Sept. 30, 1952 E. H. HALL 2,612,190

PAPER MILL FELT

Filed Jan. 27, 1949

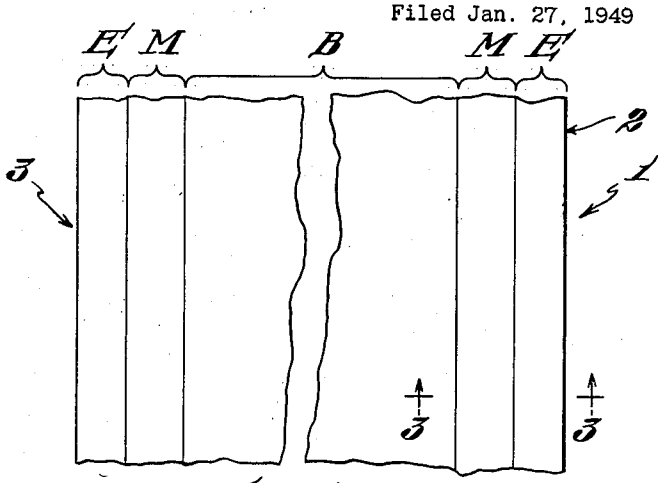


Fig. 1

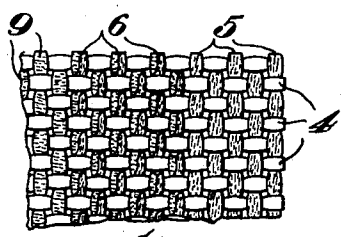


Fig. 2

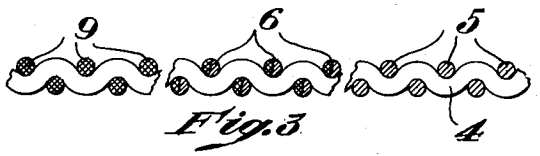


Fig. 3

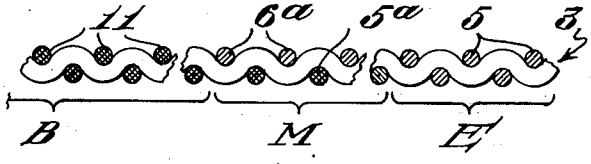
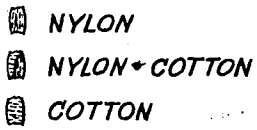


Fig. 4



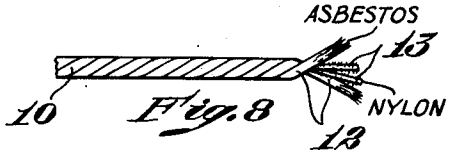


Fig. 8

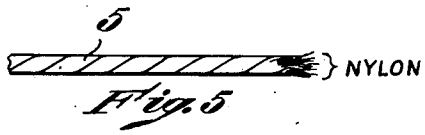


Fig. 5



Fig. 9

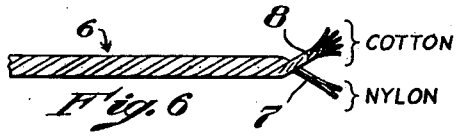


Fig. 6

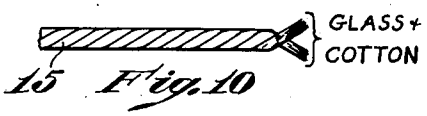


Fig. 10

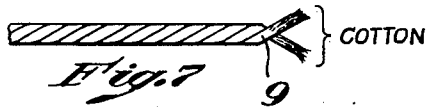


Fig. 7

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PAPER MILL FELT

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10 Claims. (Cl. 139—426)

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This invention pertains to paper mill drying felts. These felts are endless webs of woven fabric which carry the wet paper sheet through the drying zone and hold it in contact with the hot drying cylinders of the paper-making machine. The moisture in the paper sheet is absorbed by the felt, allowing the paper to dry slowly and uniformly and without "cockles." Customarily, these felts consist of warp and weft threads, interwoven to produce a multi-ply fabric. Usually, the warp threads at least, are of cotton, or cotton plied with asbestos. Strictly speaking, these so-called drying "felts" are not of felt at all, being in fact, quite similar to usual heavy canvas conveyor belts, and are to be distinguished from the true "felts" woven from woolen or part woolen yarns, with their fiber felted together, as in a blanket, and which are employed at an earlier stage in the paper manufacture.

In order to keep this swiftly moving felt or conveyor belt properly centered with reference to the rotating drying cylinders, an evener mechanism is employed comprising feeler forks which contact the opposite edges of the felt and which respond to any abnormal lateral shift of the felt, thereby setting into operation the guiding means which restores the felt to normal position.

The frictional contact of these feeler forks with the edge of the felt results in abrasion and ultimately produces raw edges and raveling. The marginal portion of the felt, for a distance of the order of three inches inwardly from its edge, becomes soaked with oil which drops from the cylinder bearings. As the margins of the felt are bent out of the normal plane at certain points in the path of travel of the felt, they are subjected to a sort of wear not experienced by the main body of the felt and, being weakened by the high temperature to which the felt is exposed and by the rotting action of the oil, the margins wear out long before the main portion of the felt has lost its usefulness. However, the breakdown of the edges and margins of the felt, occurring before the main portion of the felt shows any appreciable wear, necessitates replacement of the entire felt sometimes after a short period of use. As these felts are expensive, costing into the thousands of dollars, their frequent replacement constitutes a serious item of expense to the paper mill.

The principal object of the present invention is to provide a paper maker's drying felt having edges and margins which are more durable than the edges and margins of felts heretofore available. A further object is to provide a paper

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maker's drying felt having edges which are much more resistant to abrasion through frictional contact with other parts, than are the edges of customary felts. A further object is to provide a paper maker's drying felt having marginal portions which are substantially unaffected by exposure to lubricating oils and which are highly resistant to repeated bending.

In the attainment of the above objects, the present invention contemplates the use of pure nylon threads as the warps at the extreme edges of the felt, and the use of warp threads, in the margins, which are either wholly of nylon or in part of nylon and in part of other materials, for example cotton. Nylon is not subject to rotting or disintegration from contact with oil and is not injuriously affected by the heat or moisture to which a paper drying felt is exposed during use. Nylon is also highly resistant to abrasion, its resistance, when used for the purposes of the present invention, providing an abrasion resistance of the order of one hundred times that of cotton. While nylon is preferred, as possessing all of the valuable characteristics mentioned, it is contemplated that other materials, for example, spun gloss, may be substituted for nylon, with the attainment of similar beneficial results.

By the practice of the present invention the life of the drying felts is greatly prolonged as compared with usual felts, whether made of cotton or asbestos, and thus, not only is the cost of replacement of the felt itself substantially reduced, but the cost of frequent shut-down of the mill is likewise very substantially decreased.

Other objects and advantages of the invention will be pointed out in the following more detailed description and by reference to the accompanying drawings wherein:

Fig. 1 is a fragmentary, diagrammatic plan view of a section of paper mill drying felt embodying the present invention;

Fig. 2 is a fragmentary plan view, to larger scale than Fig. 1, showing a simple form of weave structure as illustrative of one embodiment of the invention;

Fig. 3 is a fragmentary diagrammatic section, to larger scale, on the line 3—3 of Fig. 1;

Fig. 4 is a diagrammatic transverse section, similar to Fig. 3, but illustrating a modification;

Fig. 5 is an elevation of a length of thread desirable for use in the practice of the present invention;

Fig. 6 is a view of another thread also desirable for the use in the practice of the invention;

Fig. 7 is an elevation of a length of thread used

as a warp in weaving the body portion of the drier felt;

Fig. 8 is an elevation of a length of a different type of thread which may be used either as a warp or weft, or both, in the body portion of the felt;

Fig. 9 is an elevation illustrating another kind of thread which may be used in the practice of the invention; and

Fig. 10 is a similar view illustrating another form of thread.

Paper drying felts of the type to which the present invention relates, are usually multi-ply woven fabrics, the multi-ply structure being desirable to provide the desired thickness and strength. The exposed surfaces of such felts are formed by the interlaced warp and weft yarns which are clearly visible, the surface being rough and the constituent fibers of the warps and wefts being unfelted. The general appearance of the surface of this material is that of heavy woven cotton canvas or duck. Various weave structures are employed according to the particular uses or to the preferences of the maker or user. The present invention is not concerned with the particular weave structure, any usual weave structure being useful in accordance with the present invention and the present invention is not concerned with whether the fabric be single ply or multi-ply. Thus, for convenience in illustration, but without any limiting intent, the material is herein diagrammatically illustrated as a single ply, one-and-one woven fabric. Preferably all of the warps are of the same size.

Referring to Fig. 1, the drying felt or conveyor 1 has the side or selvage edges 2 or 3, respectively. This woven material comprises weft threads 4 which may be of any of the usual materials employed for the purpose. Customarily heavy cotton yarn, usually a plied thread, for example No. 7 or 8 cotton, is used for the wefts. However, it is also customary to use asbestos threads as wefts, such threads usually consisting of asbestos fiber or roving reinforced with fine cotton yarns or fibers.

Customarily the warp threads are of cotton and are of substantially the same size and construction as the weft threads. Thus, these warp threads are customarily plied threads comprising from five to seven strands twisted together. However, it is also customary to use so-called asbestos threads for the warps, the asbestos threads, as above suggested, being composed of asbestos fiber reinforced in one way or another with cotton.

In accordance with the present invention the body portion B of the felt or conveyor may, if desired, be of any of the usual prior constructions and materials. Herein, for convenience, it may be considered that the warp threads 9 in the body of the felt are of cotton. In accordance with this invention those warp threads 5 which are involved in the selvage structures at the edges 2 and 3 and preferably several additional warps, for example from five to ten, adjacent to and extending inwardly from each selvage (these warps being indicated by the numeral 5), are of pure filament nylon, that is to say, a synthetic linear polyamide of the long molecular chain type, such, for example, as disclosed in the patent to Carothers No. 2,130,948, September 20, 1938. While nylon apparently is the most suitable material of this type now available, it is contemplated that other long, molecular chain synthetic resins, having abrasive resistant characteristics such as that of nylon, may be substituted for nylon in the practice of the present invention.

While the nylon may be confined wholly to the edge portions E of the felt, it is preferred, in accordance with the present invention, to incorporate nylon in the marginal portions M at each edge of the felt, these marginal portions comprising that area of the felt which extends inwardly from the extreme edge to a distance of from three to four inches. While it is contemplated that pure nylon warps, like the warps 5, may be employed not only at the edges but throughout these marginal portions M, the cost of nylon at the present time indicates the desirability of employing nylon in the marginal portions only in combination with other and cheaper fibrous materials. Thus, for example, in the marginal portions M, warp threads 6 may be employed, which, as illustrated in Fig. 6, are plied threads in which a major portion of the constituent yarns, for example the yarns 8, are of cotton, while a minor portion of the yarns, for example the yarns 7 are of nylon. Preferably filament nylon is employed and preferably, as just suggested, nylon and cotton yarns are twisted together to form a plied thread. However, it is contemplated that the warps used in the margins may be spun directly from a mixture of cotton and staple length nylon, or may consist of smaller yarns spun from such combined fibrous material, the yarns thus prepared being twisted together to form a plied thread of the desired size.

It will be understood that the warps and wefts will be interwoven, in accordance with customary practice in weaving paper mill drying felts, usually to produce a multi-ply fabric.

When such a felt is used in the paper-making machine, it is found that the nylon warps 5 at the edges of the felt are highly resistant to abrasive wear and that, in fact, such edges are capable of withstanding such wear for a period of the order of one hundred times that which cotton will withstand. Likewise, when nylon, or mixed nylon and cotton warps are used in the margins, it is found that these margins are far more resistant to the injurious effects of oil and grease than are cotton warps and are also highly resistant to the high temperatures encountered in paper making, particularly in the manufacture of kraft papers which require very high drying temperatures.

In Fig. 8 there is illustrated a composite yarn 10 consisting of asbestos roving 12 plied with spun nylon yarn 13. Such a yarn may be used advantageously in weaving the body portion B of the felt, either as a warp yarn or as a weft yarn or both, the nylon thread supplying such reinforcement to the asbestos as to provide great resistance to wear, particularly when the felt is used for high temperature work where cotton reinforcement to the asbestos is injured by the heat.

In Fig. 9 the numeral 14 designates a strand of spun glass. This strand may be a plied thread comprising a plurality of individual yarns of smaller size twisted together, or it may be a yarn consisting of glass fibers spun directly to the desired size. It is contemplated that such a strand may be of special value as a warp in the marginal portion M of a drying felt since such a strand is wholly unaffected by the chemical or other action of oil or grease, and is in no way affected by the high temperatures to which the felt is subjected. Such a strand may, if desired, be used at the selvage edge of the felt although its resistance to abrasion is not as high as that

of nylon or equivalent materials. Fig. 10 illustrates a modification wherein the thread 15 comprises glass and cotton fibers intermingled in one way or another to form a composite strand which, for example, may be used in the marginal portion of the felt instead of or in combination with nylon warps or mixtures of nylon with cotton.

In Fig. 4 a different arrangement is illustrated wherein, although the edge portions E are woven in the same way as shown in Fig. 3, the marginal portion M has alternate warps 5^a and 6^a of nylon and cotton. In this instance the nylon warps 5^a are pure filament nylon. While the nylon and cotton warps are shown as intercalated in alternation, it is to be understood that any desirable arrangement may be used in accordance with the amount of nylon which is practically permissible in relation to the cotton employed.

While certain desirable embodiments of the invention have herein been illustrated by way of example, it is to be understood that the invention is broadly inclusive of any and all modifications falling within the scope of the appended claims and that when herein reference has been made to certain specific dimensions, yarn numbers and the number of yarns employed in any given plied yarn, such matters are merely by way of illustration and are not to be regarded as limitations.

I claim:

1. A paper mill drying felt comprising interwoven warps and wefts, the warps being of substantially the same diameter throughout the width of the felt, those warps which are included in each selvage structure being of pure filament nylon, and those warps which are located inwardly of each selvage edge and within a distance of the order of three inches therefrom being ply yarns, including cotton and nylon twisted together.

2. A paper mill drying felt comprising interwoven warps and wefts, the warps being of substantially the same diameter throughout the width of the felt, those warps which are included in each selvage structure being of pure filament nylon, each margin for a distance of approximately three inches inwardly from its selvage comprising warps of pure nylon intercalated with warps of a natural textile fiber.

3. A paper mill drying felt comprising interwoven warps and wefts, the warps which are included in each selvage structure being of pure nylon and the warps in the marginal portions of the felt inwardly of the selvage structure being of nylon plied with cotton.

4. A paper mill drying felt comprising interwoven warps and wefts, the warps throughout the major portion of the width of the felt consisting of asbestos roving plied with spun nylon, the warps which are included in each selvage structure being of pure filament nylon.

5. A paper mill drying felt comprising interwoven warps and wefts, the warps throughout the major portion of the width of the felt consisting of asbestos roving plied with spun nylon, the warps in each margin for a distance of the order of three inches from the edge being of cotton plied with filament nylon, and those warps which are included in each selvage structure being of pure nylon.

6. A paper mill drying felt comprising interwoven unfelted warps and wefts, the warps being of substantially the same size throughout the width of the felt, those warps, at least, which are included in the selvage structures of the felt being of pure nylon, the marginal portions of the felt inwardly of the selvages to a width not substantially exceeding four inches comprising warps of nylon mixed with cotton.

7. A paper mill drying felt comprising interwoven warps and wefts, the wefts being of cotton and being of substantially the same size and with the same number of ends per inch throughout the width of the felt, the marginal portions only of the felt, for a distance not substantially exceeding four inches inwardly from each edge, consisting of warps comprising nylon interwoven with the cotton wefts.

8. A paper mill drying felt comprising interwoven warps and wefts and having the same number of ends of warp per inch throughout its entire width, the warps throughout the major portion of the width of the felt comprising cotton fibers, a portion at least of the warps in each margin of the felt comprising an artificial filamentous material which is non-absorbent of lubricating oil.

9. A paper mill drying felt comprising interwoven warps and wefts, the warps throughout the major portion of the width of the felt comprising cotton fibers, each margin of the felt for a distance inwardly from its edge of the order of three inches in width comprising compound warps of nylon and a natural textile fiber, and those warps which are included in each selvage structure being of pure nylon.

10. A paper mill drying felt comprising interwoven warps and wefts, the warps throughout the major portion of the width of felt being of cotton, each margin of the felt for a distance inwardly of its edge of the order of three inches in width comprising plied warps, each consisting of cotton and nylon yarns twisted together, and those warps which are included in each selvage structure being of pure nylon.

EDWARD H. HALL.

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