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(54) **PIN SEAMED PRESS FELT WITH BASE
FABRIC WITH MONOFILAMENT AND
CABLED MD YARNS**

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(71) Applicant: **Huyck Licensco Inc.**, Youngsville, NC
(US)

(72) Inventor: **Friedrich Postl**, Flatz (AT)

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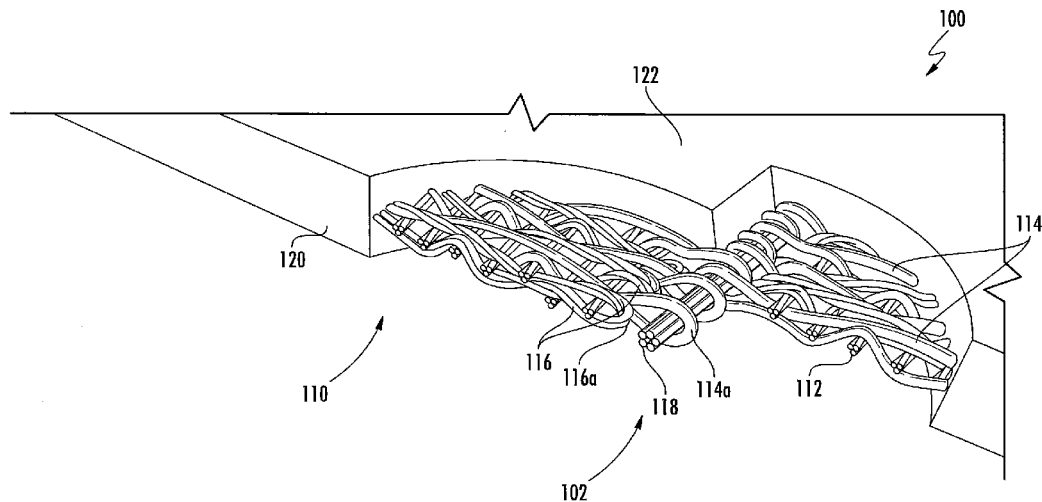
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(57) **ABSTRACT**

A press felt for a papermaking machine includes: (a) a base fabric comprising a plurality of repeat units, each of the repeat units comprising a plurality of cross machine direction (CMD) yarns and a plurality of machine direction (MD) yarns interwoven with the CMD yarns, wherein the machine direction yarns comprise a first set of MD yarns and a second set of MD yarns, wherein the first yarns include seam loops at their ends and the second yarns are devoid of seam loops at their ends; and (b) at least one batt layer overlying the base fabric.



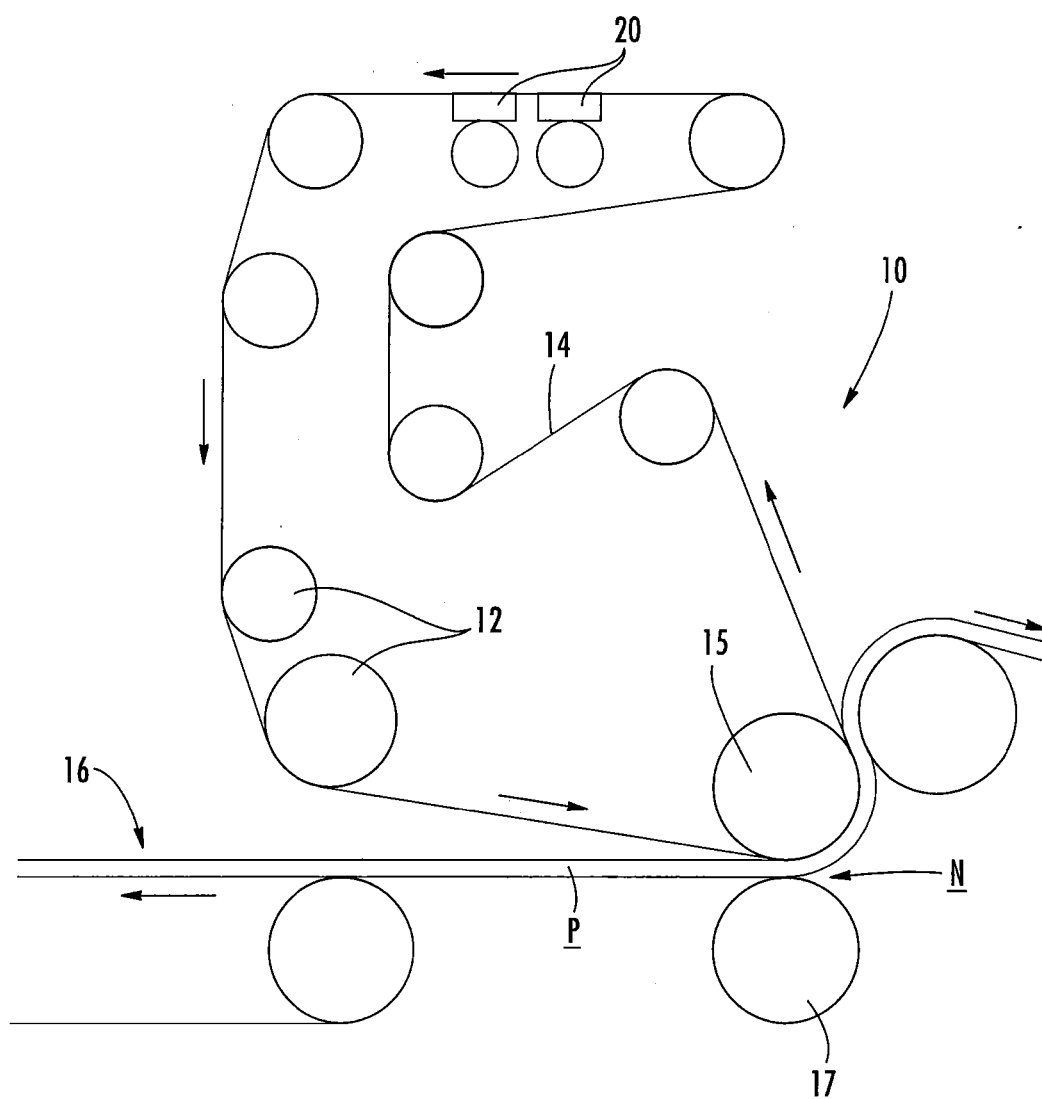


FIG. 1

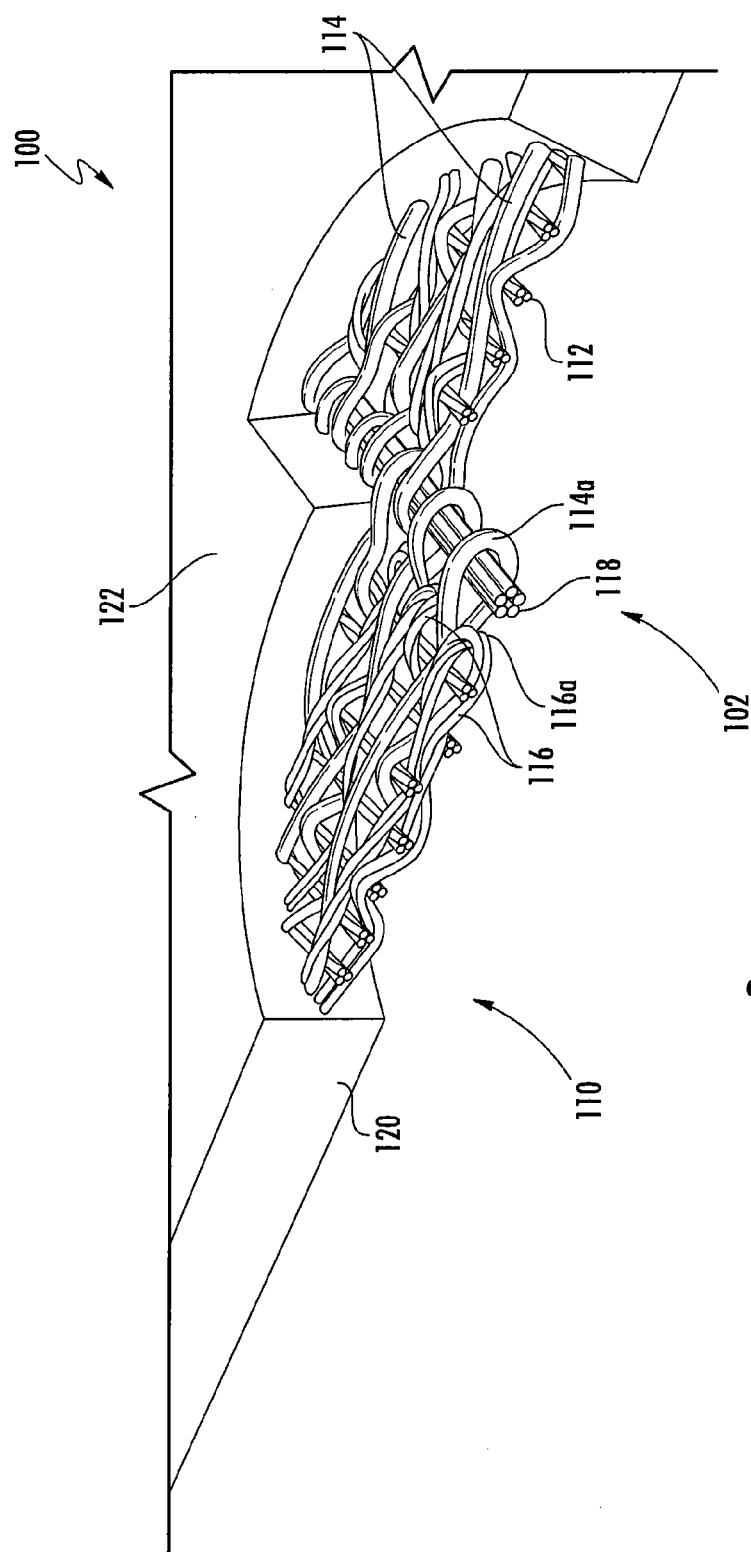


FIG. 2

PIN SEAMED PRESS FELT WITH BASE FABRIC WITH MONOFILAMENT AND CABLED MD YARNS

RELATED APPLICATION

[0001] The present application claims priority from and the benefit of U.S. Provisional Patent Application No. 62/201,216, filed Aug. 5, 2015, the disclosure of which is hereby incorporated herein in its entirety.

FIELD OF THE INVENTION

[0002] The present invention relates generally to papermaking, and more particularly to fabrics used in papermaking.

BACKGROUND OF THE INVENTION

[0003] In the conventional fourdrinier papermaking process, a water slurry, or suspension, of cellulosic fibers (known as the paper “stock”) is fed onto the top of the upper run of an endless belt of woven wire and/or synthetic material that travels between two or more rollers. The belt, often referred to as a “forming fabric,” provides a paper-making surface on the upper surface of its upper run which operates as a filter to separate the cellulosic fibers of the paper stock from the aqueous medium, thereby forming a wet paper web. The aqueous medium drains through mesh openings of the forming fabric, known as drainage holes, by gravity alone or with assistance from one or more suction boxes located on the lower surface (i.e., the “machine side”) of the upper run of the fabric.

[0004] After leaving the forming section, the paper web is transferred to a press section of the paper machine, in which it is passed through the nips of one or more pairs of pressure rollers covered with another fabric, typically referred to as a “press felt.” Pressure from the rollers removes additional moisture from the web; the moisture removal is often enhanced by the presence of a “batt” layer on the press felt. The paper is then conveyed to a dryer section for further moisture removal. After drying, the paper is ready for secondary processing and packaging.

[0005] Press felts typically include one or more base fabric layers; these can be “flat-woven” and formed after weaving into an endless belt, or can be woven in endless form.

[0006] Of course, weaving a fabric of a base layer requires that provision be made for joining it into an endless belt. Such joints should be constructed in such a manner that they are sufficiently strong to withstand the extreme load, temperature, and wear conditions the press felt experiences, yet do not cause the surface of the press felt above the seam to unduly mark the paper. One popular method of joining the base fabric of a press felt is to form loops with machine direction yarns on each end of the base fabric. To form the base fabric into an endless belt, the ends of the fabric are placed adjacent to each other, with each of the loops on one end positioned between two loops on the other end in interdigitating fashion. A “pin” (usually formed of a single monofilament or multiple monofilament strands) is then inserted into all of the loops to join the ends. After the batt layer(s) are needled or otherwise attached to the base layer, the batt layer(s) are cut at the seam location, the pin is removed, and the finished press felt is shipped to a paper mill. Once at the paper mill, the press felt can be installed by placing it onto a paper machine, then inserting another

(usually more flexible) monofilament pin or pintle into the loops. Examples of this type of seam are described in U.S. Pat. Nos. 4,764,417 and 4,737,241 to Gulya; 4,601,785 to Lilja et al.; 5,476,123 to Rydin, and 7,135,093 to Gstrein, the disclosures of which are hereby incorporated herein by reference in their entireties.

[0007] Base fabrics of press felts have taken a variety of configurations. In one configuration, the “fabric” is actually two separate fabrics that form a total of three layers. The bottom fabric is a double layer fabric that provides the seam loops, with the top fabric being a single layer fabric that is cut after weaving, combination with the bottom fabric, and needling of an overlying batt layer. An exemplary press felt of this configuration is shown in International Patent Application No. WO 0017433, the disclosure of which is hereby incorporated herein in its entirety. One apparent disadvantage of a fabric of this configuration is the need to cut the top fabric layer, which then has loose ends that can impact the manner in which the overlying batt lays over the fabric.

SUMMARY

[0008] As a first aspect, embodiments of the invention are directed to a press felt for a papermaking machine. The press felt comprises: (a) a base fabric comprising a plurality of repeat units, each of the repeat units comprising a plurality of cross machine direction (CMD) yarns and a plurality of machine direction (MD) yarns interwoven with the CMD yarns, wherein the machine direction yarns comprise a first set of MD yarns and a second set of MD yarns, wherein the first yarns include seam loops at their ends and the second yarns are devoid of seam loops at their ends; and (b) at least one batt layer overlying the base fabric.

[0009] As a second aspect, embodiments of the invention are directed to a press felt for a papermaking machine, comprising: (a) a base fabric comprising a plurality of repeat units, each of the repeat units comprising a plurality of cross machine direction (CMD) yarns and a plurality of machine direction (MD) yarns interwoven with the CMD yarns, wherein the machine direction yarns comprise a first set of MD yarns and a second set of MD yarns, wherein the first yarns include seam loops at their ends and the second yarns are devoid of seam loops at their ends, and wherein the first yarns differ in type from the second yarns; and (b) a batt layer overlying the base fabric.

[0010] As a third aspect, embodiments of the invention are directed to a press felt for a papermaking machine, comprising: a base fabric comprising a plurality of repeat units, each of the repeat units comprising a plurality of cabled cross machine direction (CMD) yarns and a plurality of machine direction (MD) yarns interwoven with the CMD yarns, wherein the machine direction yarns comprise a first set of MD yarns and a second set of MD yarns, wherein the first yarns include seam loops at their ends and the second yarns are devoid of seam loops at their ends, and wherein the first yarns are monofilament yarns and the second yarns are cabled yarns; and a batt layer overlying the base fabric.

BRIEF DESCRIPTION OF THE FIGURES

[0011] FIG. 1 is a schematic diagram illustrating the press section of a papermaking machine that may employ a press felt according to embodiments of the present invention.

[0012] FIG. 2 is an enlarged, partial, cutaway side view of the press felt of FIG. 1 showing the pin seam of the press felt of FIG. 1.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE PRESENT INVENTION

[0013] The present invention will now be described more fully hereinafter, in which embodiments of the invention are shown. This invention may, however, be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, like numbers refer to like elements throughout. Thicknesses and dimensions of some components may be exaggerated for clarity.

[0014] In addition, spatially relative terms, such as “under”, “below”, “lower”, “over”, “upper” and the like, may be used herein for ease of description to describe one element or feature’s relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as “under” or “beneath” other elements or features would then be oriented “over” the other elements or features. Thus, the exemplary term “under” can encompass both an orientation of over and under. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[0015] Well-known functions or constructions may not be described in detail for brevity and/or clarity.

[0016] As used herein, the terms “machine direction” (MD) and “cross machine direction” (CMD) refer, respectively, to a direction aligned with the direction of travel of the papermakers’ fabric on a papermaking machine, and a direction parallel to the fabric surface and transverse to the direction of travel. Also, both the flat weaving and endless weaving methods described hereinabove are well known in the art, and the term “endless belt” as used herein refers to belts made by either method.

[0017] Referring now to the drawings, a papermaking machine press section, designated broadly at 10, is illustrated in FIG. 1. The press section 10 includes a press felt 100 that is installed upon and conveyed by a set of rollers 12. In its travel, the felt 100 passes over a press roll 15. An opposed press roll 17 is positioned so that, in conjunction with the felt 100 and press roll 15, it forms a nip N between the press rolls 15, 17.

[0018] In operation, a paper web P is conveyed from a forming section 16 through the nip N formed by the press rollers 15, 17, wherein pressure is applied to the paper web P by the press rolls 15, 17. The pressure forces moisture from the paper web P that is absorbed by the felt 100. As the felt 100 is conveyed around its roller set 12, moisture is removed therefrom, and the felt 100 is conditioned by one or more suction boxes 20.

[0019] Referring now to FIG. 2, a portion of the seam 102 of the felt 100 is shown therein. The felt 100 includes a single base fabric 110 that includes cabled CMD yarns 112 interweaving with two different varieties of MD yarns. More specifically, MD yarns 114 are monofilament yarns, and MD

yarns 116 are cabled yarns. The monofilament MD yarns 114 alternate with the cabled MD yarns 116 in a 1:1 pattern as the MD yarns 114, 116 interweave with the CMD yarns 112. The weaving pattern of the MD yarns 114, 116 and the CMD yarns 112 can be any weave pattern known to those of skill in this art to be appropriate for a base fabric of a press felt and need not be described in detail herein.

[0020] As can be seen in FIG. 2, the monofilament MD yarns 114 are interwoven with the CMD yarns 112 such that seam loops 114a are formed as each MD yarn 114 “doubles back” on itself to weave with the CMD yarns 112. The seam loops 114a capture a pintle 118 or other seaming member within the seam 102. As can be seen in FIG. 2, the seam loops 114a formed in one end of the fabric 110 interdigitate with the seam loops 114a from the other end of the fabric 110 to create space into which the pintle 118 can be inserted to form the seam 102.

[0021] As can also be seen in FIG. 2, as the cabled MD yarns 116 interweave with the CMD yarns 112, they do not form seam loops when they “double back” to weave with the CMD yarns 112. Instead, when the cabled yarns 116 “double back”, they do so by forming a loop around the CMD yarn 112 nearest the seam 102. Thus, the ends 116a of the cabled MD yarns 116 are routed short of the seam 102 and are devoid of seam loops.

[0022] With respect to any of the illustrated or described embodiments, the press felt of the invention may also include one or more batt layers. Referring back to FIG. 2, the press felt 100 includes two batt layers: a machine side batt layer 120 and a paper side batt layer 122. Illustratively, these batt layers 120, 122 are attached to the base fabric layer 110 through a needling process, although other attachment techniques, such as heat bonding and adhesives, can also be used with the present invention. The machine side and paper side batt layers 120, 122 should be formed of material, such as a synthetic fiber like acrylic, aramid, polyester, or nylon, or a natural fiber such as wool, that assists in wicking water away from the base fabric layer 110. Exemplary materials for the batt layers 120, 122 include polyamide, polyester and blends thereof. The weight and thickness of the batt layers 120, 122 can vary, although it is typical that the ratio of batt weight to fabric weight is between about 0.5 and 2.0, with 1.0 being more common. Also, in some embodiments, it may be desirable to have additional batt layers or to omit either or both of the batt layers 120, 122.

[0023] The fabric 110 described above can provide performance advantages to the felt 100. The use of the monofilament MD yarns 114 can provide a smooth, stable seam, while the inclusion of the cabled MD yarns 116 can improve anchoring of the batt fiber. In the past, typically press felts with cabled MD yarns lacked seam loops, as the cabled structure of the yarns was not conducive to forming seam loops that were easily interdigitated and/or filled with a pintle. The use of MD monofilament yarns for seam loops in combination with cabled yarns can enable the felt to achieve both acceptable fiber anchoring and easy installation.

[0024] Although the MD yarns 116 are illustrated and described as being cabled monofilament yarns, in some embodiments the MD yarns 116 may be cabled or twisted monofilament/multifilament and/or monofilament/card yarn combinations. Also, the CMD yarns 112 are illustrated and described as being cabled monofilaments, but may in some embodiments be uncabled monofilaments. Other yarn varieties may also be employed.

[0025] Yarn sizes and configurations may vary with the desired properties of the press felt. Typical yarn diameters include monofilament MD yarns **114** of between about 0.2 mm and 0.6 mm. The cabled MD yarns **116** are typically formed of two or three yarns cabled together, with the typical diameter of the individual yarns (prior to cabling) being 0.10 mm to 0.40 mm. Similarly, the CMD yarns **112** are typically formed of two or three monofilament yarns cabled together, with the typical diameter of the individual monofilament yarns being 0.10 mm to 0.40 mm.

[0026] In one particular embodiment, the fabric **110** comprises the following yarns:

Yarn Type	Yarn Employed
Monofilament MD yarns	0.40 mm monofilament
Cabled MD yarns	0.20 mm × 3
Cabled CMD yarns	0.20 mm × 3

[0027] Those skilled in this art will also appreciate that, although the monofilament MD yarns **114** and the cabled MD yarns **116** are shown in an alternating 1:1 pattern, these yarns may be included in other ratios. For example, there may be 1 monofilament MD yarn for every two or three cabled MD yarns, two or three monofilament MD yarns for every cabled MD yarn, three monofilament MD yarns for every two cabled MD yarns, two monofilament MD yarns for every three cabled MD yarns, and the like.

[0028] It should also be noted that in some embodiments, the fabric **110** of the felt **100** is endless woven.

[0029] The foregoing is illustrative of the present invention and is not to be construed as limiting thereof. Although exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as recited in the claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.

That which is claimed is:

1. A press felt for a papermaking machine, comprising:

- (a) a base fabric comprising a plurality of repeat units, each of the repeat units comprising a plurality of cross machine direction (CMD) yarns and a plurality of machine direction (MD) yarns interwoven with the CMD yarns, wherein the machine direction yarns comprise a first set of MD yarns and a second set of MD yarns, wherein the first yarns include seam loops at their ends and the second yarns are devoid of seam loops at their ends; and

- (b) at least one batt layer overlying the base fabric.

2. The press felt defined in claim 1, wherein the first set of MD yarns comprises monofilament yarns.

3. The press felt defined in claim 2, wherein the second set of MD yarns comprises cabled yarns.

4. The press felt defined in claim 1, wherein the CMD yarns comprise cabled yarns.

5. The press felt defined in claim 1, further comprising a pintle inserted through the seam loops of the first set of MD yarns.

6. The press felt defined in claim 1, wherein the MD yarns of the first set alternate with the MD yarns of the second set.

7. A press felt for a papermaking machine, comprising:

- (a) a base fabric comprising a plurality of repeat units, each of the repeat units comprising a plurality of cross machine direction (CMD) yarns and a plurality of machine direction (MD) yarns interwoven with the CMD yarns, wherein the machine direction yarns comprise a first set of MD yarns and a second set of MD yarns, wherein the first yarns include seam loops at their ends and the second yarns are devoid of seam loops at their ends, and wherein the first yarns differ in type from the second yarns; and

- (b) a batt layer overlying the base fabric.

8. The press felt defined in claim 7, wherein the first set of MD yarns comprises monofilament yarns.

9. The press felt defined in claim 8, wherein the second set of MD yarns comprises cabled yarns.

10. The press felt defined in claim 7, wherein the CMD yarns comprise cabled yarns.

11. The press felt defined in claim 7, further comprising a pintle inserted through the seam loops of the first set of MD yarns.

12. The press felt defined in claim 7, wherein the MD yarns of the first set alternate with the MD yarns of the second set.

13. A press felt for a papermaking machine, comprising:

- (a) a base fabric comprising a plurality of repeat units, each of the repeat units comprising a plurality of cabled cross machine direction (CMD) yarns and a plurality of machine direction (MD) yarns interwoven with the CMD yarns, wherein the machine direction yarns comprise a first set of MD yarns and a second set of MD yarns, wherein the first yarns include seam loops at their ends and the second yarns are devoid of seam loops at their ends, and wherein the first yarns are monofilament yarns and the second yarns are cabled yarns; and

- (b) a batt layer overlying the base fabric.

14. The press felt defined in claim 13 further comprising a pintle inserted through the seam loops of the first set of MD yarns.

15. The press felt defined in claim 13, wherein the MD yarns of the first set alternate with the MD yarns of the second set.

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