Nov. 16, 1937. W. A. BARRELL 2,098,993

ASBESTOS FILLED DRIER FELT

Filed Aug. 15, 1935

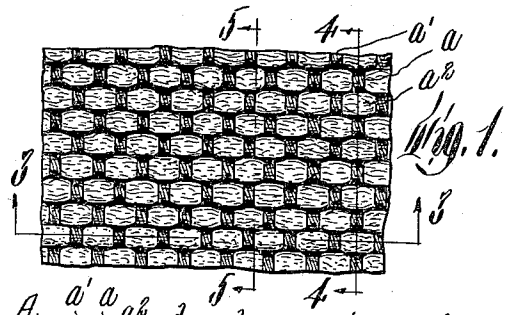


Fig. 1.

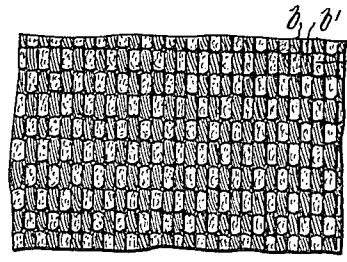


Fig. 2.

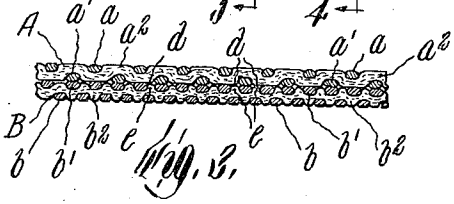


Fig. 3.

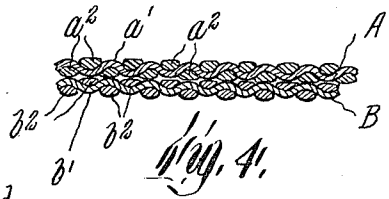


Fig. 4.

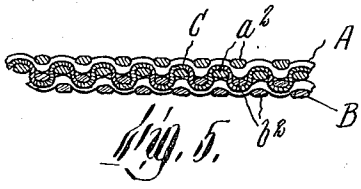


Fig. 5.

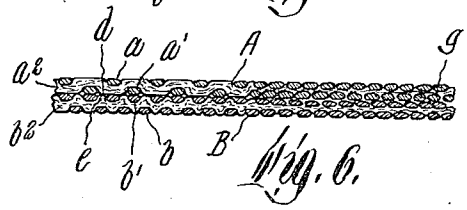


Fig. 6.

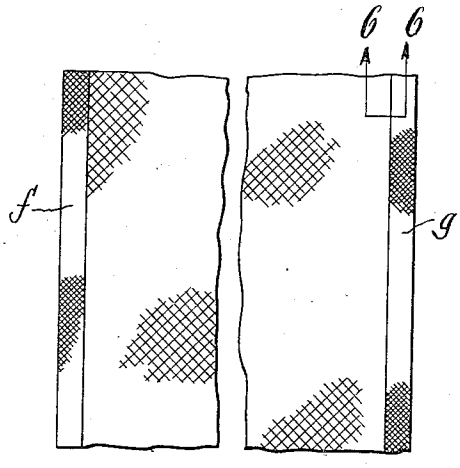


Fig. 7.

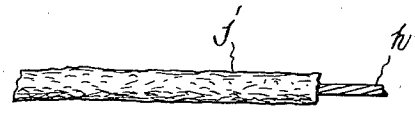


Fig. 8.



Fig. 9.

Inventor
William A. Barrell
by Wright, Brown, Quinby & Clay
Attys.

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ASBESTOS FILLED DRIER FELT

William A. Barrell, North Andover, Mass., assignor to Lawrence Duck Company, Lawrence, Mass., a corporation of Massachusetts

Application August 15, 1935, Serial No. 36,291

8 Claims. (Cl. 139—426)

This invention relates to drier felts for paper machines and particularly those which contain asbestos in their construction as a protection against the effects of heat and moisture to which such felts are subjected and to use beneficially the moisture absorbing properties of asbestos.

Objects of the invention are to produce a drier felt combining the advantages of a substantial content of asbestos with greater tensile strength and lighter weight than the asbestos felts in use prior to this invention and related inventions for which I have sought and secured patent protection; and to combine the strength due to a warp made entirely of cotton (or other fibers substantially equivalent to cotton in regard to strength and relatively light weight in comparison with asbestos) with minimum liability to stretch in length and contract in width under the severe tension to which drier felts are subjected in use. Another object is to prevent seepage of oil and grease from the drums of the drier into the asbestos content of the felt, sufficiently to avoid contact of oil soaked strands and fibers with the paper as long as the felt remains otherwise serviceable.

In carrying the invention into effect I construct my improved felt with cotton warp and asbestos filling, woven in two plies with binder warp strands passing between the two plies at points numerous enough to effect a secure connection between them. Instead of cotton for the warp I may alternatively use other fibrous material having adequate strength and which is also light enough in weight to meet commercial requirements, such other fibers being considered as equivalent to cotton for present purposes. The important point is that asbestos strands are not used for any part of the warp, but the entire content of asbestos in the felt is contained in the filling, and is so disposed as to absorb moisture readily and quickly from the paper, and to protect the cotton against the destructive effects of heat and moisture so effectively as to assure long, efficient and economical life of the felt.

An illustrative embodiment of the invention is described in detail in the following specification and shown in the drawing, in which,—

Fig. 1 is a plan view of the face of such illustrative embodiment;

Fig. 2 is a plan view of the back of the same;

Fig. 3 is a section on line 3—3 of Fig. 1, taken in the direction of the filling;

Fig. 4 is a section taken on line 4—4 of Fig. 1 in the direction of the warp of the felt;

N. B. The foregoing figures are drawn in approximately correct ratio to the actual felt, but on a larger scale for clearness.

Fig. 5 is a section on line 5—5 of Fig. 1, showing the disposition of the binder strands;

Fig. 6 is a fragmentary section of one of the selvage edges of the felt to illustrate one form of means to stop oil seepage from the drums of the drier into the body of the felt;

Fig. 7 is a fragmentary plan view of a portion of the felt, on a much reduced scale, to show the oil stops at opposite edges;

Figs. 8 and 9 are detail views, on an enlarged scale, of alternative types of asbestos filling yarn which may be used in the construction of this felt.

Like reference characters designate the same parts wherever they occur in all the figures.

This felt is composed of two plies of woven construction, designated A and B respectively. Each ply is woven of cotton warp and asbestos filling, as a plain weave; the warp strands of the ply A being designated a, a' and the filling a^2, while the warp strands of the ply B are designated b, b', and the filling as b^2. The two plies are connected together by binder warp strands c which pass over and under filling strands a^2 and b^2 alternately.

An important feature of the invention is that the asbestos filling yarn is made soft and bulky, considerably larger in diameter and softer in texture than the warp strands, whereby the latter sink deeply into the filling strands and are themselves much less bent than is the case with warp strands interwoven with hard filling. It follows from this that the asbestos lies in both surfaces of each ply, but the asbestos strands are not much crimped, (i. e. bent or offset, and shortened). The substantial absence of crimp in the weft strands and the comparative straightness of the warp strands lessens the tendency of the felt to contract in width under the tension applied to it in use. However, it may be noted that such further straightening of the warp strands as occurs under the severe tension applied to the felt in the drier causes the warp strands to sink still further into the asbestos strands and makes the asbestos more prominent in the surface.

The asbestos in the face of the felt which comes next to the paper is distributed regularly over this entire face and, owing to the originally large size of the asbestos filling yarn and its ability to spread under pressure, forms a major part of this face. It absorbs moisture at all of the numerous and closely adjacent areas where asbestos comes

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into contact with paper. Those portions of the asbestos filling which lie in the inner surfaces of the two plies (which for convenience of description may be referred to as asbestos tufts) make contact with each other at many points, some of which are denoted in Fig. 3 by the reference letters *d* and *e*, whereby the asbestos in the back ply forms in effect a continuation of the capillary moisture-conducting paths of asbestos in the face ply. Where these portions or tufts of asbestos come together, the equivalent of continuous wicks are created leading from the face to the back of the felt. Thus moisture absorbed from the paper is conducted directly through the felt to the back and evaporated at a multiplicity of points into the outer air.

Preferably, although this is not an essential, the weave of the face ply, here represented as the ply A and being the ply which comes next to the paper, is made of more open weave than the back ply B, by having fewer warp strands. This has the effect of relatively increasing the proportion of asbestos exposed on the outer or front face of the felt. The specific felt here illustrated is a plain weave made with twelve ends of warp per inch of width in the face ply, controlled by two harnesses in each of which are six ends of warp, twenty-four ends of warp per inch of width, in the back ply, also controlled by two harnesses, and six ends of binder warp per inch, controlled by a fifth harness. There are twenty-seven picks of filling per inch. The asbestos filling yarn has substantially twice the diameter of the warp yarns, which latter are of the same diameter in both plies. The binder yarns are much finer than the body warp yarns and are substantially covered and protected by the latter in both outer faces of the felt. Even though the ends of warp in the back ply are fewer than in commercial all cotton drier felts of two ply construction heretofore made with warp strands of the same size, yet the felt as a whole is not subject to as great stretching in length and contraction in width as are such all cotton felts, because of the peculiar interrelationship between the hard warp strands and soft bulky filling yarn.

It will be understood that the details just given of a specific embodiment of the invention are not to be construed as limiting the broader aspects of the invention thereto. While I claim these particulars as a subordinate feature of the invention, nevertheless I intend to protect under my broader claims substantially equivalent felts containing different numbers and weights of strands and in which the number of warp strands is the same in both plies, or in other ratios than one to two, and in which the pattern is other than a plain weave.

This felt also embodies means to prevent or resist seepage of oil from the drums and gears of the drier inward from the edges of the felt far enough to interfere with drying of the paper. The heated drums or cans of paper driers are usually more or less oily or greasy at the ends from the lubricants applied to their journal bearings and driving gears. Asbestos fiber is highly absorbent of oil as well as of water, wherefore if any part of an asbestos felt which comes into contact with the paper is already oil soaked, the paper in contact with such part is not dried so rapidly as other portions of the paper.

Heretofore drier felts containing asbestos have been of uniform construction throughout their width, whence the asbestos in the face comes into contact with the drier cans where the edges of the felt extend beyond the edges of the paper. With such felts the oil creeping over the ends of the cans is absorbed by the outer edges of such felts, and gradually accumulates and seeps inward toward the middle. Eventually the combined effects of seepage and narrowing of the felt bring oily parts into contact with the edges of the paper. Those parts of the paper therefore do not dry so rapidly as the rest of the web, from which moisture is absorbed by the oil-free asbestos fibers and strands of the felt. The only means heretofore known to obtain adequate drying of the edges of the paper under these conditions are either to reduce the width of the paper web or increase the steam pressure and temperature in the drums. Both of these methods are expensive and objectionable; the first because it involves diminished production of paper, and the second because it involves increased fuel consumption and makes all of the paper except its edges too dry. The paper does not calender well, due to insufficient moisture content, and suffers a loss of weight.

On account of these difficulties users of asbestos felts have heretofore discarded them as soon as the factors of oil seepage and width contraction have together brought oily parts of the felt into contact with the paper. But otherwise the felts so discarded have been unimpaired in usefulness and capable of much longer useful life.

In effecting the object of preventing or resisting oil seepage, I have so constructed the margins of my felt that only cotton, and not asbestos, comes into contact with the drums at the margins. The specific means here shown for doing this consists in providing so great a number of warp strands in the margins of the felt, or at least in the face ply thereof, as substantially to cover the asbestos filling. Although the warp strands are relatively hard and firm in comparison with the asbestos filling yarn, this does not mean that they are incompressible. On the contrary they have considerable capacity for compression and distortion in cross sectional form. Those at the margins are so numerous and closely crowded together that they compress one another at the crossing points of the shed, but where they cross the picks of filling they spread laterally and lie so near together that they do not sink into the filling like the more widely spaced warp yarns in the main part of the felt, and do not leave room for the asbestos to come to the surface. Sixteen ends per inch of warp in each harness at the margins of the felt, when of the same weight as the ends used in the balance of the warp, are effective for this purpose; and it is feasible thus to weave even more ends per inch of the same size yarn, or a still greater number of thinner strands.

Cotton is inherently much less absorbent of oil than asbestos fiber, while the closer and harder twist under which the cotton fibers are held in the warp strands increases their oil repellent quality.

Referring to Fig. 7, which shows a fragment of an entire felt on a greatly reduced scale, the oil repellent margins are shown at *f* and *g*. The width of these margins is somewhat less than the overlap of the felt beyond the edges of the paper web; enough less to insure that the oil stopping cotton warp strands will remain substantially clear of the paper after the felt has contracted in width as far as it will in use. A normal width of oil stop is approximately three inches, but its width may be considerably larger

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or less than this within the scope of the invention.

The asbestos content of the felt protects the cotton content from rapid deterioration because it retains heat and moisture better than cotton and for a longer period, and because, lying as it does in close embrace with the cotton strands, it tends to keep the cotton in a more even condition as to heat and moisture. In connection with the body warp strands it covers the binder strands substantially completely in the face of the felt, and so preserves the strength of the latter and the close bond between the two plies even after the cotton in the face of the felt has lost its strength and integrity. Thus the felt remains serviceable until long use has destroyed the strength of the back ply warp.

The characteristics and advantages herein described depend on the use of asbestos filling which is soft and highly compressible. It is not feasible to spin asbestos fibers alone so as to combine such softness with sufficient tensile strength to hold together when weaving. Other strands or fibers must be used for tensile strength when looseness of the asbestos fiber is desired. I have shown here two of the possible types of reinforced asbestos yarn which may be used in this felt. That shown on an enlarged scale in Fig. 8 consists of a core *h* of strong twisted cotton yarn, around which is loosely twisted a soft enveloping mass *j* of asbestos fibers. Yarns of this character are already known. Another form, shown in Fig. 9, is an original invention of my own. It consists of an elongated body *k* of asbestos fibers, without a core, (with which is preferably mingled a sufficient content of cotton fibers to increase the strength and reduce the weight of such body), around which are braided fine cotton threads *l*, of which the number is only sufficient to confine the asbestos fiber. I have found that eight such threads, of which four pass in right hand helices and are interbraided with the other four passing in left hand helices, are sufficient and ample for the purpose, although there may be more or fewer. These threads extend with a long helical lead, the length of which is many times the diameter of the yarn, whereby they form a cage of which the open meshes are so large that practically unimpeded opportunity remains for the asbestos to absorb and transmit moisture after being woven. But the confining threads prevent particles and bunches of asbestos fiber breaking loose from the yarn. Even though after weaving, some parts of these threads may overlie the asbestos in the face of the felt, and be quickly destroyed in use, their destruction does not weaken the felt appreciably because the asbestos fibers are long enough, and confined at points so near together by the over passing warp strands, that they have no tendency to disintegrate.

Such asbestos filling yarns may be made in different diameters, up to sizes amply large for the purposes set forth. Or two or more of them may be placed in each pick of the filling.

The mention herein of cotton as the fiber of which the nonasbestos strands of the felt are made is not to be taken as a necessary limitation of all phases of the invention. Actually cotton is the best material available and is used commercially to the practical exclusion of other fibers. But I reserve the right to use, and to protect under at least the broader of the appended claims, other fibers of vegetable or animal origin now known, or which may hereafter be found, to be suitable for the purpose in combination, substantially as described, with asbestos fiber.

That portion of the invention which resides in the oil stops may, within the scope of protection claimed for it, be combined with asbestos felts, or those containing asbestos, of other constructions than that shown here.

The designation in the following claims of certain strands as being asbestos strands is intended to include also those in which other fibers are associated with asbestos for the purposes previously indicated.

What I claim and desire to secure by Letters Patent is:—

1. A drier felt comprising two plies of interwoven nonasbestos warp and asbestos filling, and binder warp strands crossing picks of the filling alternately in both plies, the asbestos of the filling being exposed between adjacent warp strands on both faces of both plies and parts of the filling strands in both plies being in contact forming substantially continuous absorbent wicks through both plies.

2. A drier felt for paper machines comprising two plies of interwoven nonmineral fibrous warp and asbestos filling, and binder warp strands passing around picks of the filling alternately in both plies, the ends of warp in the face ply being fewer and more widely spaced apart than the warp yarns of the back ply, and the filling yarn being relatively soft and compressible by the warp yarns, whereby asbestos is caused to appear on the paper-contact face of the felt in areas which collectively form a major part of the area of such face, and at the opposite side of the face ply is brought into contact with portions of the asbestos filling of the back ply.

3. A drier felt for paper machines comprising two plies both woven of cotton warp and asbestos filling combined with binder warp strands passing around picks of the filling alternately in the two plies, the warp strands of the face ply being spaced so widely apart, and the filling yarn being so soft and compressible by the warp yarns as to cause asbestos to appear on the face of said ply in areas which collectively form a major part of the total area of said face, and the back ply having twice as many warp strands as the face ply of which alternate strands are in the same longitudinal planes with the face ply warp strands, and having an equal number of filling strands in the same transverse planes with filling strands of the face ply.

4. A drier felt for paper machines comprising two plies both woven of cotton warp and asbestos filling combined with binder warp strands passing around picks of the filling alternately in the two plies, the warp strands of the face ply being spaced so widely apart, and the filling yarn being so soft and compressible by the warp yarns as to cause asbestos to appear on the face of said ply in areas which collectively form a major part of the total area of said face, and the back ply having more numerous warp strands; the warp strands of said back ply however being widely enough spaced and indented deeply enough into the filling thereof to effect contact between portions of the filling on the inner face of the back ply with portions of the filling on the back of the face ply.

5. A drier felt for paper machines comprising a cotton warp and asbestos yarn interwoven as filling with the warp strands, said asbestos yarn consisting of a loose elongated body of asbestos

fiber and a confining group of fine threads interbraided with one another around such asbestos body with a sufficiently wide spacing between them to expose a substantial part of the asbestos body.

6. A drier felt for paper machines comprising a cotton warp and an asbestos filling interwoven therewith, the filling yarn comprising a soft and loosely twisted body of asbestos fibers and a cage of fine cotton yarns braided around the asbestos with large open meshes, the warp strands being smaller and harder than said asbestos yarn and being spaced apart sufficiently to indent the filling yarn and cause portions thereof to appear on the surface of the felt between the surface portions of the warp yarns.

7. A drier felt for paper machines comprising two plies of substantially the construction set forth in claim 6, and binder warp strands connecting said plies together, portions of the asbestos filling at the inner faces of the two plies being in contact with one another and collectively forming wick paths for moisture from the paper.

8. A drier felt consisting of an interwoven warp and filling of which the filling is composed of substantially asbestos yarn larger in diameter and softer than the warp yarns, and the warp yarns are of other material than asbestos and are enough smaller and denser than the filling yarn, and sufficiently spaced apart from one another, to indent the picks of filling sharply, whereby the material of the filling is caused to substantially fill the spaces between adjacent warp yarns in the face of the felt, making a flat surface.

WILLIAM A. BARRELL.

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