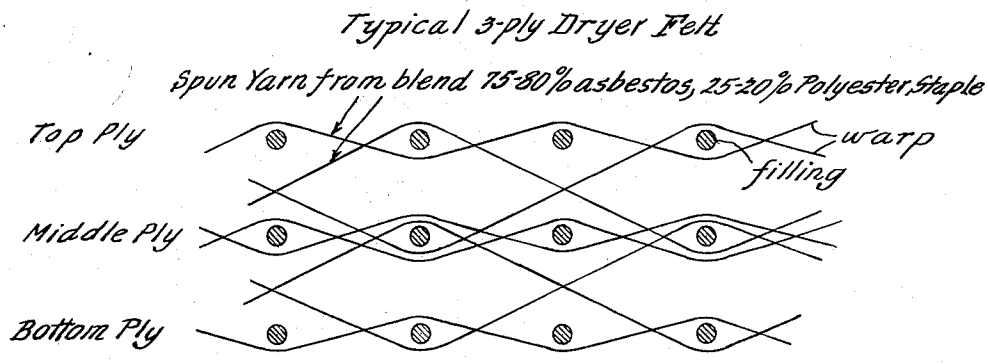
Aug. 2, 1960 D. V. ASTEN ET AL 2,947,328

ASBESTOS DRYER FELT

Filed May 10, 1955



Asten, Dietrich V. INVENTORS
Schoepf, John G.

BY Watson, Cole, Grindle & Watson

ATTORNEYS

United States Patent Office

2,947,328

Patented Aug. 2, 1960

2,947,328

ASBESTOS DRYER FELT

Dietrich V. Asten and John G. Schoepf, Philadelphia, Pa., assignors to Asten-Hill Mfg. Co., Philadelphia, Pa., a corporation of Delaware

Filed May 10, 1955, Ser. No. 507,498

3 Claims. (Cl. 139—412)

This invention relates to dryer felt for paper making machines and the like and is directed more particularly to a woven dryer felt which includes in its construction a substantial amount of asbestos fibers and is thus adapted to withstand relatively high temperatures.

As is well known in the art, paper is made by flowing a slurry of cellulosic fibers and water on to a travelling continuous belt of fine mesh screen through which a major part of the water is removed by drainage and suction. After enough of the water has been removed for the web to support its own weight, it is transferred to a fabric blanket or felt and conveyed through the nips of a series of roll-type presses and thence over the periphery of a number of cylinders heated by steam or otherwise in order to extract the residual moisture. For effective drying, the surface of the heated cylinders must be maintained at a relatively high temperature, approximately equal to or exceeding the boiling point of water. Continued exposure to high temperature results in damage to the material from which the blanket or felt is woven, and where natural fibers, such as cotton and wool, are employed, this damage tends to be severe, lessening the effective life of the felt.

It has been previously suggested that the heat resistance of a felt might be substantially improved by the use of asbestos in the construction thereof. Asbestos is a natural mineral fiber and when spun into yarns is inferior both from the standpoint of tensile and shear strength to comparable yarns spun from natural vegetable and animal fibers. This material is, however, heat resistant and nonconductive and these properties cause it to be well adapted functionally for incorporation in dryer felts. To compensate for the lack of strength of asbestos, the expedient has been adopted of assembling these fibers with other natural fibers which happen to be stronger. This has been accomplished either by plying together yarns spun from asbestos and fibers such as cotton, or by developing a sheath or outer covering of asbestos fibers around an inner core of a cotton yarn.

Since the time this expedient was put into practice, conditions in the paper industry have undergone considerable change. Demands for paper have increased materially and to keep pace with the demand it has been necessary to increase the production of paper machines. This greater output has been effected, in large measure at least, by increasing the speed of operation of these machines which, in turn, requires the use of high temperatures to bring about a corresponding increase in the drying capacity thereof. As a consequence of these variations in operating conditions, the effective life of the felt has been greatly decreased and for several reasons. The need for higher speeds of belt travel means that the felt is subjected to a greater amount of abrasion, as from the drive rolls, and of flexion, which, of course, occurs at each change of direction in the path of the felt. Further, the felt was required to absorb a greater amount of moisture and to release this moisture at a greater rate than before; the physical strain on the fibers, particularly those

of cotton, was therefore aggravated resulting in the greater deterioration thereof. The natural vegetable and animal fibers, unfortunately, are not adapted to withstand temperatures much above the boiling point of water and this shortcoming is intensified as higher temperatures are encountered; thus, these fibers are subject to severe damage on prolonged contact at temperatures essential to the increased rate of production. An additional deleterious factor involved in the production of more and better paper has been the use of new and more effective chemicals, as in the sizing or to give the paper particular desirable properties. These chemicals do not pass off into the atmosphere when the moisture is evaporated from the felt but are retained and accumulated in the felt. As this concentration of chemical additives becomes heavier, the natural fiber yarns are subjected to progessively more damage as a result of the attack of these chemicals.

The drawing shows in schematic cross section a dryer felt of the type to which the invention is directed.

After extensive experimentation, it has been discovered that the use in the construction of felts of combination of asbestos with synthetic polyester fibers obtained by the condensation of a polymethylene glycol with terephthalic acid is surprisingly effective in increasing the life of the felt. The manufacture of synthetic polyester fibers per se does not form a part of the present invention. In general, however, it is known that these fibers are derived by the reaction of a particular dibasic acid with a member of a particular class of dihydroxy alcohols. The particular disbasic acid employed is tere- or para-phthalic acid having the formula $C_6H_4(COOH)_2$. The class of dihydroxy alcohols employed is the polymethylene glycols which have the generic formula $C_nH_{2n}(OH)_2$ where n varies from 2 to about 10. The preferred member of this class of alcohols is polyethylene glycol because of its ready availability at reasonable cost. Fibers of polyethylene terephthalate may be obtained, either in staple or continuous filamentary form, from the E. I. du Pont Company, being sold by that company under the trademark "Dacron."

The following properties of the polyester fibers contemplated for use in the present invention are of significance in connection with their peculiar suitability for such use. These fibers possess almost unequalled resiliency, especially to crushing, and consequently are well-adapted to withstand continued flexing. They are characterized by outstanding resistance to temperatures of the range encountered in the drying stages of papermaking machines and can withstand prolonged exposure to temperatures approaching about 250° C. They are more than adequate from the standpoint of resistance to abrasion and are not subject to accelerated wear or attrition resulting from frictional contact with moving surfaces. When formed into yarns, they are fully comparable in tensile strength, particularly when in continuous filamentary form, with highly twisted cotton yarns, and this strength, unlike that of cotton, is maintained over long periods of use.

One of the principal roles of the dryer felt is to absorb moisture from the damp paper web with which it is in supporting contact. The synthetic polyester fibers are, however, hydrophobic, which is to say that they have vitrually no affinity for water, and, in fact, absorb less than 1 percent. It is essential to the practice of the present invention, therefore, that the synthetic polyester fibers be associated or combined with a substantial proportion of other fibers which do have the ability to absorb water and are thus capable of contributing to the drying of the paper web. This proportion should be in the order of 50 to 95 percent. The asbestos fibers will, of course, constitute a substantial amount of the non-

Published by AsbestosClaims.Law
asbestosclaims.law/library/21799/2

polyester fibers and it is particularly desirable that a high concentration of asbestos fibers be present at the surface of the felt which is in face-to-face abutting contact with the paper web. It is not necessary that asbestos fibers constitute the entire amount of non-polyester fibers, as minor proportions of other fibers, such as cotton, nylon, and the other natural and synthetic fibers, can be incorporated in the felt, especially in the regions thereof which are relatively remote from the paper web, although, as a practical matter, synthetic fibers, other than polyester, do not usually contribute to the life of the felt to an extent commensurate with the increase in cost caused by their inclusion.

The manner in which the asbestos and synthetic polyester fibers are combined is capable of considerable variation dependent largely upon the individual preferences of the particular manufacture. It is essential, however, that the association or combination be such as to effect intimate relationship of the two types of fibers in order that the full contribution of strength and durability of the polyester fibers may be realized. For example, previously prepared separate yarns of the two types of fibers may be combined in the conventional fashion into a single plied yarn consisting of interlaid or entwined helices of the individual yarns; yarns may be spun from a blend of the staple fibers of the two types and plied together, or a strand of the polyester fibers may be fed into a roving of asbestos fibers just prior to a twisting operation, thereby developing a sheath of asbestos fibers about a central core of polyester yarn. Where continuous filamentary polyester yarns are used in the core, it is desirable that one or more cotton yarns be included in the core to improve the "bond" between the sheath and core. The spinning of staple polyester fibers can be accomplished by either the cotton or wool spinning systems.

In accordance with the preferred aspect of this invention, it is contemplated that the felt be constructed of a plurality of plies of interwoven yarns, which may vary in number from about 2 to 5, the individual plies being connected together during the weaving thereof into a more or less integral "laminate" by means of sections of yarn derived from one of the plies being floated around yarns from the other plies in any one of a variety of ways. The weaving of multi-ply fabrics in a single operation by the use of a plurality of warps and wefts is a well-developed facet of the textile art and does not require a detailed discussion here. The felts that are more commonly used are those having two plies, three plies, and a hybrid between these two, having three warps and two fillings. All multi-ply felts have at least two plies in common, the ply that is in direct contact with the paper web, to be referred so as the surface or top ply, and the ply remote from the web, to be referred to as the bottom or backing ply. The plies, if any, between these two will be referred to collectively as intermediate plies.

There are a number of possible arrangements of yarns in the plies and all are within the scope of the present invention. The asbestos containing yarn must, of course, be present at the surface of the felt; hence, either or both of the filling and/or warp of the surface ply must be composed, in large measure, of asbestos fibers. Where the backing of the felt is to be constructed all, or in part, of cotton and thus be subject to loss in strength, polyester yarns should be incorporated in the surface ply and possibly in the intermediate plies. In this case, for example, any of the yarns combining asbestos and polyester fibers may be employed as both warp and filling, or as either warp or filling, with the other being constituted by an all polyester yarn. In those cases where the type of paper being produced requires the use of the chemicals which are peculiarly capable of causing deterioration, more effective protection can be obtained by forming the backing ply entirely of polyester yarns with the yarns in the surface ply being either a combination of asbestos and cotton or asbestos and polyester fibers, dependent upon the ultimate strength desired of the felt. In the event exceptional strength is required, this may be obtained by making use of continuous filamentary polyester yarns, in contrast to staple polyester yarns, as an all polyester yarn in one or both directions of the backing ply and/or in one of the directions of the surface ply. It will be understood that in any of the above situations the core yarn might be substituted for the plied yarn. The extent to which the polyester yarns are employed either in individual form or in combined relationship with asbestos fibers or yarn, or cotton fibers or yarn, is governed by the ultimate strength required of the felt consistent with the increased material cost, greater amounts of polyester fibers resulting in a more expensive felt having an increased effective life, and greater amounts of cotton resulting in a cheaper felt of lesser durability. A compromise between two conflicting objectives may be achieved by replacing some of the polyester fibers of the otherwise all-polyester yarns with cotton or other less expensive fibers.

In many cases, the intermediate plies may be formed exclusively of cotton as this decreases the overall cost of the felt. In other cases, where exceptional strength and/or durability are prerequisites, the warp and/or filling of one or more of the intermediate plies may be constituted all or in part of polyester fibers.

In the course of their manufacture by extrusion techniques polyester fibers are subjected to a stretching and, consequently, tend to return or shrink to their original unstretched length unless they are subjected to heat treatment to relieve unbalanced stresses set up in the fiber molecules as a result of stretching. Although it is possible to subject the completed felt to a heat treatment, this is liable to result in damage to the felt should it contain fibers such as cotton or wool. For this reason, it is recommended that the individual polyester yarns be subjected to heat at the temperature in the vicinity of 200° C. prior to use in weaving. These yarns may be heat set while they are in package form, during the course of the twisting operation before combination with other yarns, or in a separate throwing operation. Virtually any heating instrumentality is suitable for this purpose.

It is to be understood that where the term "polyester fibers" is employed in the specification and claims, it is intended to comprehend all of the various forms in which polyester materials are available to the textile trade, including staple and continuous filaments.

In order to facilitate a full and complete understanding of the invention, the following examples are given as illustrative of its practice. In these examples the term "cut" is employed in its usual sense in the felt industry as applied to asbestos yarns, meaning the number of yards, expressed in hundreds, of yarn per pound of weight.

Example I

A three-ply felt having a total of 60 ends and 39 picks was woven employing in the surface ply as both warp and filling a yarn plied with 10 turns S ply twist from two 13 cut yarns spun from a 75–25 blend of asbestos and polyester staple fibers and having 12 turns of Z twist; in both the intermediate and backing plies as filling a 7 cut 5 turn S yarn of asbestos wrapped around a core of two ends of 10 count cotton; and as warp in both intermediate and backing plies a yarn plied with 5 turns S twist from 5 strands of 8 count cotton. This felt was relatively inexpensive to manufacture and was more satisfactory in strength and durability than a comparable felt constructed of asbestos and cotton alone.

Example II

The felt of Example I was duplicated except that a yarn plied with 5 turns S twist from four 10 count (cot-

Published by AsbestosClaims.Law
asbestosclaims.law/library/21799/3

ton system) yarns spun from 100% staple polyester fibers was employed as the backing warp. This felt was more durable than the felt of Example I, particularly when exposed in use to chemicals.

Example III

The felt in Example II was duplicated except that the intermediate filling was a 2 ply 10 turn S yarn plied from 13 cut 12 turn Z yarns spun from a 75–25 blend of asbestos and polyester staple. The additional polyester and asbestos fibers in the intermediate ply further enhanced the life of the felt and its resistance to high temperatures.

Example IV

The felt in Example II was duplicated except that the 2 ply 10 turn S yarn plied from 13 cut 12 turn Z blended yarns was used as the filling in all plies. The life of this felt was from 75% to 150% greater than that of a comparable felt where the polyester fibers were replaced by cotton fibers. The total fiber content of this felt was about 30.5% polyester fibers, 60% asbestos fibers, and 9.5% cotton fibers.

Example V

The felt of Example IV was duplicated except that in the warp a 4 ply yarn plied with 5 turns S twist from 10 count (cotton system) 100% polyester yarns was alternated with the 13 cut, 2 ply blended yarn in the warp of the surface ply. The heat resistance and chemical resistance of this felt were exceptional. Its absorbency was slightly lower than in Example IV and its cost was the greatest of all preceding examples. The fiber content was 36% polyester, 54% asbestos, and 10% cotton.

Example VI

The felt of Example V was duplicated except that 13 cut, 2 ply blended yarn was replaced by 7 cut 5 turn S yarn formed by wrapping a roving of a 78–22 asbestos cotton blend about a core of two ends of 10 count cotton and 2 ends of 220 denier polyester. The strength of this felt in all directions was greater than in the preceding examples.

Example VII

The felt of Example V was duplicated except that the 100% polyester spun yarn was replaced by a yarn plied with 2 turns S from three 1100 denier polyester continuous filamentary yarns. The strength was also excellent, being equal or greater to that of Example VI.

It will be appreciated that combinations of yarns other than those given in the examples are possible and that these combinations and combinations with other yarns may be employed in the preceding examples and in felts formed with different numbers of plies. The actual construction of the felts is a matter of wide variation and well within the skill of the art. It is not the particular construction that constitutes the invention but rather that broad concept of employing fibers of asbestos and polyester, either alone or in association with other fibers, in the formation of multi-ply dryer felts; consequently, the examples are included solely for the purpose of illustrating rather than restricting the practice of this invention.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A dryer felt adapted to withstand high temperatures, flexion, abrasion, and prolonged exposure to high concentrations of chemicals employed in paper manufacture, said felt being constructed of a plurality of interconnected plies, each of which is woven from warp and filling yarns, the surface ply being composed predominantly of asbestos fibers, said felt being characterized in that at least the warp of said surface ply comprises essentially yarn spun from a homogeneous blend of polyester staple fibers and asbestos fibers and containing about 75–80% asbestos fibers and about 20–25% polyester fibers.

2. A dryer felt as in claim 1 wherein both the warp and filling of said surface ply comprise essentially said yarn spun from said homogeneous blend of asbestos fibers and polyester staple fibers.

3. A dryer felt as in claim 1 wherein said spun yarn is a plied yarn formed by twisting together a plurality of individual yarns, each of which is spun from said homogeneous blend of polyester staple fibers and asbestos fibers.

References Cited in the file of this patent

UNITED STATES PATENTS

2,317,910	Hill	Apr. 27, 1943
2,506,667	Hall	May 9, 1950
2,542,297	Sunbury	Feb. 20, 1951
2,604,689	Hebeler	July 29, 1952

FOREIGN PATENTS

702,046	Great Britain	Jan. 6, 1954
710,078	Great Britain	June 9, 1954

OTHER REFERENCES

J. of Tex. Inst., February 1947. (Copy in Division 21.)

Published by AsbestosClaims.Law
asbestosclaims.law/library/21799/4