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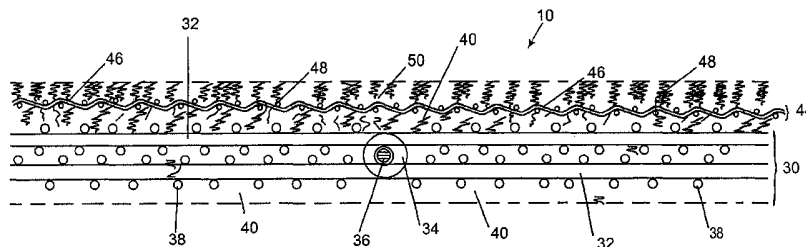
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(54) Title: STRATIFIED PRESS FABRIC



(57) Abstract: A stratified press fabric (10) for the press section of a paper machine includes a base fabric (30) in the form of an endless loop. A first staple fiber batt material (40) is attached to the outer side of the base fabric (44) by needling. A fine fabric covers the first staple fiber batt material, and a second staple fiber batt material (50) is attached to the fine fabric by needling. The fibers making up the second staple fiber material are finer, that is, of smaller diameter or denier, than the fibers making up the first staple fiber material. The fine fabric prevents the coarser fibers of the first staple fiber batt material from being needled therethrough to mix with the finer fibers of the second fiber batt material.

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STRATIFIED PRESS FABRIC

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 The present invention relates to the papermaking arts. More specifically, the present invention relates to press fabrics for the press section of a paper machine.

10 2. Description of the Prior Art

During the papermaking process, a cellulosic fibrous web is formed by depositing a fibrous slurry, that is, an aqueous dispersion of cellulose fibers, onto a moving forming fabric in the forming section of a paper machine. A large amount of water is drained from the slurry through the forming fabric, leaving the cellulosic fibrous web on the surface of the forming fabric.

The newly formed cellulosic fibrous web proceeds from the forming section to a press section, which includes a series of press nips. The cellulosic fibrous web passes through the press nips supported by a press fabric, or, as is often the case, between two such press fabrics. In the press nips, the cellulosic fibrous web is subjected to compressive forces which squeeze water therefrom, and which adhere the cellulosic fibers in the web to one another to turn the cellulosic fibrous web into a paper sheet. The water is accepted by the press fabric or fabrics and, ideally, does not return to the paper sheet.

The paper sheet finally proceeds to a dryer section, which includes at least one series of

rotatable dryer drums or cylinders, which are internally heated by steam. The newly formed paper sheet is directed in a serpentine path sequentially around each in the series of drums by a dryer
5 fabric, which holds the paper sheet closely against the surfaces of the drums. The heated drums reduce the water content of the paper sheet to a desirable level through evaporation.

It should be appreciated that the forming,
10 press and dryer fabrics all take the form of endless loops on the paper machine and function in the manner of conveyors. It should further be appreciated that paper manufacture is a continuous process which proceeds at considerable speeds. That
15 is to say, the fibrous slurry is continuously deposited onto the forming fabric in the forming section, while a newly manufactured paper sheet is continuously wound onto rolls after it exits from the dryer section.

20 The present invention relates specifically to the press fabrics used in the press section. Press fabrics play a critical role during the paper manufacturing process. One of their functions, as implied above, is to support and to carry the paper
25 product being manufactured through the press nips.

Press fabrics also participate in the finishing of the surface of the paper sheet. That is, press fabrics are designed to have smooth surfaces and uniformly resilient structures, so that, in the
30 course of passing through the press nips, a smooth, mark-free surface is imparted to the paper.

Perhaps most importantly, the press fabrics accept the large quantities of water extracted from the wet paper in the press nip. In order to fulfill this function, there literally must be space, commonly referred to as void volume, within the press fabric for the water to go, and the fabric must have adequate permeability to both water and air for its entire useful life. Finally, press fabrics must be able to prevent the water accepted from the wet paper from returning to and rewetting the paper upon exit from the press nip.

Contemporary press fabrics are produced in a wide variety of styles designed to meet the requirements of the paper machines on which they are installed for the paper grades being manufactured. Generally, they comprise a woven base fabric into which has been needled a batt of fine, nonwoven fibrous material. The base fabrics may be woven from monofilament, plied monofilament, multifilament or plied multifilament yarns, and may be single-layered, multi-layered or laminated. The yarns are typically extruded from any one of the synthetic polymeric resins, such as polyamide and polyester resins, used for this purpose by those of ordinary skill in the paper machine clothing arts.

The woven base fabrics themselves take many different forms. For example, they may be woven endless, or flat woven and subsequently rendered into endless form with a woven seam. Alternatively, they may be produced by a process commonly known as modified endless weaving, wherein the widthwise edges of the base fabric are provided with seaming

loops using the machine-direction (MD) yarns thereof. In this process, the MD yarns weave continuously back-and-forth between the widthwise edges of the fabric, at each edge turning back and forming a seaming loop. A base fabric produced in this fashion is placed into endless form during installation on a paper machine, and for this reason is referred to as an on-machine-seamable fabric. To place such a fabric into endless form, the two widthwise edges are brought together, the seaming loops at the two edges are interdigitated with one another, and a seaming pin or pintle is directed through the passage formed by the interdigitated seaming loops.

Further, the woven base fabrics may be laminated by placing at least one base fabric within the endless loop formed by another, and by needling a staple fiber batt through these base fabrics to join them to one another. One or more of these woven base fabrics may be of the on-machine-seamable type. This is now a well known laminated press fabric with a multiple base support structure.

In any event, the woven base fabrics are in the form of endless loops, or are seamable into such forms, having a specific length, measured longitudinally therearound, and a specific width, measured transversely thereacross. Because paper machine configurations vary widely, paper machine clothing manufacturers are required to produce press fabrics, and other paper machine clothing, to the dimensions required to fit particular positions in the paper machines of their customers. Needless to

say, this requirement makes it difficult to streamline the manufacturing process, as each press fabric must typically be made to order.

In response to this need to produce press fabrics in a variety of lengths and widths more quickly and efficiently, press fabrics have been produced in recent years using a spiral technique disclosed in commonly assigned U.S. Patent No. 5,360,656 to Rexfelt et al., the teachings of which are incorporated herein by reference.

U.S. Patent No. 5,360,656 shows a press fabric comprising a base fabric having one or more layers of staple fiber material needled thereinto. The base fabric comprises at least one layer composed of a spirally wound strip of woven fabric having a width which is smaller than the width of the base fabric. The base fabric is endless in the longitudinal, or machine, direction. Lengthwise threads of the spirally wound strip make an angle with the longitudinal direction of the press fabric. The strip of woven fabric may be flat-woven on a loom which is narrower than those typically used in the production of paper machine clothing.

The base fabric comprises a plurality of spirally wound and joined turns of the relatively narrow woven fabric strip. The fabric strip is woven from lengthwise (warp) and crosswise (filling) yarns. Adjacent turns of the spirally wound fabric strip may be abutted against one another, and the helically continuous seam so produced may be closed by sewing, stitching, melting or welding. Alternatively, adjacent longitudinal edge portions

of adjoining spiral turns may be arranged
overlappingly, so long as the edges have a reduced
thickness, so as not to give rise to an increased
thickness in the area of the overlap. Further, the
5 spacing between lengthwise yarns may be increased at
the edges of the strip, so that, when adjoining
spiral turns are arranged overlappingly, there may
be an unchanged spacing between lengthwise threads
in the area of the overlap.

10 In any case, a woven base fabric, taking the
form of an endless loop and having an inner surface,
a longitudinal (machine) direction and a transverse
(cross machine) direction, is the result. The
lateral edges of the woven base fabric are then
15 trimmed to render them parallel to its longitudinal
(machine) direction. The angle between the machine
direction of the woven base fabric and the helically
continuous seam may be relatively small, that is,
typically less than 10° . By the same token, the
20 lengthwise (warp) yarns of the woven fabric strip
make the same relatively small angle with the
longitudinal (machine) direction of the woven base
fabric. Similarly, the crosswise (filling) yarns of
the woven fabric strip, being perpendicular to the
25 lengthwise (warp) yarns, make the same relatively
small angle with the transverse (cross-machine)
direction of the woven base fabric. In short,
neither the lengthwise (warp) nor the crosswise
(filing) yarns of the woven fabric strip align with
30 the longitudinal (machine) or transverse (cross
machine) directions of the woven base fabric.

In the method shown in U.S. Patent No. 5,360,656, the woven fabric strip is wound around two parallel rolls to assemble the woven base fabric. It will be recognized that endless base fabrics in a variety of widths and lengths may be provided by spirally winding a relatively narrow piece of woven fabric strip around the two parallel rolls, the length of a particular endless base fabric being determined by the length of each spiral turn of the woven fabric strip, and the width being determined by the number of spiral turns of the woven fabric strip. The prior necessity of weaving complete base fabrics of specified lengths and widths to order may thereby be avoided. Instead, a loom as narrow as 20 inches (0.5 meters) could be used to produce a woven fabric strip, but, for reasons of practicality, a conventional textile loom having a width of from 40 to 60 inches (1.0 to 1.5 meters) may be preferred.

U.S. Patent No. 5,360,656 also shows a press fabric comprising a base fabric having two layers, each composed of a spirally wound strip of woven fabric. Both layers take the form of an endless loop, one being inside the endless loop formed by the other. Preferably, the spirally wound strip of woven fabric in one layer spirals in a direction opposite to that of the strip of woven fabric in the other layer. That is to say, more specifically, the spirally wound strip in one layer defines a right-handed spiral, while that in the other layer defines a left-handed spiral. In such a two-layer, laminated base fabric, the lengthwise (warp) yarns

of the woven fabric strip in each of the two layers make relatively small angles with the longitudinal (machine) direction of the woven base fabric, and the lengthwise (warp) yarns of the woven fabric strip in one layer make an angle with the lengthwise (warp) yarns of the woven fabric strip in the other layer. Similarly, the crosswise (filling) yarns of the woven fabric strip in each of the two layers make relatively small angles with the transverse (cross-machine) direction of the woven base fabric, and the crosswise (filling) yarns of the woven fabric strip in one layer make an angle with the crosswise (filling) yarns of the woven fabric strip in the other layer. In short, neither the lengthwise (warp) nor the crosswise (filling) yarns of the woven fabric strip in either layer align with the longitudinal (machine) or transverse (cross-machine) directions of the base fabric. Further, neither the lengthwise (warp) nor the crosswise (filling) yarns of the woven fabric strip in either layer align with those of the other.

As a consequence, the base fabrics shown in U.S. Patent No. 5,360,656 have no defined machine- or cross-machine-direction yarns. Instead, the yarn systems lie in directions at oblique angles to the machine and cross-machine directions. A press fabric having such a base fabric may be referred to as a multi-axial press fabric. Whereas the standard press fabrics of the prior art have three axes: one in the machine direction (MD) , one in the cross-machine direction (CD), and one in the Z-direction, which is through the thickness of the fabric, a multi-axial

press fabric has not only these three axes, but also has at least two more axes defined by the directions of the yarn systems in its spirally wound layer or layers. Moreover, there are multiple flow paths in the Z-direction of a multi-axial press fabric. As a consequence, a multi-axial press fabric has at least five axes. Because of its multi-axial structure, a multi-axial press fabric having more than one layer exhibits superior resistance to nesting and/or to collapse in response to compression in a press nip during the papermaking process as compared to one having base fabric layers whose yarn systems are parallel to one another.

Turning now to the fine, nonwoven fibrous material needled into the base fabric in the production of a contemporary press fabric, many such press fabrics are manufactured with a so-called stratified batt structure.

Stratified batt structures comprise a plurality of batt layers, each of which consists of fibers of a different denier. Typically, a layer or layers of fibrous batt material, consisting of relatively coarse fibers, is needled into the base fabric first. Then, a layer or layers of fibrous batt material consisting of finer fibers are applied over the layers of coarser fibers. The result is a press fabric having high air and water permeability, due to the coarse fibers in the interior batt layers, and a smooth pressing surface with a high degree of pressure uniformity, due to the fine fibers on the surface.

Preferably, the pressing surface of the press fabric will be free of needle tracks, the spaces or holes left where the barbed needles used in the needling process

5 have penetrated the surface. In order to remove the needle tracks from the surface of the press fabric, it is common to needle it from the other side, so that the needles will force batt fiber from within the press fabric outward to fill the needle tracks
10 and smooth the surface of the press fabric. Unfortunately, where the press fabric has a stratified batt structure, this reverse needling forces coarse fibers from within the press fabric to the surface. This compromises the smooth pressure
15 distribution otherwise obtained by the fine surface layer, since coarse fibers are brought up to the surface, and makes it difficult to provide a stratified press fabric that is free of needle tracks.

20 The present invention provides a solution to this problem of the prior art.

SUMMARY OF THE INVENTION

25 Accordingly, the present invention is a stratified press fabric which, like those of the prior art, comprises a base fabric, which is in the form of an endless loop having an outer side and an inner side. A first staple fiber batt material is
30 attached to the outer side of the base fabric. The first staple fiber batt material is composed of a plurality of first staple fibers.

A fine fabric is disposed over the first staple fiber batt material on the outer side of the base fabric, and a second staple fiber batt material is attached to the fine fabric. The second staple fiber batt material is composed of a plurality of second staple fibers which are finer, that is, of smaller diameter or denier, than those of the plurality of first staple fibers.

The first staple fiber batt material is generally attached to the outer side of the base fabric by needling. Similarly, the second staple fiber batt material is generally attached to the fine fabric in the same manner. Inevitably, some needle tracks will remain on the surface of the second staple fiber batt material at the conclusion of the needling process. The number and size of the needle tracks may be diminished by needling from the inner side of the base fabric. With the present invention, the fine fabric, which has openings no larger than 0.50 mm in any dimension, prevents the coarser fibers of the plurality of first staple fibers from being transported up to the paper-contacting surface of the press fabric.

The present invention will now be described in more complete detail, with frequent reference being made to the figures identified below.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic perspective view of the stratified press fabric of the present invention;

Figure 2 is a like view of an alternate embodiment thereof; and

Figure 3 is a cross-sectional view taken as indicated by line 3-3 in Figure 1.

5

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to these figures, Figure 1 is a schematic perspective view of the press fabric 10 of the present invention. Press fabric 10 is of the on-machine seamable variety and takes the form of an endless loop once its two ends 12,14 have been joined to one another at seam 16.

In an alternate embodiment, as shown in schematic perspective view in Figure 2, press fabric 20 has no seam and is in the form of an endless loop.

Figure 3 is a cross-sectional view taken as indicated by line 3-3 in Figure 1. Press fabric 10 includes a base fabric 30. In general, the base fabric 30 may be a woven, nonwoven, nonwoven arrays of MD or CD oriented yarns knitted or braided structure of yarns of the varieties used in the production of paper machine clothing, such as monofilament, plied monofilament and/or multifilament yarns extruded from polymeric resin materials. Resins from the families of polyamide, polyester, polyurethane, polyaramid and polyolefin resins may be used for this purpose.

The base fabric 30 may alternatively be composed of mesh fabrics, such as those shown in commonly assigned U.S. Patent No. 4,427,734 to

Johnson, the teachings of which are incorporated herein by reference. Further, the base fabric 30 may be produced by spirally winding a strip of woven, nonwoven, knitted, braided or mesh material
5 according to the methods shown in commonly assigned U.S. Patent No. 5,360,656 to Rexfelt et al., the teachings of which are incorporated herein by reference. The base fabric 30 may accordingly comprise a spirally wound strip, wherein each spiral
10 turn is joined to the next by a continuous seam making the base fabric 30 endless in a longitudinal direction.

The base fabric 30 may be endless, or, as shown in Figure 3, on-machine-seamable. As shown, base
15 fabric 30 is woven from monofilament yarns in a two-layer, or duplex, weave. Machine-direction yarns 32, which are the weft yarns in the on-machine-seamable base fabric 30, form seaming loops 34 which are interdigitated to create a
20 passage through which a pintle 36 is directed to join the base fabric 30 into endless form. Cross-machine direction yarns 38, which are the warp yarns during the weaving of the base fabric 30, are, like the machine-direction yarns 32, shown to be
25 monofilament yarns for the purposes of illustration.

One or more layers of staple fiber batt material 40 are applied to the outside of base fabric 30, and optionally to the inside as well, and constituent fibers thereof are driven into base
30 fabric 30 by needling. The attachment is effected so as to leave a layer of staple fiber batt material 40

on the outside, and optionally on the inside, of the base fabric 30.

A fine fabric 44 is then disposed on the staple fiber batt material 40 on the outside of the base fabric 30. The fine fabric 44 may be woven or nonwoven, and may be endless, flat-woven or spiraled onto the staple fiber batt material 40. As depicted in Figure 3, the fine fabric 44 is of a single layer weave, such as the plain weave shown, of machine-direction yarns 46 and cross-machine direction yarns 48, both of which may be monofilament yarns. However, yarns other than monofilament yarns may be used in the weaving of the fine fabric 44. Both the yarns 46,48 and the mesh formed by the woven structure of fine fabric 44 are finer than those of base fabric 30.

More generally, fine fabric 44, like base fabric 30, may be a woven, nonwoven, nonwoven arrays of MD or CD oriented yarns, knitted or braided structure of yarns of the varieties used in the production of paper machine clothing, such as monofilament, plied monofilament and/or multifilament yarns extruded from polymeric resin materials. Resins from the families of polyamide, polyester, polyurethane, polyaramid and polyolefin resins may be used for this purpose.

Fine fabric 44 may alternatively be composed of mesh fabrics, such as those shown in commonly assigned U.S. Patent No. 4,427,734 to Johnson, the teachings of which are incorporated herein by reference. Further, the fine fabric 44 may be produced by spirally winding a strip of woven,

nonwoven, knitted, braided or mesh material according to the methods shown in commonly assigned U.S. Patent No. 5,360,656 to Rexfelt et al., the teachings of which are incorporated herein by
5 reference. The fine fabric 44 may accordingly comprise a spirally wound strip, wherein each spiral turn is joined to the next by a continuous seam making the fine fabric 44 endless in a longitudinal direction.

10 If fine fabric 44 is endless, it may be disposed on staple fiber batt material 40 in the manner of a sleeve or sock. Moreover, where fine fabric 44 is endless, or spiraled onto staple fiber batt material 40 in accordance with the teachings of
15 U.S. Patent No. 5,360,656, and base fabric 30 is on-machine-seamable as depicted in Figure 3, it will ultimately be necessary to cut fine fabric 44 transversely in the vicinity of the seam formed by seaming loop 34 and pintle 36 to enable the press
20 fabric 10 to be installed on a paper machine, as is well known to those of ordinary skill in the art.

In any event, fine fabric 44 is so called because its component yarns and/or mesh material are finer (smaller size or diameter, thinner or of
25 smaller denier) than those of base fabric 30, and its mesh is finer than that of base fabric 30. As an example, the fine fabric 44 may have openings no larger than 0.50 mm in any dimension.

Finally, one or more layers of staple fiber
30 batt material 50 are applied to the outside of fine fabric 44, and constituent fibers thereof are driven into and entangled within fine fabric 44 by

needling. The attachment is effected so as to leave a layer of staple fiber batt material 50 on the outside of the fine fabric 44.

5 Staple fiber batt material 40 and staple fiber
batt material 50 may comprise staple fibers of any
polymeric resin used in the production of paper
machine clothing, but are preferably of a polyamide
resin. The staple fibers making up staple fiber
10 batt material 50 may have a smaller cross-sectional
size or diameter or denier than those of staple
fiber batt material 40. For example, the staple
fibers of stable fiber batt material 50 may be of 6
denier, while staple fibers of staple fiber batt
material 40 may be of 24 denier.

15 In contrast to the stratified press fabrics of
the prior art, the fine fibers of staple fiber batt
material 50 are separated from the relatively
coarser fibers of staple fiber batt material 40 by
fine fabric 44. The fine fabric 44 limits the
20 amount by which the fine fibers of staple fiber batt
material 50 penetrate into staple fiber batt
material 40 and base fabric 30 during the needling
of staple fiber batt material 50.

 Moreover, when the backside of the press fabric
25 10 is needled, following the attachment of staple
fiber batt material 50 to the faceside, the fine
mesh of fine fabric 44 prevents the transport of the
relatively coarser staple fibers of staple fiber
batt material 40 into the staple fiber batt material
30 50.

 In the stratified press fabrics of the prior
art, the fine fiber portion may be as great as 75%

fine fiber after needling, while the coarse fiber portion may be as great as 75% coarse fibers, with the remaining 25% of the fibers in each portion being fibers of the opposite kind, driven thereinto
5 by the needling. There is also an intermediate region at the interface between the fine and coarse fiber portions where the fine and coarse fibers are mixed. The present invention may eliminate or substantially reduce this mixing. As a result,
10 there may be little or no coarse fibers of staple fiber batt material 40 on the faceside of the press fabric 10.

In addition, fine fabric 44 provides press fabric 10 with added compaction resistance while
15 minimally impeding water flow.

Among the advantages of the present stratified press fabric 10 are its superior smoothness characteristics, which result from its homogeneous layer of faceside batt. This surface layer imparts a
20 smoother surface to the wet paper web it contacts within a press nip.

The present stratified press fabric 10 minimizes rewet because the homogeneous layer of fine faceside batt permits less water to return to
25 the paper web following exit from a press nip compared to the press fabrics of the prior art. The same uniformity of the pressing surface maximizes the dryness of the paper sheet following exit from the nip. Moreover, the fine, homogeneous, smooth
30 faceside batt makes the press fabric 10 less prone to sheet blowing upon approach to a press nip, and

reduces sheet marking because of its lack of needle tracks.

Of course, the fine fabric 44 is desirably "fine" enough not to mark a paper web through the staple fiber batt material 50 needled thereover, and to prevent relatively coarse staple fiber batt material 40 from mixing with the relatively fine staple fiber batt material 50 during the needling process. Furthermore, the fine fabric 44 may be "fine" enough to inhibit the transport of fibers 50 therethrough and have enough structural integrity to withstand the needling process.

Additionally, fine fabric 44 may be woven or knitted structures produced using yarns (warp and weft) having diameters in the range from 0.04 mm to 0.50 mm. Such yarns may have the same or different diameters or deniers. Further, the yarns may be extruded from polyamide, polyurethane, polyethylene terephthalate (PET), polybutylene terephthalate (PBT), polyolefin and other polymeric resins commonly used for this purpose by those of ordinary skill in the art.

As an example, the fine fabric 44 may be woven from 0.25mm polyamide warp yarns and 0.25-mm polyamide weft yarns, and have eighteen (18) of each per centimeter. Such fabric may have openings, which are approximately 0.30 mm by 0.30 mm, and which are sufficiently small to prevent the needling of coarse batt fibers therethrough from the inner side of the base fabric.

In another example, the fine fabric 44 may be woven from 0.19-mm polyethylene monofilament warp

yarns and 0.25-mm polyethylene monofilament weft
yarns, at a density of 21.4 warp yarns per
centimeter and 18 weft yarns per centimeter. Such
fabric may have openings which are approximately
5 0.28 mm by 0.30 mm.

Fine fabric 44 may alternatively be extruded of
molded films, and may be perforated or unperforated.
In the latter case, perforations will be made during
the needling process. Nonwovens or spun-bonded
10 materials may also be used.

Modifications to the above would be obvious to
those of ordinary skill in the art, but would not
bring the invention so modified beyond the scope of
the appended claims.

What Is Claimed Is:

1. A stratified press fabric for the press section of a paper machine, said press fabric comprising:
- 5 a base support structure, said base support structure being in the form of an endless loop and having an outer side and an inner side;
- a first staple fiber batt material attached to said outer side of said base support structure, said
- 10 first staple fiber batt material comprising a plurality of first staple fibers;
- a fine fabric, said fine fabric covering said first staple fiber batt material on said outer side of said base support structure; and
- 15 a second staple fiber batt material attached to said fine fabric, said second staple fiber batt material comprising a plurality of second staple fibers, said second staple fibers being finer than said first staple fibers,
- 20 wherein said fine fabric limits transfer of said first staple fibers and said second staple fibers therethrough and intermingling of said first staple fibers and said second staple fibers.
- 25 2. A stratified press fabric as claimed in claim 1 wherein said base support structure is a fabric selected from the group consisting of woven, nonwoven, nonwoven arrays of MD or CD oriented yarns, knitted and braided fabrics.

30

3. A stratified press fabric as claimed in claim 2 wherein said base support structure is an extruded mesh fabric.
- 5 4. A stratified press fabric as claimed in claim 1 wherein said base support structure is a strip of material spirally wound in a plurality of turns, each turn being joined to those adjacent thereto by a continuous seam, said base support structure
10 being endless in a longitudinal direction, said strip material being selected from the group consisting of woven fabrics, nonwoven fabrics, knitted fabrics, braided fabrics and extruded mesh fabrics.
- 15 5. A stratified press fabric as claimed in claim 1 wherein said base support structure is an on-machine-seamable fabric.
- 20 6. A stratified press fabric as claimed in claim 1 wherein said fine fabric is a fabric selected from the group consisting of woven, nonwoven, knitted and braided fabrics.
- 25 7. A stratified press fabric as claimed in claim 6 wherein said fine fabric is an extruded mesh fabric.
8. A stratified press fabric as claimed in claim 1 wherein said fine fabric is a strip material
30 spirally wound in a plurality of turns, each turn being joined to those adjacent thereto by a continuous seam, said fine fabric being endless in a

longitudinal direction, said strip material being selected from the group consisting of woven fabrics, nonwoven fabrics, knitted fabrics, braided fabrics and extruded mesh fabrics.

5

9. A stratified press fabric as claimed in claim 1 wherein said fine fabric is an endless fabric.

10. A stratified press fabric as claimed in claim 1
10 wherein said first staple fibers have a first diameter and said second staple fibers have a second diameter which is smaller than said first diameter.

11. A stratified press fabric as claimed in claim 1
15 wherein said first staple fibers have a first cross-sectional size and said second staple fibers have a second cross-sectional size which is smaller than said first cross-sectional size.

20 12. A stratified press fabric as claimed in claim 1 wherein said fine fabric has openings no larger than 0.50 mm in any dimension, so that said first staple fibers are not driven therethrough when said stratified press fabric is needled from said inner
25 side of said base support structure.

13. A stratified press fabric as claimed in claim 1
wherein said support structure is comprised of two or more bases selected from the group consisting of
30 woven, nonwoven, nonwoven arrays of MD or CD yarns, knitted, braided, extruded meshes of film structures.

14. A stratified press fabric for the press section of a paper machine, said press fabric comprising:
- base support structure fabricated from yarns
- 5 having one or more first effective diameter values and arranged so as to have a first mesh arrangement, said base support structure being in the form of an endless loop and having an outer side and an inner side;
- 10 first staple fiber batt material attached to said outer side of said base support structure, said first staple fiber batt material comprising a plurality of first staple fibers having one or more second effective diameter values;
- 15 a fine fabric fabricated from yarns having one or more third effective diameter values and arranged so as to have a second mesh arrangement, said fine fabric arranged on an outer side of said first staple fiber batt material; and
- 20 a second staple fiber batt material attached to said fine fabric, said second staple fiber batt material comprising a plurality of second staple fibers having one or more fourth effective diameter values each smaller than the one or more second
- 25 effective diameter values,
- wherein at least one of the one or more third effective diameter values and openings within said second mesh arrangement are respectively smaller than the one or more first effective diameter
- 30 values and openings within said first mesh arrangement, and

wherein said fine fabric limits transfer of said first staple fibers and said second staple fibers therethrough and intermingling of said first staple fibers and said second staple fibers.

5

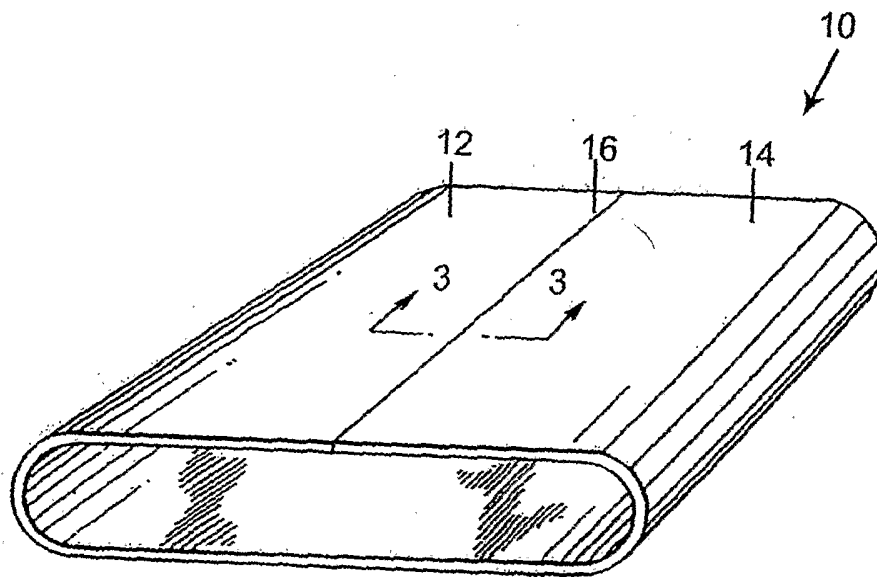


FIG.1

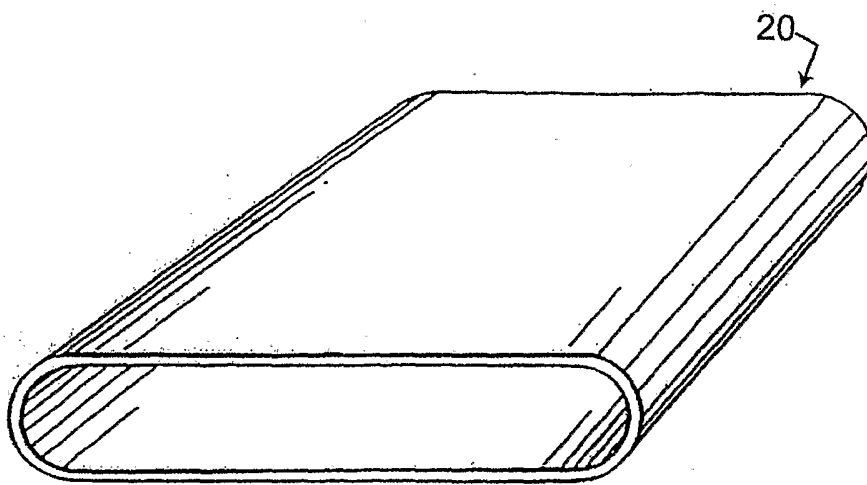


FIG. 2

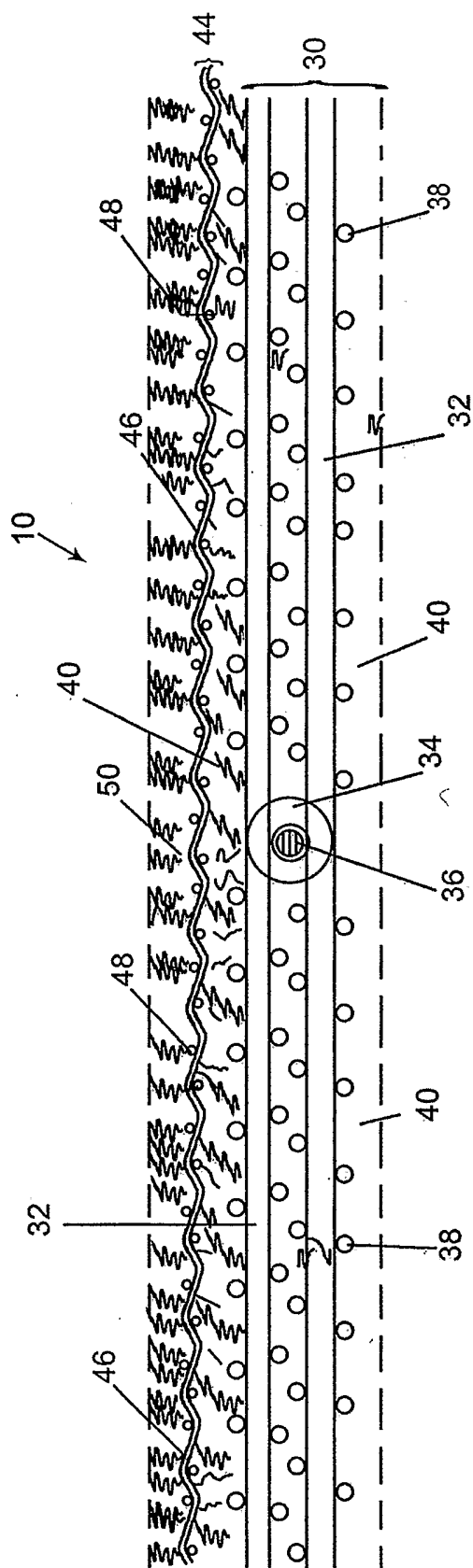


FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/34337

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 D21F7/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 162 190 A (ASHWORTH GORDON) 24 July 1979 (1979-07-24) examples 2-4	1, 14
A	US 3 392 079 A (FEKETE EUGENE Z) 9 July 1968 (1968-07-09) column 7, line 3-16 figure 5	1, 14
A	US 4 781 967 A (LEGGE ROBERT W ET AL) 1 November 1988 (1988-11-01) column 3, line 4 -column 5, line 12 claims 1-3 figure 1	1, 14
	-/--	

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

° Special categories of cited documents :

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- *P* document published prior to the international filing date but later than the priority date claimed

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Date of the actual completion of the international search

4 March 2004

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

Internatio application No
PCT/US 03/34337

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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