The instant invention is directed to a transfer belt or fabric for use in the press section of papermaking machines. The fabric employs a sheath-core composite yarn which may be heated on one or both surfaces so that the sheath component is melted. Melting produces a support layer (26) which is non-porous or substantially non-porous. The core of each yarn (20/22) is unaffected by melting and thus becomes embedded in the support layer (26).
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TRANSFER FABRIC

Background of the Invention

The invention relates to a process for the production of a transfer belt or fabric for use in the press section of papermaking machines and to the transfer belt which has been produced.

In U.S. 5,611,892 a compact pressing arrangement is disclosed, in which the central roller is covered by a stretched conveyor belt and in which the paper is transferred without traction to the dry belt. From DE 43 21 406 A1 two shoe presses functioning separately from each other are known, both of these being covered by an impermeable belt.

U.S. 5,298,124 discloses a transfer belt on which a polymer layer is applied. The base fabric may be woven, knitted or non-woven. The polymer layer may be applied to one or both sides of the support.

The disadvantages with this latter transfer belt have been shown to be that the application of the polymer layer by means of a wiping blade or coating knife is very expensive, because in most cases a subsequent treatment is required such as, the calibration, the surface treatment by grinding, etc. On the whole, it has been found that, while the utilization of a transfer belt to convey the paper sheet in order to keep it free from being drawn does have advantages for the paper sheet, the transfer belt is relatively expensive to produce and may be short-lived.
It is, therefore, the object of the present invention to propose a process for the production of a conveyor or transfer belt or fabric as well as a conveyor or transfer belt or fabric which can be produced relatively easily and which has a long life.

This object is attained by means of a process according to the invention for the production of a conveyor or transfer belt or fabric for a papermaking machine for the production of sheet-shaped products in which manner a flat pre-product is produced which contains a core-and-jacket thread and that the pre-product is applied on or at one of its surfaces by melting, so that a support layer for the sheet-shaped product is created from the material of the jacket of the core-and-jacket thread.

Summary of the Invention

The instant invention is directed to a method of forming a transfer belt which employs core-and-jacket thread which may be treated, e.g. by means of a hot pressing roller on the surface, so that the jacket of the thread is melted forming a support surface which is non-porous or substantially non-porous from this melted-on material. The core of each individual thread is then embedded in this support layer. It is considered to be a great advantage that the pre-product can be produced in a relatively simple manner which may then be again processed farther with relative ease by a heat treatment to become a conveyor belt by melting on the surface. As a rule only a minimum of retouching work is required, because the surface is given the desired form and quality by the hot pressing roller.

The process for forming the transfer belt or fabric of the invention includes:

providing composite yarns comprising continuous filament synthetic core yarns encased in
a jacket formed of synthetic material and providing the jacket with a first melt point and the core yarns with a second melt point higher than the first melt point;

intermeshing the composite yarns to form a continuous porous fabric having a support surface and a running surface;

heating the continuous fabric to a temperature sufficient to cause the synthetic material forming the jacket of the composite yarns, at least adjacent the support surface, to melt and fuse, forming at least the support surface non-porous and to a hardness of Shore harness of A50-A97.

The process includes heating the fabric to a temperature sufficient to melt and fuse the synthetic material forming the jacket of the composite yarns throughout.

The process further includes forming the intermeshing of the yarns by one of weaving, knitting, and coiling.

The process further includes selecting as the synthetic forming the core yarns one of PA, PPS, PE, PET, PEEK, PPA, and PCTA.

The process further includes selecting PU as the synthetic material forming the jacket.

The process further includes forming the fabric as a multi-layered fabric with at least an upper and a lower layer with the yarns of the upper layer being core yarns and the yarns of the lower layer being synthetic filament yarns.

The process finally includes forming the core yarns of one of continuous monofilament and multi-filament yarns and forming the jacket about the core yarns by one
of twisting and fabricating yarns formed of one of continuous and staple filaments and to
a wall thickness of between 0.1 and 1.0 mm.

The transfer fabric of the invention is for use with the press section of a
papermaking machine. It includes a plurality of forming yarns which are intermeshed by
weaving, knitting, or coiling and which are arranged to extend generally longitudinally and
transversely of the fabric. The forming yarns comprise composite yarns having a core
formed of yarns of one of PA, PPS, PE, PET, PEEK, and PCTA which are encased within
a jacket formed of PU. The composite yarns are intermeshed to form the transfer fabric
continuous and to have a support surface and a running surface.

The PU forming the jackets of the composite yarns adjacent the support surface
is fused into a continuous non-porous layer forming the support surface non-porous and to
a Shore hardness of A50 to A97. The yarns forming the core maintain their structural
integrity and provide the transfer fabric with longitudinal and transverse stability.

The jackets, which are formed of PU, of each of the composite yarns may be
fused throughout the transfer fabric forming the entire transfer fabric non-porous and
locking the core yarns in position thereby providing structural integrity throughout.

The transfer fabric may comprise at least an upper and a lower layer with the
PU forming the jackets of the composite yarns forming only the upper layer being fused or
the jackets of the composite yarns forming both layers may be fused. The layers may be
interconnected by laminating or fabricating.
Description of the Drawings

The construction designed to carry out the invention will hereinafter be described, together with other features thereof.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown and wherein:

Figure 1 is a sectional side view of the press section of a papermaking machine incorporating the fabric of the invention;

Figure 2 is a sectional view of a core yarn with a monofilament core;

Figure 3 is a sectional view of a core yarn with a multi-filament core;

Figure 4 is a sectional side view of a pre-product fabric woven with core yarns;

Figure 5 is a sectional top view of the pre-product fabric of Figure 4;

Figure 6 is a sectional side view of a multi-layer pre-product fabric in which only one layer is woven with core yarns;

Figure 7 is a sectional top view of the fabric of Figures 4 or 6 with the jacket melted to form a planar non-porous outer surface;

Figure 8 is a sectional side view of a fused single layer fabric of the invention;

Figure 9 is a sectional side view of a fused multi-layer fabric of the invention;

and,

Figure 10 is a top view of an alternative weave configuration of the pre-product for forming the transfer fabric of the invention.
Description of a Preferred Embodiment

A simple example of the process provides for the core-and-jacket thread to be woven, knitted non-woven or doubled into the pre-product. The pre-product in this case may be in a single layer, several layers and/or with floating thread in the longitudinal direction. As long as it is assured that sufficient jacket material of the core-and-jacket thread is available on the side of the conveyor belt which supports the paper sheet, the form of the base body, whether woven, knitted non-woven or laid down and whether all of the forming yarns are core coated is immaterial. Further, whether the base body is formed endless, formed flat and seamed is immaterial. Also, the type seam employed is immaterial.

The pre-product may be formed with longitudinal yarns being arranged in groups, of up to four yarns, arranged side by side and incorporated into the fabric as a single yarn. In plural layer fabrics, these yarn groups may be limited to the support layer or may appear throughout.

In doubling, a pattern of threads is produced and the individual threads are combined by fusing with each other forming a surface by melting on.

The transfer belt or fabric of the invention is produced by a process according to the invention. The transfer fabric is formed with a support surface which is heat treated to be a planar and non-porous. This surface may consist of a thermoplastic PU, for example, coming from a core-and-jacket thread whose core is surrounded with a thermoplastic PU. The core of the thread is a PA, PPS, PE, PET, PEEK, PPA, PCTA or similar material. As mentioned earlier, the conveyor belt may be in one or several layers.

In case of a multi-layer woven belt, the upper weft is e.g. a core-and-jacket thread with a
PU jacket may form the support surface while the lower weft provides for load absorption through the fact that the lower weft or longitudinal thread is a highly resistant thread.

The core-and-jacket thread may be twisted or not twisted. The core may be a monofilament, multi-filament and twisted or not twisted or knitted. The jacket of the core-and-jacket thread has advantageously a wall thickness from 0.1 to 1.0 mm. In this manner sufficient material for the forming of the support layer is made available.

It is furthermore possible to produce the conveyor belt or transfer fabric from several single layers. For this, the layer towards the paper side is made as described of a woven, doubled or knit layer. Subsequent hot pressing causes this layer to be laminated onto a woven, doubled or knit carrier or inner layer. The carrier layer of the resulting composite structure has as its first task to absorb the longitudinal stress. The carrier layer or layers may or may not be formed of core-and-jacket yarns or only the longitudinal or transverse yarns may be core-and-jacket yarns.

After production of the support layer, which is non-porous, it can be run through a grinding process by which it is calibrated and all markings may be eliminated from the support surface. Alternatively, a desired roughness can also be produced on the support surface. It is furthermore possible to form the thermoplastic support surface afterwards with a desired structure by using a suitably hot engraving roller. It is, for example, possibly by this method to provide the support surface with ridges or grooves oriented in a longitudinal direction which are used to reduce the hydraulic pressure which occurs in the pressing nip.

The support layer has preferably a hardness of Shore A50 to A97.
Turning now to the drawings, Figure 1 shows a schematic of a press section of a papermaking machine. The press section includes a press felt 10 which travels about a plurality of guide rolls and through a pair of press rolls. Also, a transfer fabric 12 which moves about a plurality of rollers and through the press rolls. Transfer fabric 12 receives paper 14 from the press felt and supports or grips it through a capillary action between its support surface and the surface of the paper. This gripping action holds the paper firmly in position as it is carried into and out of the pressure exerted at the press nip by the press rolls as the liquid is forced out and carried off by the press felt.

The strength or force of the gripping action may be varied by providing longitudinal grooves along the support surface which influence the effect of the capillary action in direct proportion to their size. The primary requirement is that the capillary effect be sufficient to maintain the paper engaged with the support surface as it passes through the press rolls.

Upon leaving the press rolls, press felt 10 separates from the paper as the transfer fabric carries it toward a vacuum roll of the dryer section.

The vacuum force of the vacuum rolls is sufficient to separate the paper from the support surface of the transfer fabric and direct it to the dryer section.

Figures 2 and 3 are cross-sections of composite yarns 16 which are acceptable for forming the transfer fabric of the invention. Composite yarn 16 of Figure 2 comprises a monofilament core 20 formed of one of a PA, PPS, PE, PET, PEEK, PPA, or PCTA and a jacket 21 formed of a PU. As is well known, PU has a melting point lower than that of anyone of the core forming materials. Composite yarn 16 of Figure 3 is formed with a
multi-filament core 22 of the same synthetic materials and a jacket formed of a PU. Preferably, the transfer fabric is formed using composite yarns of the same materials throughout, however, this could vary as desired.

Figures 4 and 5 show an example of the fabric of the invention woven as a single layer fabric 24 with composite yarn 16 being used as both the warp and weft. The fabric is formed to a density which, along with the wall thickness of forming jacket 21, is sufficient to cause the forming jacket when heated to its melting point to flow and fuse together so that at least the entire upper surface is formed into a non-porous continuous surface.

Figure 6 shows the fabric of the invention formed as a multi-layered fabric in which the upper or support layer 28 is woven with composite yarns 16 forming both the warp and the weft. Inner layer or carrier fabric 29 is also woven with continuous monofilament or multi-filament yarns forming warp and weft yarns 30, 32. Carrier fabric 29 may or may not be formed simultaneously with support fabric 28. Fabrics 28 and 29 may or may not be formed interconnected. Fabrics 28 and 29 may be formed continuous, in which case the longitudinal yarns are the weft, or it may be formed flat, in which case the longitudinal yarns are the warp yarns.

Yarns 30 and 32 may be formed of any one of a PA, PPS, PE, PET, PEEK, PPA, or PCTA.

Figure 7 shows fabric 24 or fabric 28 after heating, in which support surface 26 is comprised of a continuous non-porous substantially planar surface formed by the fusing
of the PU jackets. It is noted that core yarns 20/22 are not substantially altered and remain in position and are secured relative to each other by the fused PU.

Support surface 26 may be subsequently ground to be completely planar or it may be pressed while malleable with an engraving roller to form longitudinal ridges or grooves.

Figure 8 is a side view of fabric 24 shown as it appears after the fusing of jackets 21, which have formed the fabric to be non-porous. It can be seen that core yarns 20/22 remain in their relative positions and are secured by the fused jacket material. Support surface 26 is indicated on the upper surface.

The multi-layered fabric is shown in Figure 9 which is a side view of the multi-layered fabric of Figure 6 shown after fusing. In upper fabric 28, jackets 21 have been melted and fused together to form upper surface 26 continuous and also to blend and fuse with the yarns of lower fabric layer 29 to laminate it with the upper fabric layer. Here again, the number of layers is optional and the number of layers formed with the composite yarn is optional.

Turning to Figure 10, an alternative interlacing configuration is shown for the formation of support fabric 33. In this example, longitudinal or warp yarns are arranged in groups of four as indicated at 34 and woven as a single yarn. The transverse or weft yarns 36 are woven individually with the warp groups 34. The fabric of Figure 10 may individually comprise the transfer fabric or it may be incorporated with a carrier fabric in the manner shown in Figure 9. Fabric 33 is formed of composite yarns 16.
A further development provides that a filling material in the form of particles or fibers are located in the material of the jacket of the core-and-jacket thread. The hardness or elasticity of the support layer can be adjusted to the desired value by means of these fillers. Furthermore, it is possible to adjust the elasticity and tenacity of the fabric in such a way that it can handle all the tension requirements needed for the paper-machine process.

While a preferred embodiment of the invention has been described using specific terms, such description is for illustrative purposes only, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the following claims.
What is claimed is:

1. The process for forming a transfer fabric for use in the press section of a papermaking machine including:
   providing composite yarns comprising continuous filament synthetic core yarns encased in a jacket formed of synthetic material, said jacket having a first melt point and said core yarns having a second melt point higher than said first melt point;
   intermeshing said composite yarns to form a continuous porous fabric having a support surface and a running surface;
   heating said continuous fabric to a temperature sufficient to cause said synthetic material forming said jacket of said composite yarns, at least adjacent said support surface, to melt and fuse forming at least said support surface non-porous.

2. The process of claim 1, including heating said fabric to a temperature sufficient to melt and fuse said synthetic material forming said jacket of said composite yarns throughout.

3. The process of claim 1, including forming said intermeshing of said yarns by one of weaving, knitting and coiling.

4. The process of claim 1, including selecting as said synthetic forming said core yarns one of PA, PPS, PE, PET, PEEK, PPA, and PCTA.

5. The process of claim 1, including selecting PU as said synthetic material forming said jacket.

6. The process of claim 1, including forming said fabric as a multi-layered fabric having at least an upper and a lower layer.
7. The process of claim 6, including forming said lower layer of continuous filament synthetic yarns.

8. The process of claim 1, including forming said support surface planar by grinding.

9. The process of claim 1, including employing an engraving to form said support surface with ridges.

10. The method of claim 1, including forming said core yarns of one of continuous monofilament and multi-filament yarns.

11. The method of claim 1, including forming said jacket about said core yarns by one of twisting and fabricating yarns formed of one of continuous and staple filaments.

12. The method of claim 1, including forming said jacket to a wall thickness of between 0.1 and 1.0 mm.

13. The method of claim 1, including providing said support surface with a hardness of between Shore A50 to A97.

14. The transfer fabric formed by the process of claim 1.

15. A transfer fabric for use with the press section of a papermaking machine comprising:

   a plurality of intermeshed forming yarns extending longitudinally and transversely of said fabric, said forming yarns comprising composite yarns having a core formed of yarns of one of PA, PPS, PE, PET, PEEK and PCTA encased within a jacket.
formed of PU, said intermeshed composite yarns forming said transfer fabric continuous with a support surface and a running surface;

providing that at least said PU forming said jackets of said composite yarns adjacent said support surface is fused into a continuous non-porous layer forming said support surface non-porous, and further providing said yarns forming said core maintain structural integrity and provide said transfer fabric with longitudinal and transverse stability.

16. The fabric of claim 15 wherein said PU forming said jackets of each of said composite yarns is fused throughout said transfer fabric forming said transfer fabric non-porous and locking said yarns forming said cores in position providing structural integrity throughout.

17. The fabric of claim 15 wherein said support surface has a harness of Shore A50 to A97.

18. The fabric of claim 15 wherein said transfer fabric comprises at least an outer and an inner layer with said PU jackets of said composite yarns forming said outer layer being fused.

19. The fabric of claim 18 wherein said composite yarns forming said transfer fabric are intermeshed by one of being woven, knitted, non-woven and coiled.

20. The fabric of claim 15 wherein said upper and lower layers are interconnected by laminating.
21. The fabric of claim 15 wherein said composite yarns comprise continuous filament core yarns and one of continuous filament yarns and staple filament yarns forming said jacket.

22. The fabric of claim 21 wherein said jacket is formed by one of twisting and fabricating said jacket forming yarns.

23. The fabric of claim 15 wherein said support surface includes longitudinal ridges.

24. The fabric of claim 15 wherein said longitudinal yarns are arranged in groups of up to four yarns intermeshed into said fabric as a single yarn.

25. The fabric of claim 15 wherein said transfer fabric comprises at least an outer and an inner layer, said longitudinal yarns forming said outer layer being arranged in groups of up to four and intermeshed with said transverse yarns as a single yarn, said longitudinal yarns forming said inner layer being individually intermeshed with said transverse yarns.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7): Please See Extra Sheet.

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)


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

NONE

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>US 5,611,892 A (KARVINEN et al) 18 March 1997</td>
<td>1-25</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C.

See patent family annex.

Date of the actual completion of the international search

30 MAY 2000

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Date of mailing of the international search report

13 JUL 2000

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Form PCT/ISA/210 (second sheet) (July 1998)
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER:
IPC (7):
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