fine pore size such that it has comparatively high flow resistance with respect to the water in the web W, particularly in the uncompressed form of the felt F1.

In contrast, the inside felt F2 is formed of felted or woven felt fabric structure, having relatively high liquid permeability, and relatively substantial pore size (voids) with resultant substantial compressibility and expansibility depending upon whether or not pressure is being applied thereto.

Expressed in relative terms, the felts F1 and F2 both have porous felt body structures, in a general sense, but the outside felt F1 has at least about 25% less fluid permeability than the inside felt F2, particularly at the off-running side of the press nip N–1. Also, at the off-running side of the press nip N–1 the outside felt F1 has at least 25% less expansibility than the inside felt F2. At the oncoming side of the nip N–1, the relative conditions of porosity between the felts F1 and F2 is that the outside felt F1 preferably has at least 25% less compressible volume of voids than the felt F2. Actually, the foregoing numerical figures of 25% would be closer to substantially at least about 50% in each case for the preferred practice of the instant invention. There is no exact practical maximum difference between the two felts F1 and F2 and the properties just discussed, except that the felts F1 and F2 will retain their overall function as press felts in the instant arrangement. Thus, the percent compressibility and/or percent voids in the felt F2 can well be several times (e.g., three or four times or more) greater than that for the felt F1. Also, the fineness of the pores in the felt F1 should be considered because it is known that the web W possesses extremely fine pore size and therefore is extremely functional with respect to capillary action (which is one of the undesirable functions involved in rewetting). Accordingly, the fineness of pore size in the felt F1 should preferably relate to or approach the pore size within the web itself.

Although it is not desired to limit the invention to any particular theory, it is believed that in the pressing of paper webs, the paper web itself is capable of a reasonable amount of compression and a substantial amount of dewatering when subject to the relatively high pressures along the nip load line, e.g., pressures in the neighborhood of 300 to 450 pounds per lineal inch. On the other hand, the web W will expand to some extent as it is relieved of the nip pressure and such expansion serves to create a very high vacuum within the body of the web W, e.g., possibly as much as 30 inches of mercury vacuum. This extremely high vacuum tends to accelerate the undesirable rewetting effect. Moreover, the very fine capillary passages in the web W (by virtue of the cellulose fibers therein) will have a so-called "wicking" effect tending to cause accelerated migration of water via capillary action back into the web. In this respect, it will be appreciated that the pore sizes in the web are much smaller than those ordinarily employed in paper machine press felts, and certainly much smaller than those of the present press felt F2. On the other hand, it is desirable for the outside felt F1, interposed between the press felt F2 and the web W in the present structure to have minimum sized pores as well as minimum liquid or water-permeability, at least under ambient atmospheric pressure. In the sense that the felt F1 has minimum water-permeability, it will be appreciated that it will function as a barrier to reduce or neutralize the tendency in the expanding web to draw water from the grooved roll surface back through the felt system. On the other hand, the use of very fine porosity in the relatively hard dense outside felt F1 will also have the effect of counteracting capillary action within the web itself at the off-running side of the nip, whereby the web will attempt to pull back water into itself via capillary actiton. The finer the pore size in the outside felt F1, the greater the tendency therein toward capillary action and thus the tendency to resist or overcome the capillary action inherent in the expanded web W. Thus, the overall pore sizes in the felt F1 are preferably about one-half or even one-fifth the pore sizes of the inside felt F2, which inside felt will have preferably the pore size ordinarily used in the case of conventional press felts, in that it not only has ample pore size but also has a substantial compressible body to afford adequate protection at the instant nip N–1 not only for the web W but also for the comparatively harder and more dense outside felt F1. The felt F1 has properties of density, hardness, resistance to water flow, extremely fine pore size, and the like, which properties would not lend the felt F1 ordinarily to direct contact with a press roll such as the press roll 12 having recesses therein, because there would be a tendency to wear such a felt F1 much more rapidly in such an arrangement, than would be the case for the relatively softer and more compressible and more pliable press felt F2. The press felt F2 thus affords protection not only for the web W but also for the outside felt F1.

Additionally, it will be appreciated that the relatively high compressibility and resultant high expansibility of the comparatively highly porous inside felt F2 will result in the generation of an internal vacuum or subatmospheric pressure in the body of the felt F2 at the off-running side of the nip N–1. This vacuum will possibly tend to reach only about 15 inches of mercury, but it will have a tendency to resist the rewetting flow of water through the outside felt F1. Thus, the outside felt F1 in its condition which has already been described at the off-running side of the nip N–1 will function as a barrier to generally resist the flow of rewetting water therethrough to the web W, and the inside felt F2 will further assist the outside felt F1 in this function by virtue of the internal vacuum which is created within the felt F2 during its own expansion at the off-running side of the nip N–1.

It must be appreciated that if the second felt F2 and the web W were in contact at the off-running side of the nip N–1 the tendency of the expanding felt F2 to create an ininternal vacuum would be more or less overcome by the tendency within the web W to create a still lower subatmospheric pressure within itself (e.g., perhaps as much as 30 inches of mercury). In such situation, there would be a relatively unequal contest between the web and the felt F2 for available water therebetween; whereas in the practice of the instant invention, the felt F1 interposed therebetween has high resistance to water permeability per se. Thus, the felt F1 actually cooperates with the vacuum creating tendency of the felt F2 during expansion so as to materially resist in the rewetting effect on the web itself.

On the other hand, it will be appreciated that the relative pressure differentials at the off-running side of the nip N–1 will not be in excess of substantially atmospheric pressure, or 15 pounds per square inch; whereas the relative pressures involved at the press nip N–1 itself, at the nip load line, will be extremely great, in the neighborhood of 300 to 450 pounds per lineal inch. The expression pounds per lineal inch is used in the trade to indicate the load actually applied at the nip N–1, but it does not mean that it represents the pressure per square inch, because the peripheral dimension of the nip load line is ordinarily less than one inch, perhaps closer to one-half inch. Thus, using a pressure of 300 pounds per lineal inch

in a press nip wherein the peripheral dimension of the maximum nip load is only one-half inch, the actual pressure in pounds per square inch in the maximum pressure region will be closer to 600 pounds per square inch, or some 40 atmospheres. Thus, the driving force would be 40 times greater to urge water out of the web W and through both of the felts F1 and F2 and into the grooves of the grooved roll 12. Thus, any tendency in the outside felt F1 to resist the flow of water therethrough (which is a very real tendency at ambient atmospheric pressures) would be substantially overcome at the very high pressures in the nip itself. This apparent undesirable feature of the outside felt F1 is thus substantially overcome by virtue of the tremendous driving force of perhaps 40 atmospheres of pressure tending to drive water therethrough at the nip. On the other hand, it will be appreciated that the nip load is maintained for only a fraction of a second on any given peripheral increment of the web, first felt and second felt at the nip N–1, so that movement of the water at the maximum nip load is extremely rapid. On the other hand, the separation of the web W from the first felt F1 and the separation of the first felt F1 from the second felt (as well as the separation of the second felt from the surface of the roll 12) are all functions which will require considerably more linear travel and considerably more time than the fraction of a second involved in the application of maximum pressure at the peak load in the nip N–1. Hence, the comparative water impermeability of the felt F1 may be overcome substantially completely at the very high pressures of maximum nip load, even though applied for a very short period of time, but such properties of resistance to water flow under essentially ambient atmospheric conditions are extremely important in the felt F1 in carrying out its essential function as the off-running side of the nip N–1, which must be done over a period of time that is at least several times longer than the fraction of a second involved at maximum nip load pressure. Once pressure is relieved in the felt F2, this felt will expand very rapidly because is has good recovery properties characteristic of good press felts and the felt F2 is preferably made of wool or a comparable type of material that does possess the functional properties of rapid and total recovery, comparatively high void volume and excellent cushion at the nip.

Referring briefly to FIG. 1A, it will be seen that the fragmentary embodiment shown therein relates to the relative condition of the elements at the maximum nip load. For this purpose it will be appreciated that the elements shown in FIG. 1A as well as those shown in FIG. 1B are shown schematically, without attempting to suggest anything more than generalities relative to the comparative sizes of the elements. Thus, the top plain roll 11 and the bottom grooved roll 12 are shown with the web W and the two felts F1 and F2 being squeezed therebetween along a nip load line L. The grooved roll 12 is shown with an imperforate inner metallic shell 12*a* and an outer rubber cover 12*b* with grooves 22*a* and 22*b* therein, the groove mouths have an axial dimension *x* of 0.020 (to 0.025) inch preferably; but *x* may range from a practical minimum of about 0.005 inch to a practical maximum of 0.035 or even up to 0.05 inch using the two felts F1 and F2. The land width *y* is 0.08 (to 0.1) inch preferably, but may range practically from 0.05 to 0.15 or 0.25 inch. Preferably the relationship between grooves and lands is such that the open area is within the practical range of 10% to 40%, preferably 15% to 33⅓%. Here it is 25%. The other aspects of the groove roll are disclosed in the aforesaid Justus patents incorporated herein by reference.

In FIG. 1A the maximum nip load pressure P_m will be exerted against the middle of the land area whereas a minimum nip load pressure P_0 will be exerted opposite the groove mouths. The pressure P_0 depends upon the ability of the felt F2 to bridge the mouth opening; and such pressure will be somewhat lower than the pressure P_m in the middle of the lands. In any event, the felt F2 will be compressed substantially in the nip N–1. The hard dense felt F1 will also be compressed and so will be the web W and the water in the web W will tend to flow very rapidly through both belts F1 and F2 and into the grooves 22*a* and 22*b*, which grooves are designed to have more than ample volume to receive all of the water so expressed. Thus, the groove depth here indicated is 0.125 inch, but in any case the cross sectional area of the groove in the view shown in FIG. 1A is at least 2 x 2, and as here indicated it is 5 x 2, so that there will be no resistance to the flow of water into the grooves 22*a* and 22*b*, or into any other recesses which might be used as water receiving recesses in a press roll in place of the instant grooved roll in the practice of the instant invention.

It will be appreciated that in their compressed forms the felts F1 and F2 will both have a tendency to resist the flow of water more so than they would in uncompressed form, but such latter condition is not possible while the web W is being pressed in the nip. On the other hand, whatever tendency either of the felts F1 and F2 may have to resist the flow of water under ambient atmospheric conditions, this tendency is substantially overcome by the multi-atmospheric pressures there applied at the nip itself.

As indicated in FIG. 1B, however, immediately after separating from the maximum load line at the press nip, the pressure starts to be relieved on the elements between the rolls 11 and 12. Thus, assuming that the felt F2 has actually reached the stage of initial separation from the surface of the roll 12 as indicated by the gap G in FIG. 1B, it will be appreciated that the pressure at the gap G will be substantially that of ambient atmospheric pressure. The felt F2 has expanded, however, as substantially in the process of its brief travel from the maximum nip load condition of FIG. 1A and in expanding the felt F2 will have created an internal subatmospheric pressure or vacuum here designated P_v of perhaps 15 inches of mercury. At the same time, however, the web will have expanded (perhaps less noticeably from the size point of view) and the web will tend to create a vacuum within its fibrous body of perhaps 30 inches of mercury which would be twice the internal vacuum P_v for the felt F2 and such vacuum in the web W is designated P_w. There will also be theoretically at least some tendency for the middle felt F1 to develop subatmospheric pressure within its expanding body, in such pressure is indicated by the reference letter P_f. Because the felt body for the felt F1 is relatively dense and comparatively incompressible it will expand only slightly and its tendency to generate to subatmospheric pressures within its own body will be comparatively nominal, although there will necessarily and theoretically be some tendency to create such pressure P_f, particularly since the porosity in the outside felt F1 is quite fine and even the flow of ambient atmospheric air to fill the voids created by expansion of the felt F1 will be comparatively slow. In the condition shown in FIG. 1B the only access to ambient atmospheric air is through the gap G, however, since separation of the various other elements is not indicated. Thus, any satisfaction of the pressure differentials throughout the elements W, F1 and F2 will have to take place through the contiguous faces of these elements. Thus the very high vacuum within the web W must be satisfied either by the flow of rewetting moisture back through the felts F1 and F2 or by volatilization of whatever moisture is retained in the web W at the very low internal pressures P_w. This latter phenomenon will tend to occur predominantly in the practice of the instant invention because the barrier felt F1 will tend to resist the flow of rewetting water therethrough. Moreover, the lower but still very effective vacuum P_v within the substantially expanded felt F2 will also tend to draw water away from the interface between the two felts F1 and F2 and thus minimize the chances of rewetting water passing through the felt F1 and into the web W. Although the expanding felt F2 will also tend to draw water from

the roll **12**, to the extent that it can, this rewetting of the felt F2 will still involve a certain time element, i.e., it cannot take place instantaneously and it must take place as the water attempts to flow through the porous body of the felt F2. Also, it will be appreciated that the off-running guide roll **14***b* of FIG. 1 tends to hold the off-running reach of the felt F2 at least at the level of the tangent line T (and higher if the arrangement is practical), so that the felt F2 will have a minimum amount of contact with the surface of the grooved roll **12** at the off-running side of the nip N–1. A certain amount of contact is unavoidable and in the course of this contact a certain amount of rewetting of the felt F2 is thus unavoidable. Nevertheless, it will be appreciated that the grooved roll structure **12** is still particularly advantageous from this point of view for the reason that the water that is to rewet the felt F2 must travel up the walls of the grooves **22***a* or **22***b* and then at least half of the land width, i.e., *y*/2, and then up toward the middle of the felt here designated F_m for the felt F2 in order to reach the portion of the felt most remote from the water in the grooves **22***a* and **22***b*. It will be seen that the travel path for moisture in order to satisfy the partial vacuum P_v within the felt F2 is very substantial by virtue of the use of the grooved roll **12** in this arrangement. Thus, satisfaction of this partial vacuum P_v is effectively delayed by the lengthening of the travel path for moisture. Moreover, the times involved at the off-running side of the nip N–1 during which the elements F1 and F2 remain in contact are also limited to some extent, so that the expanded felt F2 will at least temporarily possess the internal vacuum P_v which serves to resist flow of water toward and into the other felt F1 in contact therewith. But it will also be appreciated that the felts F1 and F2 are separated relatively quickly after the press nip N–1, so that as the felt F2 is losing its internal partial vacuum P_v and thus losing its ability to cooperate with the outside felt F1 to resist the flow of water through the felt F1, the felt F2 is also being separated from the felt F1. The timing here is difficult from a theoretical point of view, but essentially the expanded press felt F2 will have its partial vacuum internally during the early stages if not all of the stages of its contact with the felt F1 at the off-running side of the nip N–1. Thus, by separating the felts F1 and F2 at the off-running side of the nip N–1, as quickly as is possible from a practical point of view, it will be appreciated that the desired effect of separating the felt F2 from the felt F1 is achieved in such a way as to minimize the chances of a condition existing whereby the felt F2 will readily convey water to the felt F1 and thus defeate the purpose of the felt F1 in minimizing rewetting of the web W.

I claim as my invention:

1. In a device expressing liquid from a liquid-bearing fibrous web, in combination, a first press roll, a second press roll defining with the first roll a press nip, said second press roll presenting to such press nip a periphery defining a multiplicity of closely spaced lands and recesses, such recesses receiving liquid at the nip and carrying received liquid away from the nip, an inside felt wrapping said second press roll periphery and being formed of a porous body having liquid-permeability and compressibility under super-atmospheric pressure at said nip and having, under subsequent ambient pressure at the off-running side of said nip, fluid-permeability and expansibility tending to generate subatmospheric pressure within the body thereof and, an outside felt interposed between the fibrous web and such inside felt at the nip, said outside felt being formed of a porous body having at least 25% less fluid-permeability than said inside felt at the off-running side of said nip means to separate said inside and outside felts immediately beyond said nip at its off-running side.

2. The device of claim **1** wherein said outside felt has at least 25% less expansibility than said inside felt at the off-running side of said nip.

3. The device of claim **1** wherein said outside felt has at least 25% less compressible volume of voids than said inside felt.

4. The device of claim **1** wherein the second press roll periphery is defined by a plurality of closely spaced generally circumferential lands and grooves.

5. The device of claim **4** wherein the first press roll is a plain smooth roll engaging the fibrous web at such nip.

6. In a device for expressing liquid from a liquid-bearing fibrous web, in combination, a first press roll, a second press roll defining with the first roll a press nip, said second press roll presenting to such press nip a periphery defining a multiplicity of closely spaced lands and recesses, such recesses receiving liquid at the nip and carrying received liquid away from the nip, a press felt wrapping said second press roll periphery and being formed of a porous body having liquid-permeability and compressibility under super-atmospheric pressure at said nip and having, under subsequent ambient pressure at the off-running side of said nip, fluid-permeability and expansibility tending to generate subatmospheric pressure within the body thereof and, another felt interposed between the fibrous web and such press felt at the nip, said other felt being formed of a porous body having at least 25% less expansibility than said press felt at the off-running side of said nip and thereby tending to create less internal subatmospheric pressure than the press felt at the off-running side of said nip means to separate said inside and outside felts immediately beyond said nip at its off-running side.

7. The device of claim **6** wherein said other felt has at least 25% less compressible volume of voids and said other felt has at least 25% less fluid-permeability than said press felt at the off-running side of said nip.

8. The device of claim **7** wherein the second press roll periphery is defined by a plurality of closely spaced generally circumferential lands and grooves.

9. The device of claim **8** wherein the first press roll is a plain smooth roll engaging the fibrous web at such nip.

10. The device of claim **6** wherein the second press roll periphery is defined by a plurality of closely spaced generally circumferential lands and grooves wherein such grooves are sufficiently narrow to substantially preclude entrance of the felt under nip pressure and sufficiently numerous to present a total open area on the surface of not more than substantially 33%.

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REUBEN FRIEDMAN, Primary Examiner

T. A. GRANGER, Assistant Examiner

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,556,940 Dated April 7, 1970

Inventor(s) D. C. Cronin

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 51, "containing" should read--conditioning--.
Column 5, line 39, "is" should read--it--.
Column 6, line 10, "2 x 2" should read--2 x^2--;
line 11, "5 x 2" should read--5 x^2--.
Column 7, line 50, "defeate" should read--defeat--.

Signed and sealed this 21st day of September 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Pate