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INDUSTRIAL AND PAPERMAKER'S FELT

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Fig. 1.

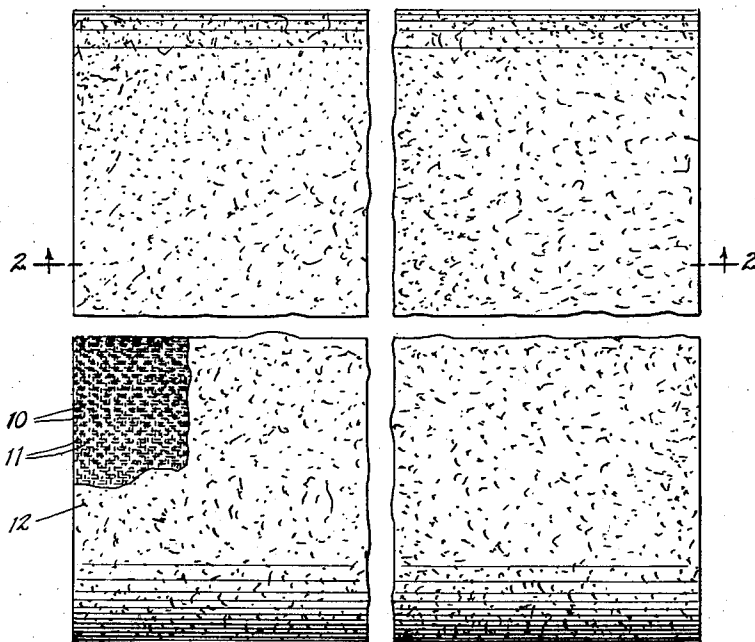


Fig. 2.

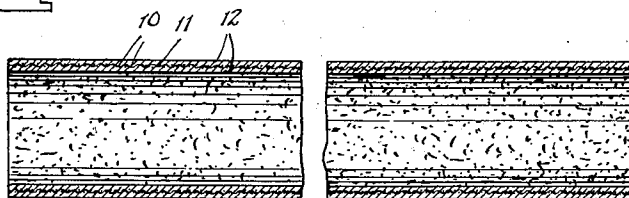
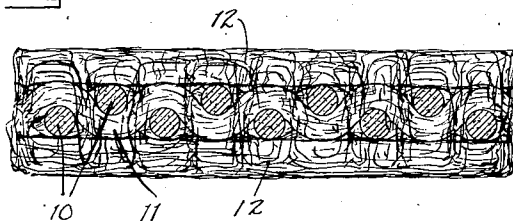


Fig. 3.



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INDUSTRIAL AND PAPERMAKER'S FELT

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6 Claims. (Cl. 28—79)

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The present invention relates to industrial and paper makers' felts, and is directed particularly to an improved woven felt for use in the manufacture of such paper machine products as pulp, paper, paperboard, asbestos cement products, millboard, gasketboard, asbestos paper and the like. Such felts are usually in the form of an endless belt, either woven in endless belt form or woven as a flat fabric which is thereafter joined together at its ends to form an endless belt, the belt being mounted in the paper making machine upon suitable rolls. Its principal functions are to impart a finish to the sheet of paper or other material carried on the felt, and to remove water from it by drainage of the water through the felt, this water removal being accomplished through the cooperation of press rolls, suction boxes, and the like. The paper maker's felt thus constitutes a mechanical part of the paper machine, and in such use is subjected to friction, abrasion, chemical deterioration, and deterioration due to bacterial molds, mildews, funguses, etc. Its structural and functional characteristics are therefore peculiarly related to the requirements of its use in paper machines, as distinguished from fabrics designed for other uses such as clothing, carpets, blankets, and the like.

The invention is concerned with paper makers' felts of the woven type, wherein the warp and weft of the weave are comprised principally of wool yarns, which are subjected to the process of "fulling" for the purpose of shrinking and compacting the fabric and causing the wool fibers to felt with each other. As such felts are usually made, the fibers of the yarns are required to give the necessary tensile strength to the felt and also to provide the required paper formation and wear resisting face and inside surfaces, the face or paper formation surface being depended upon to impart a smooth finish to the paper sheet being formed as it passes through the rolls of the paper machine, and the inside surface being depended upon to resist the wear of the rolls, suction boxes, etc. of the paper machine on which the felt is running.

Heretofore it has been necessary in order to cushion the weave, so as to provide a smooth paper formation surface, that a nap be raised on the fabric from the threads or fibers of the woven yarn, such nap fibers being usually raised by brushing or teazeling from their more or less horizontal position in the woven yarn to a more or less vertical position. The strength of the yarn is therefore reduced by the number of

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fibers which are transposed from their normal position in the spun yarn to raised nap producing position, since in this raised position they cease to contribute to the tensile strength of the yarn. Where it is necessary to raise the nap on the inside surface of the felt to resist abrasion there is a further substantial loss of tensile strength. Thus in order to give a smooth face surface to the felt or an abrasion resisting back surface, the strength of the warp and weft of the woven felt must to a substantial degree be sacrificed. In addition to sacrificing the strength of the felt the napped surfaces, after a very short period of use, wear down to such an extent that the weave of the felt is exposed on the face surface giving an undesirable weave marking or imprint to the surface of the paper being made, and at the same time there is a progressive wearing down of the knuckles of the woven fabric on the inside surface through the abrasive action of the rolls of the machine upon which the felt is supported. The useful life of the felt is therefore shortened, requiring frequent stoppage of production to replace the felts.

The object of the present invention is to provide an improved woven felt in which the nap surfaces are produced by the application through needling of pile fleeces to the woven felt fabric, the needling process consisting in forcing the fibers of the fleeces into and through the woven felt fabric, thus leaving parts of the fibers upon the surface to form a cushioning paper formation or abrasion resisting surface, while other portions of the fibers are engaged in the woven fabric and interlocked with the fibers thereof as well as with other fibers of the added fleeces. The needling of the fleeces to the woven felt fabric is preferably carried out by the needling method as disclosed for instance in the Reissue Patent No. 21,890, reissued August 26, 1941, to Patrick H. Walsh and Percival T. Gates for Industrial and Papermakers' Felts.

It is proposed according to the invention to add pile fleeces by needling to the woven felt fabric, such pile fleeces consisting of any desired fibrous material best suited to carrying out the functions and purposes of the paper maker's felt. For instance, the added pile fleeces may consist entirely of one kind of fibrous material, such as wool or other natural fibers, or of synthetic fibers, or it may consist of blends in any desired percentages of natural and synthetic fibers. Also the material applied to the face may be different from that applied to the inside

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surface of the felt, so that material having the best paper surface formation characteristics may be applied to the face and material having the best abrasion resisting characteristics may be applied to the inside surface. As the fleeces are attached by interlocking of the fibers brought about by the needling process, as distinguished from attaching by felting, materials may be employed which are incapable of "fulling" and this has the advantage of resisting the tendency of paper making felts to continue to "full" while in use on the paper machine. This continued "fulling" causes the felts to become progressively more dense and in so doing tends to rapidly fill up with dirt and other foreign material. It is also possible to employ synthetic material in the added fleeces, which, in addition to being highly resistant to friction and abrasion, is also highly resistant to chemical deterioration and deterioration due to bacterial molds, mildews, funguses, etc. Synthetic material may be employed which has a smooth and slippery surface so that dirt and other foreign substances passing through the felt with the drainage water do not adhere to the fibers, as they do in the case of wool, which has a scaly surface and makes the felt susceptible to "filling up" after a relatively short use in the paper machine.

Thus, by increasing the percentage of fibrous material having these characteristics these advantages are proportionately increased.

A suitable synthetic fiber material having the desired characteristics for obtaining the advantages made possible by the invention is the polyamide known as nylon. Other suitable materials are resins like rayon, fiber milk products like casein fiber, and glass fiber.

By means of the invention it is possible to cushion the face surface of the woven felt, thus presenting a smooth surface to the material being produced on it without weakening the woven fabric by napping. Furthermore, the needed-in fleece surface is more compact than the usual napped surface of the heretofore known type of woven felt and is, therefore, more resistant to wear. In particular, the application of the added fleeces to the inside surface or wear side of the felt, has the important advantage of protecting the knuckles of the woven felt to such a great extent that the useful life of the felt is materially increased. For instance, where resistance to abrasion of a very high order is desired, it is possible to produce a wearing surface for the woven felt consisting wholly of synthetic fiber such as nylon which is far more resistant to abrasion than wool or a blend of wool and nylon.

With the above and other objects in view, an embodiment of the invention is shown in the accompanying drawing, and this embodiment will be hereinafter more fully described with reference thereto and the invention will be finally pointed out in the claims.

In the drawings:

Fig. 1 is a plan view of a paper maker's felt in the form of an endless belt, according to the invention, a portion of the woven felt fabric being shown without pile fleece fibers attached thereto.

Fig. 2 is a transverse sectional view along the line 2-2 of Fig. 1.

Fig. 3 is an enlarged transverse sectional view showing a portion of the felt.

Referring to the drawings, the paper maker's felt, according to the illustrated exemplary em-

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bodiment of the invention, is in the form of an endless belt comprising a woven felt base consisting of warp yarns 10 and weft yarns 11, preferably consisting of wool fibers. This fabric is subjected to the usual treatment of "fulling," whereby it is shrunk and compacted and the woolen fibers are caused to felt together. These operations are well known in the art, and a detail description thereof is therefore not necessary. The woven felt fabric is not subjected to the usual brushing or teasing operation in order to raise a nap on its surfaces, but the surfaces are left substantially intact, so that the felted wool fibers will remain as nearly as possible in their original substantially horizontal position in the yarns in order to maintain their maximum tensile strength.

At at least one side, and preferably at both sides, pile fleeces 12, of suitable fibrous material are needed into the woven felt fabric after it is fulled in order to provide a cushioning layer at one or both sides, this layer when applied to the face providing a paper formation surface and when applied to the inside surface providing an abrasion resistance surface for engagement over the rolls supporting the felt and over the press rolls, suction boxes, and the like over which the felt passes.

The needling process consists in applying one or more bats, layers, or pile fleeces of fibrous material to the surface of the woven felt fabric and progressively needling it into and through the fabric, the material being gradually moved beneath vertically reciprocating needles which force the fibers into and through the fabric. In practice one or more layers or fleeces are needed at each side of the felt fabric, and after such layers are attached they may be subjected to a further needling operation without the addition of fibrous material, so as to cause a tuck-in and further interlocking of the fibers at each side of the felt.

According to the invention the fiber material may consist wholly of natural fibers, such as wool, or wholly of synthetic fibers, such as nylon, or it may consist of a blend of natural and synthetic fibers in any desired percentages. The face surface may, if desired, have different material needed thereto than the material needed to the inside surface. Because of the fact that the needed fibers are attached to the woven felt fabric by forcing portions of the fibers vertically into and through the fabric so as to interlock therewith and with other of the needed fibers, and does not depend for attachment upon "fulling" and felting of the fibers, it is possible to employ in the needed layers non-fulling synthetic fibrous material, such as nylon, having advantageous properties that are not present, for instance, in wool fibers.

Among these properties are the following: relatively great tensile strength permitting long fibers to be needled back and forth through the material without breaking; smoothness of the fibers which provides for better drainage; resistance to "fulling" when the felt is in use on the paper machine, eliminating or greatly reducing the tendency of the felt to become progressively more dense and in so doing to fill up with dirt and foreign material; increased resistance to abrasion; and increased resistance to deterioration from chemical action and from the effects of bacterial molds, mildews, funguses, etc. The invention furthermore permits of the relatively inexpensive reconditioning of used felts

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through the addition of pile fleeces thereto by needling before any abrasive wear takes place upon the knuckles of the woven felt fabric.

What is claimed is:

1. A paper maker's felt for supporting and draining paper making material, comprising a woven felt base and a non-woven nap cushion at one side of said base interlockingly needled thereto, said base consisting of warp and weft yarns of fullable fiber material felted together by fulling preliminarily to the needling of said nap cushion thereto to provide a felted fibrous body for interlockingly receiving the needle directed fibers of said nap cushion, said nap cushion consisting of a fleece of unwoven fibrous material, the individual fibers of which are disposed partially at said one side of said felt base in the form of a nap cushion and partially through said felted base in a direction perpendicular thereto to direct drainage through said felted fibers of the base in a direction following the direction of said needled fibers.

2. The invention as defined in claim 1, further characterized in that said fleece of fiber material is composed at least in part of non-fullable fibers.

3. A paper maker's felt for supporting and draining paper making material, comprising a woven felt base and non-woven nap cushions at the opposed sides of said base interlockingly needled thereto, said base consisting of warp and weft yarns of fullable fiber material felted together by fulling preliminarily to the needling of said nap cushions thereto to provide a felted fibrous body for interlockingly receiving the needle directed fibers of said nap cushions, said nap cushions each consisting of a fleece of unwoven fibrous material, the individual fibers of which are disposed partially at said respective sides of said felt base in the form of a nap cushion and partially through said felted base in a direction perpendicular thereto to direct drainage through said felted fibers of the base in a direction following the direction of said needled fibers.

4. The invention as defined in claim 3, further characterized in that at least one of said fleeces of fiber material is composed at least in part of non-fullable fibers.

5. The process of making paper maker's felt for supporting and draining paper making material, which consists in interlockingly needling

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a non-woven nap cushion consisting of a fleece of unwoven fibrous material at one side of a woven felt base consisting of warp and weft yarns of fullable fiber material felted together by fulling preliminarily to the needling of said nap cushion thereto to provide a felted fibrous body for interlockingly receiving the needle directed fibers of said nap cushion, the needling operation disposing the individual fibers of said fleece partially at said one side of said felt base in the form of a nap cushion and partially through said felted base in a direction perpendicular thereto to direct drainage through said felted fibers of the base in a direction following the direction of said needled fibers.

6. The process of making paper maker's felt for supporting and draining paper making material, which consists in interlockingly needling non-woven nap cushions consisting of fleeces of unwoven fibrous material at the respective opposed sides of a woven felt base consisting of warp and weft yarns of fullable fiber material felted together by fulling preliminarily to the needling of said nap cushions thereto to provide a felted fibrous body for interlockingly receiving the needle directed fibers of said nap cushions, the needling operation disposing the individual fibers of said fleeces partially at said sides of said felt base in the form of nap cushions and partially through said felted base in a direction perpendicular thereto to direct drainage through said felted fibers of the base in a direction following the direction of said needled fibers.

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