Nov. 16, 1937. W. A. BARRELL 2,098,994

ASBESTOS FACED DRIER FELT

Filed Aug. 15, 1935

Fig. 1.

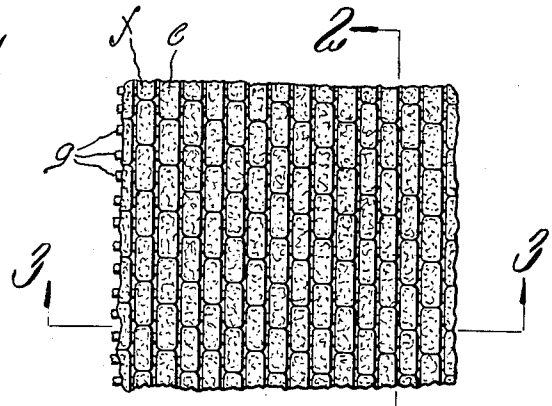



Fig. 2.

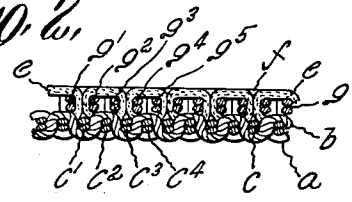
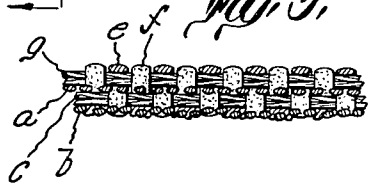



Fig. 3.



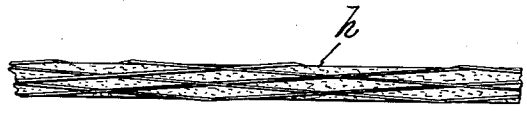
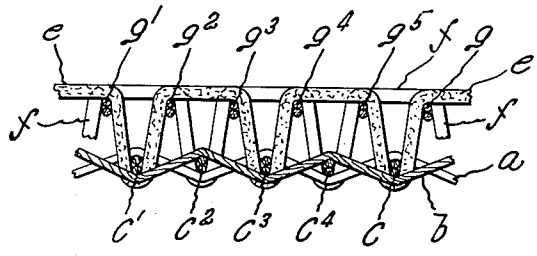




Fig. 4.

Fig. 5.



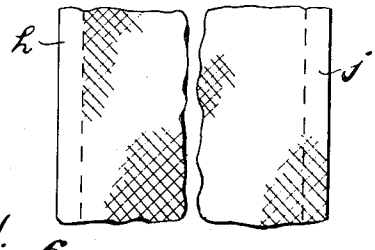




Fig. 6

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# UNITED STATES PATENT OFFICE

2,098,994

## ASBESTOS-FACED DRIER FELT

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Application August 15, 1935, Serial No. 36,292

7 Claims. (Cl. 139—426)

The present invention relates to drier felts for paper machines, that is, the wide bands by which newly made paper, containing all the water which remains after the paper has passed through squeezing rolls, is conducted around a multiplicity of steam heated drums in being dried by evaporation. Such so called felts of woven construction have long been used; and to some extent felts of this type have been made more resistant to the destructive effects of heat and moisture by incorporation of asbestos in their structure. While asbestos, as so used, has proved its worth as a means to increase resistance of the felt to deterioration by burning and rotting, and also to hasten drying of the paper by absorption and evaporation of moisture, its great weight in comparison with the cotton which has generally been used for making drier felts, and other textile fiber suitable for the purpose is a serious drawback. Even when asbestos fiber has been combined with a substantial proportion of cotton, as has been done to provide the essential strength in which spun asbestos fiber is deficient, the felts heretofore made with enough asbestos for heat protective purposes have been substantially heavier than all-cotton felts of comparable dimensions.

A primary object of the present invention is to lessen the weight of drier felts containing a sufficiency of asbestos for heat protection, and being otherwise sufficiently strong and durable for satisfactory practical use. In other words, this object is to produce a felt in which the body is of cotton, (or the practical equivalent of cotton) so woven as to have adequate strength and satisfactory resistance to elongation and narrowing in use, and of which the face which in use comes next to the paper is substantially wholly overlaid by asbestos so interwoven with the body structure as to be securely united thereto in a composite construction which involves a minimum of total weight and of manufacturing cost.

Another object is to avoid the fluffing off or detachment of bits and wads of asbestos fibers from the strands in which the asbestos is contained. A difficulty heretofore met with in drier felts containing asbestos warp strands woven with two or more harnesses (i. e., in such manner that adjacent strands may rub against one another when the shed is changed), is that by reason of the looseness with which the asbestos fibers are confined at the surface of such strands, the fibers are more or less rubbed and torn away in the course of weaving—in other words, they "fluff off"—and small masses of asbestos fluff remain on the surface of the felt, sufficiently entangled with surface fibers so that they can be removed only by prohibitively costly methods, but at the same time so lightly connected that when embedded in the soft damp paper during practical use of the felt, they may remain in the paper and cause defects. Or bunches of fluff which do not so remain may make depressions in the paper.

In the accomplishment of these objects I have produced an asbestos faced drier felt of which, in its preferred form, the body is a single ply of firm, strong, closely woven fabric made of cotton strands, although other suitable materials than cotton may be used for either the warp or filling, or both, and the asbestos covering is provided in the form of strands parallel with the warp of the body, interwoven with certain non-contiguous filling strands of this body structure, and supported over one face thereof by interposed weft strands. The asbestos strands are each arranged to overlie two or more picks of supporting filling wherever they come to the face but embrace a single pick only of the body structure at each point of interweaving therewith, and contiguous asbestos strands are passed into and out of the body ply oppositely to one another, that is, they are shifted in the course of weaving by different harnesses.

An important factor in the accomplishment of both objects above mentioned is a new character of asbestos strand which I have invented and incorporated in the felt. It comprises a body of loosely twisted asbestos fibers and an open meshed surrounding cage of fine cotton strands braided around it. By virtue of this strand construction I am enabled both to provide an adequate covering of asbestos with a minimum quantity of asbestos, and to prevent fluffing off of the asbestos fibers by rubbing of contiguous strands against one another when the shed of such strands is changed.

The invention comprises the novel construction of felt herein disclosed, in all its equivalent embodiments, drier felts of any construction embodying asbestos strands of the composite character herein described, and such a strand as an element of drier felt construction and for other purposes.

In the drawing herewith furnished,—

Fig. 1 is a plan view of a fragment of drier felt embodying this new invention;

Fig. 2 is a section taken on line 2—2 of Fig. 1, along the warp of the felt;


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Fig. 3 is a cross section taken on line 3—3 of Fig. 1;

Fig. 4 is a side view on an enlarged scale of one of the asbestos strands;

Fig. 5 is a diagrammatic view of the weave in the direction of the warp;

Fig. 6 is a fragmentary plan view of a portion of the felt, on a much reduced scale, showing marginal oil stops.

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

The felt here shown consists of a single ply body structure composed of interwoven warp strands *a*, *b*, and filling strands *c*, preferably as a plain weave; asbestos cover strands *e* and *f*; and supporting filling or weft strands *g*. The strands *a*, *b*, *c* and *g* are all made of cotton preferably, but may be of other equivalent fibers; i. e., equivalent in the sense of having adequate strength and adequate bulk and firmness to provide the desired resistance to stretching in length and contracting in width of the felt when in normal service. The warp strands *a* and *b* furnish the entire tensile strength of the felt to sustain the load imposed in carrying the paper through the drier. They are provided in sufficient numbers, of sufficient weight, and are sufficiently hard twisted, in accordance with well understood principles and facts of drier felt manufacture, to furnish the necessary strength for this purpose, and also to limit the elongation and contraction in width of the felt within the accepted commercial tolerances.

The strands *e* and *f* heretofore referred to as asbestos strands are so called because they contain asbestos. In fact they contain the entire content of asbestos in the whole felt. However, this does not imply that they must be composed entirely and exclusively of asbestos, and actually they are combined with threads or strands of other fiber to add strength and preserve their integrity in weaving, as is more fully explained further on. They are interwoven with the filling strands *c* of the body fabric and with the supporting weft strands in the manner presently described, or in an equivalent way. In the following description successive strands of the two sets or series designated *c* and *g* respectively will be distinguished specifically from one another by exponents. The asbestos strand *e* passes over a supporting weft $g'$, under and around a weft strand $c'$ of the body fabric, then up between the supporting weft $g'$ and the next adjacent supporting weft $g^2$, over the latter weft and the next further adjacent supporting weft $g^3$, down and around a third filling strand $c^3$ of the body (skipping the intermediate strand $c^2$), then up and over the next two supporting strands $g^4$ and $g^5$; and so on in continuously repeated pattern throughout the entire length of the felt. The next adjacent asbestos strand *f*, on either side of the strand *e*, passes over the two supporting wefts $g'$ and $g^2$, then down between the supporting wefts $g^2$ and $g^3$, around the filling strand $c^2$ of the body, then over the supporting wefts $g^3$ and $g^4$, down again into the body and around the pick $c^4$; and so on in repeated pattern. The asbestos strands *e* and *f*, arranged as thus described, alternate with one another throughout the width of the felt.

It will thus be seen that each asbestos strand passes over all of the supporting weft or filling strands in groups of two or more, and is formed with tying loops which pass around nonadjacent picks of filling in the body structure, each loop passing between adjacent picks of the supporting filling; while the loops of adjacent asbestos strands pass through respectively different spaces between supporting weft strands and around different picks of the body filling. While I have here shown the asbestos strands as embracing the supporting wefts in groups of two, and as repeating the pattern transversely of the felt also in groups of two, it is to be understood that this specific pattern is not an essential of the invention but that there may be three or more supporting and covering strands in each repeat of the pattern. It is important, however, that the loops of asbestos strands be distributed among all of the spaces between supporting wefts in order to maintain the face of the felt flat in one plane and prevent the supporting wefts from crowding and bunching upon one another.

The supporting wefts *g* perform the important and necessary function of holding the asbestos strands clear of the body warp on the face of the felt and enabling them to spread laterally so as to cover the face. The asbestos strands are thus spread to a considerable extent by the tension under which they are held in weaving, and are additionally flattened and spread in service by the pressure with which they are held against the drying drums and paper web; whence the body weave and the supporting weft strands become fully covered by asbestos, or substantially so. In any event the warp strands of the body structure, on which the tensile strength of the felt depends, are fully enough covered to be well protected from temperatures high enough to destroy them rapidly. The asbestos not only keeps them out of direct contact with the hot and moist paper but, with the aid of the supporting wefts, provides insulating spaces which assist in retarding heat penetration.

These supporting strands are preferably laid double in order to give added strength and increased life to the seams by which the ends of felts are sewed together. The body filling is also preferably double. It is not essential that the double filling strands be laid one on top of the other, as here shown, but they may equally well be laid side by side in longitudinal planes of the felt; and when so arranged they reduce the number of picks per inch and permit faster weaving. The felt is thus made lighter and thinner because the binding loops of its asbestos strands are fewer and shorter, and its body warp is shorter.

The felt constructed as thus described is made on a four harness loom and may be woven with one or two shuttles. Describing in detail, by way of illustration but not of limitation, the specific felt here illustrated, it is made with thirty-two ends of cotton warp per inch of width in the body, distributed in two harnesses, and ten asbestos strands per inch of width, also in two harnesses. There are twelve picks of filling per inch in the body, and the same number between the body and asbestos strands.

The asbestos strands contain a novel invention having important utility and advantage in this art. One of them is illustrated on an enlarged scale in Fig. 4. It is well known that asbestos fiber is not spinnable alone into strands sufficiently strong for weaving. Therefore the asbestos fiber is either combined with other fibers or treated with some binding material to give needed strength. The most commonly used mode of preparation is probably that in which the asbestos fiber is applied to a core filament and twisted or rolled around the core, with or

without the aid of binding thread intertwisted with both the core and the asbestos envelope. In all such strands the enveloping fibers of asbestos are more or less loosely intermingled and the outermost fibers are readily pulled out and dislodged. When such strands are used as warp and are shifted by heddles so as to form and change a shed, the rubbing of adjacent strands on one another dislodges bunches of the fiber with every change of the shed, and such loose bunches of fiber remaining in light attachment to the finished goods are highly detrimental in drier felts because they either indent the paper being dried or are transferred to the paper. In either case the paper is made effective by them. The prevention of such rubbing or fluffing off of asbestos fiber is the reason why, in making the asbestos faced drier felt of my prior Patent No. 1,991,366, February 19, 1935, the asbestos strands are woven with a single harness.

The new construction of asbestos strands which I have invented and am about to describe is immune from this liability of fluffing off. It consists of a loosely twisted elongated mass *h* of asbestos fibers, (with which cotton fibers are preferably interspersed in a sufficient quantity to increase the strength and reduce the weight of a mass of given bulk), and a confining cage of fine threads (preferably cotton) interbraided with wide meshes. The number of threads forming the confining cage is preferably the smallest capable of being successfully braided, i. e., eight, of which four extend in right hand helices and the other four in left hand helices around the asbestos mass. The braided threads constitute but a small proportion of the total mass of the composite strand, but they are sufficiently numerous and strong to give all the strength needed for successful weaving in the manner previously described and under the moderate tension to which these strands are subjected. Their helical lead is so long that the tension which is imposed on them in weaving the felt has little force to compress the asbestos or to elongate or draw out the strand. At the same time the spaces between the threads are too narrow to permit protrusion of the asbestos fiber, and as a result the strands when shifted to change the shed for the supporting wefts, contact with one another on the confining threads, and the asbestos fibers of adjacent strands do not rub against one another to any considerable extent and are not dislodged. Hence no loose asbestos fluff appears on the surface of the finished felt.

Of course the confining threads are exposed at numerous points on the face of the felt and there come into direct contact with the paper being dried and may be more or less rapidly destroyed by the heat and moisture. But their destruction has no influence on the life of the felt as a whole. Even though the loosely twisted asbestos may not be strong enough by itself for weaving, nevertheless the length of the fibers and the frictional contact between them are sufficient to secure them in the short lengths of the cover strands on the face of the felt between the loops by which they are confined and bound in the body structure. In other words, the asbestos fibers are so tightly held at such frequent intervals in the finished felt that they have no tendency to disintegrate and break loose even after the confining threads have lost their integrity. On the contrary, the wetting and pressure to which they are exposed rather tends to mat them more firmly and permanently together and to form nearly a continuous layer extending over the contact face of the felt. As the asbestos content of these strands has no interior core, such as a hard-twisted cord, it is free to flatten and spread as far as permitted by the cage threads.

In order to prevent seepage of oil from the drums or cans of the drier into the part of the felt which comes into contact with the paper, I may provide in the margins of the felt cover strands like the strands *e* and *f* but made of cotton instead of asbestos. Such margins are indicated at *h* and *j* in Fig. 6; the unshaded areas between the edges of the felt there represented and the parallel broken lines being marginal zones in which cotton cover strands are placed, while the shaded central part is the main portion containing asbestos cover strands. The ends of the heated drums or cans of the paper drier are liable to be greasy by creeping of oil from their bearings and driving gears. The margins of the felt extend beyond the edges of the paper web being dried and usually come near to the ends of the drums. Asbestos is absorptive of oil as well as of water; and it has been found in the use of asbestos felts heretofore that the asbestos fibers at the edges absorb oil from the drums and the absorbed oil accumulates and gradually seeps inward to the portions of the felt which contact with the edges of the paper web. When this occurs, the paper is not dried evenly because the oily parts of the felt do not absorb moisture from the paper so easily and quickly as do the nonoily parts. But the cotton cover strands, being relatively non-absorbent or repellent of oil, prevent such absorption and creeping of oil. In other words, they are oil stops which exclude oil from the paper contacting area of the felt virtually as long as the felt remains serviceable. The marginal zones in which this oil stop construction is embodied have a width somewhat less than the distance between the edges of the felt and the adjacent edges of the paper; enough less to permit such narrowing of the felt as normally occurs in use to take place without producing any considerable overlap of the oil stopping margins on the paper. A normal satisfactory width of such an oil stop is approximately three inches; but it may be considerably greater or less than this. In place of cotton as the material for making the oil stopping cover strands, I may use other fibers which are satisfactorily repellent to oil, or non-absorbent of oil when twisted into strands suitable for weaving. Such other materials are equivalent to cotton for the purposes of this phase of the invention.

It is to be understood that, although the several factors of the invention herein described cooperate with one another to a single result, yet I claim protection for each of such features in all other combinations and environments with which they may be successfully used.

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. An asbestos-faced drier felt consisting of a woven body structure of non-asbestos fiber and cover strands consisting of a central body of loosely twisted asbestos fiber and an enclosing cage of fine threads interconnected with an open mesh, said cover strands extending side by side


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over one face of the body structure and being connected therewith.

2. An asbestos-faced drier felt comprising a body structure woven of non-asbestos strands, asbestos strands consisting each of an elongated mass of loosely twisted asbestos fibers and a confining cage of fine threads interconnected with open meshes between them and with a long helical lead, and supporting strands transverse to said asbestos strands interwoven therewith and with the body structure, each of the asbestos strands overlying the supporting strands in groups of two or more each and being so arranged as to overlie, at each crossing point, the spaces between supporting strands through which the next adjacent asbestos strands pass in their interwoven connection with the body structure.

3. An asbestos-faced drier felt comprising a body structure of interwoven non-asbestos warp and weft strands, asbestos warp strands and non-mineral weft strands overlying one face of said body structure and being interwoven therewith, said asbestos strands comprising loosely twisted asbestos fibers and a confining cage of interconnected fine threads laid around the asbestos center of the strands with a helical lead many times greater than the diameter of the strand, wherefore said threads exert minimum compressing force on the asbestos fiber when subjected to tension, every alternate asbestos strand passing over two supporting weft strands, then between the second and third strands into interwoven connection with a weft strand of the body structure, then over the third and fourth supporting strands into woven engagement with the third weft strand of the body, and so on, while the intermediate asbestos strands pass over the second and third supporting wefts, between the third and fourth of such wefts into connection with the second weft of the body structure, over the fourth and fifth supporting weft, into connection with the fourth weft of the body structure, and so on.

4. A drier felt of woven construction having asbestos in its face, of which the asbestos content is comprised in elongated strands of loosely twisted asbestos fiber and a confining cage of fine threads extending with a long helical lead around the asbestos, half of such threads going in right hand helices and the other half in left hand helices and being interbraided with those of right hand helix.

5. A woven drier felt having asbestos exposed on an outer face, and in which the asbestos content is comprised in elongated strands of loosely twisted asbestos fiber and a confining cage of fine threads extending with a long helical lead around the asbestos, half of such threads going in right hand helices and the other half in left hand helices and being interbraided with those of right hand helix, such threads being so few in number and of such long helical lead as to leave wide openings between them, such strands being interwoven with other strands of the felt.

6. An asbestos-faced drier felt comprising a body made as a single-ply fabric having structural strands, supporting strands lying on, and in contact with, one face of the body, and asbestos strands overlying said supporting strands in contact therewith and having loops at intervals passing between certain supporting strands and around certain structural strands of the body, whereby said asbestos strands are tied to the body and hold down the supporting strands.

7. An asbestos-faced drier felt comprising a single-ply body made of interwoven warp and weft strands, asbestos cover strands overlying one face of said body in parallel with the warp strands thereof, and supporting weft strands between and in contact with said cover strands and the adjacent face of the body; each cover strand having loops passing between adjacent supporting strands through the body and around weft strands thereof, there being a plurality of supporting strands between each two adjacent loops of a cover strand.

WILLIAM A. BARRELL.