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METHOD AND APPARATUS FOR TREATING IMPREGNATED FIBER WEBS

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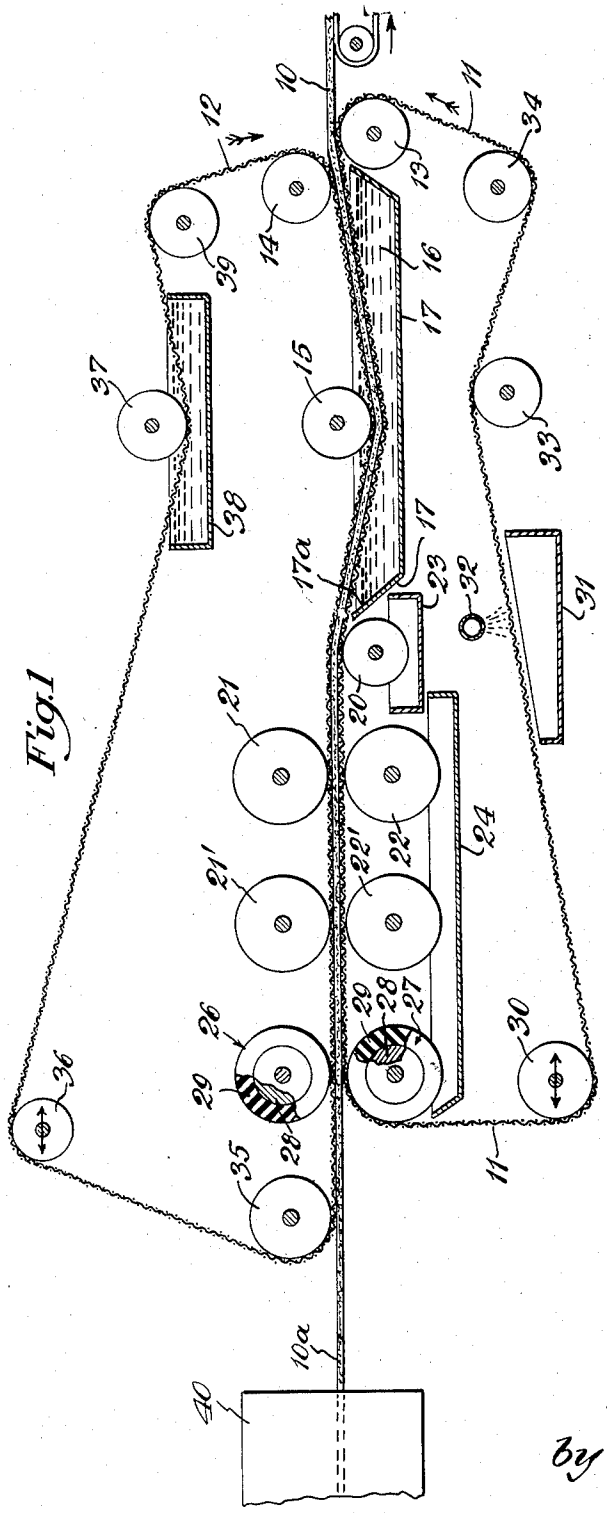


Fig. 1

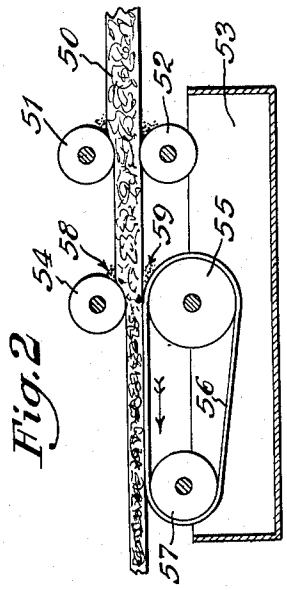


Fig. 2

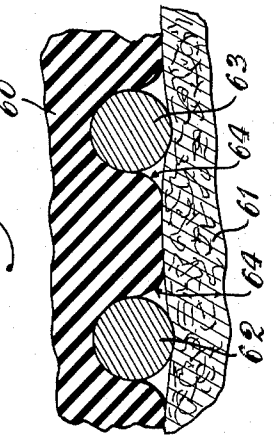


Fig. 3

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METHOD AND APPARATUS FOR TREATING IMPREGNATED FIBER WEBS

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The present invention relates to the production of impregnated fiber webs and in particular to the impregnation of porous fiber felts and the subsequent consolidation thereof.

The term "consolidation" as used in the present invention refers to the increase in percentage of fiber in the product from the initial impregnated state. This involves the loss of volatile liquid from the impregnating bath, which is usually water, but not necessarily so. To do this is to increase the consistency in fiber. An important reason for increasing the consistency of an impregnated web is to decrease the load in volatilizing residual liquid, usually the drying load where the liquid is aqueous. Densification is inherent in squeezing liquid from the web, but densification of the web is not necessarily inherent in the process.

The fiber webs for impregnation by the present invention may be felts, or woven or non-woven fabrics. The web may be such as assembly of fibers that it lacks sufficient strength to be self-supporting during impregnation. For this reason and for others, the invention contemplates supporting the web before, during and after impregnation by carrying means providing openings therethrough for liquid to enter and leave the web, such as an open-mesh wire screen. In the case of loosely felted fiber mats requiring such support, it is common that the surface fibers are so loosely anchored into the web, that they are easily picked off by rolls and other members which contact the web, especially when wet with impregnating liquid. On this account, it is desirable in such cases to house the web between carrying means having open areas therein for use in the impregnation and thereafter until such a condition of the web is attained that the surface fibers are not easily removed, and the web has a self-supporting strength.

As is well known, fiber webs are more easily impregnated when open and porous, which condition results in an excess of impregnating liquid which can be expressed to a greater or less degree by squeezing the mat. Where mats of certain densities are desired, it is common to impregnate a web of lower density and then to express excess liquid and at the same time densify the mat, then to volatilize residual volatile vehicle, usually water.

Economics dictate the desirability of expressing as much as possible of the excess liquid from an impregnated web in preference to volatilizing residual liquid vehicle from the impregnating bath.

The present invention is directed to the economic production of dry impregntaed fiber webs, not only as to processing steps but also as to apparatus useful with a wide range of webs to be impregnated to produce a wide range of impregnated mats.

It is the general object of the invention to nullify the effect of the volume of dead spaces resulting from use of one or two open-area supports or conveyors, such as wire-mesh screens, when expressing liquid from an impregnated web in contact with open-area means, by filling and thereby closing said dead spaces, during expression, thus to preclude both retention of expressed liquid therein and re-

absorption into the mat of liquid contained in said dead air spaces.

It is one object of the invention to carry a web through an impregnating step and at least one densifying step on a supporting foraminous carrier, and to effect a final squeeze on such assembly by means entering and substantially filling the openings in the carrier.

It is also an object of the invention to house a web to be impregnated between two foraminous carriers for impregnating and densifying it, and to effect the final squeeze on such assembly by means entering the openings of the two carriers.

It is a particular object of the invention to provide pressing means for a wet impregnated web comprising a wire-mesh screen for facial contact with the web and a pressing roll having a soft yielding and resilient surface layer for entering the interstices of the screen, the screen structure and the character of the surface of the roll being mutually adapted to each other so as to effect at the height of the pressing step a substantial elimination of liquid-holding spaced within the faces of the screen.

Various other and ancillary objects and advantages of the invention will become apparent from the following description and explanation of the invention in its presently preferred embodiment, which is given in connection with the accompanying drawing in which:

Fig. 1 represents diagrammatically one use of the process in suitable apparatus to provide impregnated webs for drying.

Fig. 2 represents another embodiment of the invention suitable for self-sustaining impregnated webs.

Fig. 3 is an enlarged detailed view illustrating a principle involved.

The web to be impregnated may be one or more layers of fiber structures, either felted, or woven, or combed, or carded. For universal use, the apparatus shown in Fig. 1 is provided with two carriers for the web. The bottom carrier serves to support those webs which have no self-sustaining strength either before, during or after impregnation. The upper carrier, as well as the lower carrier, serves to prevent the lifting and eroding of loose fibers from the web as it passes through the process.

The carriers may vary over a wide variety of structures, so long as each provides areas of facial contact with the web and open areas to expose the web. A series of parallel wires or ribbons is suitable, as is a continuous sheet having a multiplicity of openings therein. However, the preferred and practical carriers are wire-mesh screens, which are chosen for illustrating and explaining the invention, without any intention of limiting the invention thereto.

The invention may be practiced on a dry unbonded fiber felt of wood fibers, textile fibers, or mixtures of other short and long fibers. Such a web having a density of about 1 lb. per cu. ft. has little strength to sustain it over a horizontal span, and its fibers are so loosely held that they are easily picked off. Consequently, such a web is housed between two open-carriers for impregnation. So housed, as between wire-mesh screens, it is immersed in a liquid impregnating bath. Being of low density it is easily impregnated, an on removal from the bath it carries a large excess of the liquid. The assembly may be passed through one or more sets of squeeze rolls to attain increased density and then dried. Drying time and cost increase with the amount of residual liquid in the densified web, and also are greater the less dense the web. It is, therefore, an important objective to effect the minimum of residual liquid for the density achieved.

In developing the present invention wherein there is a final squeeze by hard rolls on an assembly of an impregnated web and two housing screens, disadvantages have been encountered. It was observed that the screens,

used as endless conveyers, were quite wet with expressed liquid as the screens parted from the compressed felt. It was found that the openings in the screens at the height of the compression were pockets closed at one face by the compressed felt and at the other by the pressing roll, and such pockets were full of expressed liquid. On leaving the roll, and removing the web from the screens, the bulk of the pocketed liquid went back into the web, and the remainder wetted the pressing roll and the screen. The screen was washed to recover the impregnant and to remove fibrous deposits therein, but the roll gradually accumulated solids with disadvantage. The return of liquid from the screen into the web decreased the consistency requiring added time and cost to dry the web.

To overcome all these disadvantages, a wire screen and a pressing roll for it are chosen as a working combination such that at the height of the squeeze the surface of the pressing roll deforms and enters the openings of the screen, substantially filling them and providing against the web a substantially continuous face consisting of the screen face and at the screen openings the intruding surface of the roll.

Such a roll surface is preferably one which is non-absorptive of the impregnating liquid, and it should be inert to the liquid and sufficiently soft, yielding and resilient to function as described without acquiring a permanent set. Felt-covered rolls are suitable, but rubber-faced rolls are more desirable. Suitable rubber therefor is obtainable in varying degrees of softness. The wire-size of the screen, the character of its weave, and the size of the openings, as well as the character of the rubber, are chosen for mutual cooperation as described.

The apparatus shown in Fig. 1 is suitable for use with the low-density webs referred to, and although all the parts are not essential for other webs such as woven fabrics, the apparatus as shown may be used with any web.

In Fig. 1 the numeral **10** represents any web to be impregnated, as for example, a web of 80% cotton fibers, 20% sulfite fibers, having a density of 0.98 lb. per cu. ft. and a thickness of 0.9 inch. As formed dry on a cylinder machine it has a tensile strength along the web of 5 grams, and across the web of 30.7 grams, as pull on a 1-inch width.

The web **10** is fed over a short span from its forming machine between two endless wire screen conveyers **11** and **12** traveling in the same direction and at the same velocity as the web **10**. Screen **11** rides up to and over roll **13** to act as a receiving surface for web **10**. Screen **12** rides down to and under roll **14** to ride on top of web **10**. The resulting assembly dips down under roll **15** which is partly immersed in a liquid bath **16** in open tank **17**, the liquid **16** being any impregnating liquid, for example, a latex dispersion later described. In the tank, the path and speed of travel of the moving assembly are sufficient to allow much of the air in the mat to be replaced by liquid. By virtue of the moderate tension maintained in the two endless screens, the web is subjected to a light compression as the assembly passes beneath roll **15**, and on leaving the roll **15** the web expands to a degree dependent upon its resiliency and in so doing the web draws into it the surrounding impregnant. The overly soaked assembly rides up and over roll **20** and horizontally forward into a squeezing zone. The squeezing zone may have one or more pairs of squeeze rolls of any kind, for example, steel rolls **21** and **22** set to squeeze residual air and liquid from the web by a momentary compression, followed by slight inherent expansion of the web to provide a less-than-saturated web. Where more than one pair of squeeze rolls is employed, as for example the two pair **21—22** and **21'—22'** illustrated, they are set to act progressively, each adding an increment of density to the web. Drip tank **23** underlies roll **20** and the top edge **17a** of tank **17** overlies one end of drip tank **23** of which the other end lies over drip tank **24**. Drip tank **24** underlies the described squeeze rolls in the squeezing zone, as well as a final set of squeeze rolls to be particularly described below.

When the screen-web assembly leaves the squeeze rolls **21—22** and **21'—22'**, the interstices of the screens are variously wet or loaded with some of the excess liquid squeezed from the web, which latter, as said above, is less than saturated, and therefore receptive of more liquid. On release of pressure from each set of rolls, the expanding mat draws in the pool of liquid filling the screen openings under the steel rolls at the height of the compression. The assembly then passes between a pair of final squeeze rolls **26** and **27** each with a steel core **28** and heavy layer of suitably soft elastic material **29**, such as rubber for use with latex dispersion, adapted in its degree of softness to deform and enter the chosen size of mesh in screens **11** and **12**, under the squeezing pressure employed, and adapted by its elasticity substantially to restore its form on removal from contact with the screen. A further compression of the web thus occurs, not solely between the wire strands of screens **11** and **12** but between substantially continuous surfaces composed of said wire strands and the intruding areas of the soft material **29** at the interstices of the screens. This prevents accumulation of liquid in the openings of the screens, causing all the excess to be expressed, and causing the mat to hold the minimum of liquid for the prevailing compression. Thus, on release of the assembly, the impregnated web expands slightly presenting surfaces free from liquid as such, and the soft faces of rolls **26—27** withdraw from the screens leaving them partially cleaned for return to the entering web **10**.

Lower screen **11** turns down under a roll **30** which is arranged for horizontal adjustment as a take-up for tensioning screen **11**. The screen **11** then runs over a tank **31** where a sprayer **32** washes water through the screen to clean it. The washings so procured may be used to dilute a supply of more concentrated latex. Then the washed screen **11** runs over guide roll **33** and idler roll **34** back to roll **13**. Screen **12** runs over a roll **35** in leaving the web, which roll may be a drive roll, over adjustable take-up roll **36**, under guide roll **37** which may dip in a washing tank **38** of latex to remove stray fibers, then over roll **39** and down to entering roll **14** over web **10**. Numeral **10a** represents the impregnated web freed from the screens and of self-sustaining density, moving to a suitable drier **40**.

The apparatus for carrying out the process of the invention need not be as described. For example, the squeeze rolls **21** and **22** or the pair **21'—22'**, or both of them, need not be the hard-faced rolls mentioned. These also may have soft faces to enter the open spaces of the carriers on which they ride. However, the final squeeze over an open carrier is the one wherein it is important that the squeeze roll enter the carrier.

Where the web employed is such that the upper conveyer **12** may be dispensed with, the final squeeze roll for the upper face of the web may be a hard-faced roll in the absence of a screen or other open member between the roll and the web.

Fig. 2 represents a modified form of apparatus in which an impregnated web **50** of self-sustaining character passes through two steel pressing rolls **51** and **52** over drip tank **53**, and then between two pressing rolls **54** and **55**. Upper roll **54** is shown as a hard-surfaced roll, and lower roll **55** is a soft rubber-surfaced roll to enter the openings of endless open-area carrier **56**. Carrier **56** is a series of parallel ribbons, wires or tapes, running between driving and guiding roll **57** and the press roll **55**. Drip tank **53** lies below rolls **55** and **57**, to catch the liquid draining from the pools indicated

by numerals 58 and 59 at the nips of the web and the rolls.

Fig. 3 illustrates in a general way the action of a soft pressing roll 60 on a web 61 with an open-area carrier between them. The numerals 62 and 63 represent two members of the carrier, such as two adjacent wires of a screen, or two parallel strands of carrier 56 in Fig. 2. The surface 64 of roll 60 deforms and enters the opening between members 62 and 63 substantially closing the opening. In doing so, there are incidental advantages. There is a slight rubbing action between the face 64 and the carrier, which is accumulative to clean the carrier and the surface 64 of roll 60, with the result in the apparatus of Fig. 1 that rolls 26 and 27 are maintained cleaner than the hard rolls 21—22 and 21'—22', and in apparatus of Fig. 2, roll 55 is maintained cleaner than rolls 51, 52 and 54. Where this advantage becomes important, depending upon the concentration and type of impregnant, it is of advantage to employ screens or other open-area carriers at both faces of the mat and to provide all the pressing rolls with soft resilient surfaces for entry into the open areas of the carriers.

The invention may be practiced with a wide variety of liquid impregnants, preferably aqueous, to avoid the dangers of volatile organic liquid vehicles. The following are examples of impregnating liquid useful in the present invention, giving rise to the advantages described above.

The following compositions are illustrative, but not given as limitations:

Composition A

Latex solids (butadiene styrene-medium styrene) ----------pounds--	50
Stabilizer solids (as 10% dispersion of alkali-soluble copolymer of styrene) ----------grams--	23
Antioxidant solids (as a 23.5% dispersion primarily of polymerized trimethyl dihydroquinoline ----------grams--	66.0
Wetting agent (alkyl aryl polyether alcohol) do----	640
Water to make 42.2 gallons.	

The foregoing composition is merely representative of desirable latex dispersions. The latex may vary in kind and in concentration, being at about 14% concentration in Composition A. The antioxidant is used to preserve the latex solids in the finished fabric. The stabilizer serves to maintain the emulsion during use against coagulation. The wetting agent assists the emulsion in penetrating the fabric. The functions of these ingredients, and numerous agents for those functions, are well known, and are available for compounding similarly useful latex impregnating baths. It is pointed out that these agents are not all employed as the single ingredient. For example, the functioning antioxidant and stabilizer ingredients of Composition A are first prepared in stable dispersion form with appropriate ingredients, and such dispersions are used as the supply drawn upon for compounding the impregnating bath.

Composition B (containing carboxy methyl cellulose)

Latex solids (as a commercial dispersion butadiene styrene-medium styrene, containing antioxidant) ----------pounds--	19
Carboxy methyl cellulose (high viscosity) dissolved in water ----------grams--	360
Stabilizer solids (as 10% dispersion of alkali-soluble copolymer of styrene) ----------grams--	7.5
Wetting agent (alkyl aryl polyether alcohol) do----	640
Water to make 42.2 gallons.	

In the above, the latex solids are present at about 5.5% concentration. The carboxy methyl cellulose is a thickening agent desirable with a lower concentration of latex solids.

Composition C

Enzyme-converted starch ----------pounds--	22.1
Wetting agent ----------grams--	640
Water to make 42.2 gallons.	

From the foregoing it will be appreciated that the invention may be carried out in a variety of ways other than those described, without departing from the spirit and scope of the invention as expressed in the appended claims.

I claim:

1. The method which comprises continuously conveying a porous fiber web in facial contact with at least one open-area carrier, passing the resulting assembly through a bath of impregnating liquid consisting of dispersed solids and volatile dispersing liquid vehicle therefor, thereby filling the pores of said web with said liquid and thereby loading the open-area carrier with said liquid, passing the resulting loaded assembly through at least one area of compression and thereby densifying the web and expressing liquid from the web in part through said carrier, whereby the openings in said carrier retain expressed liquid, passing the resulting assembly through a compression zone and compressing the web over substantially the entire area thereof within said zone including substantially all the area of the web exposed to the open area of said carrier, said last-mentioned compression of the web being effected by pressing onto the carrier the surface of resilient compressing material capable of entering the open areas and therein compressing the web while also compressing the carrier, thereby densifying the web and removing residual liquid from the open area of said carrier and excess liquid from the web, removing the resulting web from the resulting cleaned carrier, and volatilizing from the web the residual liquid vehicle.

2. The method which comprises continuously conveying a porous fiber web in facial contact with and between two open-area carriers moving in the same direction at the same velocity, passing the resulting assembly through a bath of impregnating liquid consisting of dispersed solids and volatile dispersing liquid vehicle therefor, thereby filling the pores of said web with said liquid and thereby loading the carriers with said liquid, passing the resulting loaded assembly through at least one area of compression and thereby densifying the web and expressing liquid from the web through said carriers, whereby the open areas of said carriers retain expressed liquid, passing the resulting assembly through a compression zone and compressing the web over substantially the entire area thereof within said zone including substantially all the areas of the web exposed to the open areas of said carriers, said last-mentioned compression of the web being effected by pressing onto the carriers the surfaces of resilient compressing material capable of entering the open areas and therein compressing the web while also compressing the carriers, thereby densifying the web and removing residual liquid from the open area of said carriers and excess liquid from the web, removing the resulting web from said carriers, and volatilizing from the web the residual liquid vehicle.

3. The method which comprises continuously conveying a web of porous fiber felt in facial contact with and between two open-area carriers moving in the same direction at the same velocity, passing the resulting assembly through a bath of impregnating liquid consisting of dispersed solids and volatile dispersing liquid therefor, thereby filling the pores of said felt with said liquid and thereby loading said carriers with said liquid, passing the resulting loaded assembly through at least one area of compression and thereby densifying the felt and expressing liquid from the felt through said carriers, whereby the open areas of said carriers retain expressed liquid, passing the resulting assembly through a compression zone and compressing the felt over substantially the entire area

thereof within said zone including substantially all the areas of the felt exposed to the open areas of said carriers, said last-mentioned compression of the felt being effected by pressing onto the carriers the surfaces of resilient compressing material capable of entering the open areas and therein compressing the felt while also compressing the carriers, thereby densifying the felt and removing residual liquid from the open area of said carriers and excess liquid from the felt, removing the resulting felt from said carriers, and volatilizing from the felt the residual liquid vehicle.

4. The method which comprises continuously conveying a porous felt of unbonded fibers in facial contact with and between two endless open-area carriers moving in the same direction at the same velocity, passing the resulting assembly through a bath of impregnating liquid consisting of dispersed solids and volatile dispersing liquid therefor, thereby filling the pores of said felt with said liquid and thereby loading said carriers with said liquid, passing the resulting loaded assembly through at least one area of compression and thereby densifying the felt and expressing liquid from the felt through said carriers, whereby the open areas of said carriers retain expressed liquid, passing the resulting assembly though a compression zone and compressing the felt over substantially the entire area thereof within said zone including substantially all the areas of the felt exposed to the open areas of said carriers, said last-mentioned compression of the felt being effected by pressing onto the carriers the surfaces of resilient compressing material capable of entering the open areas and therein compressing the felt while also compressing the carriers, thereby densifying the felt and removing residual liquid from the open area of said carriers and excess liquid from the felt, removing the resulting felt from said carriers, and volatilizing from the felt the residual liquid vehicle.

5. The method which comprises continuously conveying a porous fiber web in facial contact with at least one open-area carrier, passing the resulting assembly through a bath of impregnating liquid consisting of dispersed solids and volatile dispersing liquid therefor, thereby filling the pores of said web with said liquid and thereby loading said carrier with said liquid, whereby the openings in said carrier retain expressed liquid, passing the resulting assembly through a compression zone and compressing the web over substantially the entire area thereof within said zone including substantially all the area of the web exposed to the open area of said carrier, said last-mentioned compression of the web being effected by pressing onto the carrier the surface of resilient compressing material capable of entering the open areas and therein compressing the web while also compressing the carrier, thereby densifying the web and removing residual liquid from the open area of said carrier and excess liquid from the web, removing the resulting web from said carrier, and volatilizing from the resulting impregnated web the residual liquid vehicle.

6. The method which comprises continuously conveying a porous fiber web in facial contact with and between two open-area carriers moving in the same direction at the same velocity, passing the resulting assembly through a bath of impregnating liquid consisting of dispersed solids and volatile dispersing vehicle therefor, thereby filling the pores of said web with said liquid and thereby loading said carriers with said liquid, whereby the open areas of said carriers retain expressed liquid, passing the resulting assembly through a compression zone and compressing the web over substantially the entire area thereof within said zone including substantially all the areas of the web exposed to the open areas of said carriers, said last-mentioned compression of the web being effected by pressing onto the carriers the surfaces of resilient compressing material capable of entering the open areas and therein compressing the web while also compressing the carriers, thereby densifying the web and removing residual liquid from the open area of said carriers and excess liquid from the web, removing the resulting web from said carriers, and volatilizing from the resulting impregnated web the residual liquid vehicle.

7. The method which comprises continuously impregnating a porous fiber web with impregnating liquid consisting of dispersed solids and volatile dispersing liquid vehicle therefor, placing the impregnated web in facial contact with at least one open-area carrier, passing the resulting assembly through a compression zone and compressing the web over substantially the entire area thereof within said zone including substantially all the area of the web exposed to the open area of said carrier, said last-mentioned compression of the web being effected by pressing onto such carrier the surface of resilient compressing material capable of entering the open areas and therein compressing the web while also compressing the carrier, thereby densifying the web and removing liquid from the web through said carrier, removing the resulting web from said carrier, and volatilizing from the web the residual liquid vehicle.

8. The method which comprises continuously impregnating a porous fiber web with impregnating liquid consisting of dispersed solids and volatile dispersing liquid vehicle therefor, placing the impregnated web between two open-area carriers, passing the resulting assembly through a compression zone and compressing the web over substantially the entire area thereof within said zone including substantially all the area of the web exposed to the open areas of said carriers, said last-mentioned compression of the web being effected by pressing onto said carriers the surfaces of resilient compressing material capable of entering the open areas and therein compressing the web while also compressing the carrier, thereby densifying the web and removing liquid from the web through said carriers, removing the resulting web from said carriers, and volatilizing from the web the residual liquid vehicle.

9. The method of increasing the fiber consistency of a fiber web containing expressible liquid while said web is in facial contact with conveying means having open areas of appreciable depth from face to face thereof, which comprises substantially filling said open areas with resilient material arranged to press on said conveying means, while filling said open areas, in a narrow linear band crossing said conveying means and simultaneously applying pressure to said resilient material and thereby compressing the said conveying means and said web along said band, whereby to express liquid from the open areas of said conveying means and from said web, and relatively moving said band progressively in one direction along the extent of said web.

10. The method of increasing the fiber consistency of a fiber web containing expressible liquid while said web is housed between and in facial contact with two conveying means each having open areas of appreciable depth from face to face thereof, which comprises substantially filling the open areas of the said two conveying means with resilient material arranged to press on said conveying means while filling said open areas in narrow linear bands opposite each other and simultaneously applying pressure to said resilient material and thereby compressing the assembly of said web and said conveying means along said bands, whereby to express liquid from the open areas of said conveying means and from said web, and relatively moving said bands progressively in one direction along the extent of said web.

11. Apparatus for impregnating a fiber web comprising at least one open-area conveyer for a porous fiber web to be impregnated in facial contact with said conveyer, an immersion tank for impregnating liquid adapted to receive said assembly of carrier and web for immersion in liquid in said tank, means initially to compress

and then release the resulting impregnated assembly for expressing excess liquid in part through the open areas of said conveyer, and final means to compress and then release the resulting assembly, said final compression means being positioned to contact said conveyer and having soft elastic material adapting it by its softness to deform and enter the openings of said conveyer and contact the web and by its elasticity adapting it substantially to restore its form on removal from contact with the conveyer.

12. Apparatus for impregnating a fiber web comprising two open-area conveyers for housing in facial contact between them a porous fiber web to be impregnated, an immersion tank for impregnating liquid adapted to receive the resulting assembly for immersion of liquid in said tank, means initially to compress and then release the resulting impregnated assembly for expressing excess liquid therefrom through the open areas of said conveyers, and final means to compress and then release the resulting assembly, said last means being positioned to contact said conveyer and having soft elastic material at the pressing surfaces adapting it by its softness to deform and enter the open areas of said conveyers and contact the web and by its elasticity adapting it substantially to restore its form on removal from contact with the conveyer.

13. Apparatus for continuously impregnating a continuously moving porous fiber web comprising at least one endless open-area conveyer for carrying said web in facial contact therewith, an immersion tank for impregnating liquid, means to move the resulting assembly into and out of liquid in said tank for impregnating the web, a pair of squeeze rolls for compressing and then releasing the impregnated assembly in passage between them whereby to express excess liquid in part at least through the open areas of said conveyer, and an additional pair of squeeze rolls for compressing and then releasing the resulting assembly in passage between them, said last-mentioned pair of rolls having soft elastic material positioned to contact said conveyer and adapting the pair by its softness to deform and enter the open areas of said conveyer and contact the web and by its elasticity adapting it substantially to restore its form on removal from contact with the conveyer.

14. Apparatus for continuously impregnating a continuously moving porous fiber web comprising a pair of endless open-area conveyers arranged to move together at the same velocity and to receive between them and carry a porous fiber web in facial contact therewith, an immersion tank for impregnating liquid, means to move the resulting assembly into and out of liquid in said tank for impregnating the web, a pair of squeeze rolls for initially compressing and then releasing the impregnated assembly in passage between them whereby to express excess liquid through the open areas of said conveyers, and an additional pair of squeeze rolls for finally compressing and then releasing the resulting assembly, said last-mentioned pair of squeeze rolls having surface layers of soft elastic material adapting the pair by its softness to deform and enter the open areas of said conveyers and contact the web and by its elasticity adapting it substantially to restore its form on removal from contact with the conveyer.

15. Apparatus for impregnating a web comprising at least one open-area conveyer for a porous fiber web to be impregnated in facial contact with said conveyer, an immersion tank for impregnating liquid adapted to receive said conveyer-web assembly for immersion in liquid in said tank, and means to compress and then release the impregnated assembly, said means having soft elastic material positioned to contact said conveyer and adapting it by its softness to deform and enter the open areas of said conveyer and contact the web and by its elasticity adapting it substantially to restore its form on removal from contact with the conveyer.

16. Apparatus for impregnating a web comprising two open-area conveyers for housing in facial contact between them a porous fiber web to be impregnated, an immersion tank for impregnating liquid adapted to receive the resulting assembly for immersion of liquid in said tank, and means to compress and then release the impregnated assembly, said means having soft elastic material at the pressing surfaces adapting it by its softness to deform and enter the open areas of said conveyers and contact the web and by its elasticity adapting it substantially to restore its form on removal from contact with the conveyer.

17. Apparatus for continuously impregnating a continuously moving porous fiber web comprising at least one endless open-area conveyer for carrying said web in facial contact therewith, an immersion tank for impregnating liquid, means to move the resulting assembly into and out of liquid in said tank for impregnating the web, and a pair of squeeze rolls for compressing and then releasing the impregnated assembly in passage between them, one of said rolls being positioned to contact a conveyer and having soft elastic material adapting it by its softness to deform and enter the open area of said conveyer and contact the web and by its elasticity adapting it substantially to restore its form on removal from contact with the conveyer.

18. Apparatus for continuously impregnating a continuously moving porous fiber web comprising a pair of endless open-area conveyers arranged to move together at the same velocity and to receive between them and carry a porous fiber web in facial contact therewith, an immersion tank for impregnating liquid, means to move the resulting assembly into and out of liquid in said tank for impregnating the web, hard-surfaced squeeze rolls for compressing and then releasing the impregnated assembly in passage between them whereby to express excess liquid through the openings of said conveyers, and a pair of squeeze rolls for compressing and then releasing the impregnated assembly, said last-mentioned rolls having surface layers of soft elastic material adapting the pair by its softness to deform and enter the open areas of said conveyers and contact the web and by its elasticity adapting it substantially to restore its form on removal from contact with the conveyer.

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