July 25, 1961 H. E. SUNBURY 2,993,261

WET BRUSHING OF WOVEN ASBESTOS FABRIC

Filed June 16, 1955

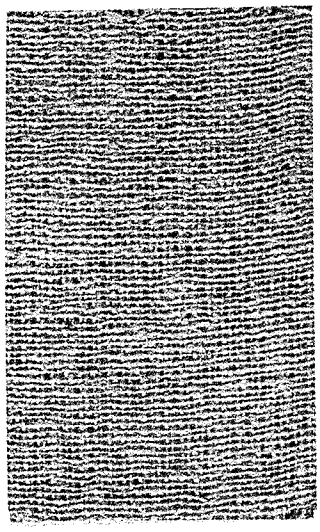


Fig. 3



Fig. 2

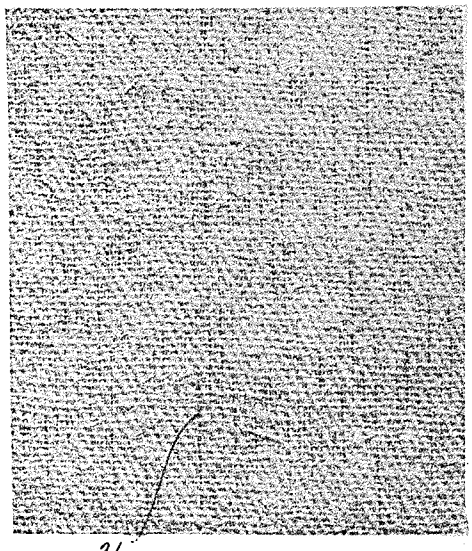


Fig. 5

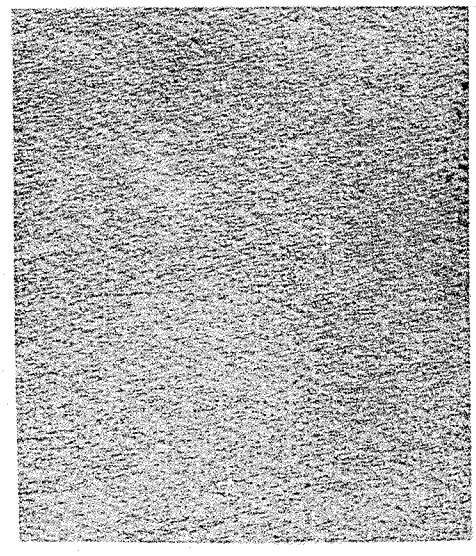


Fig. 4

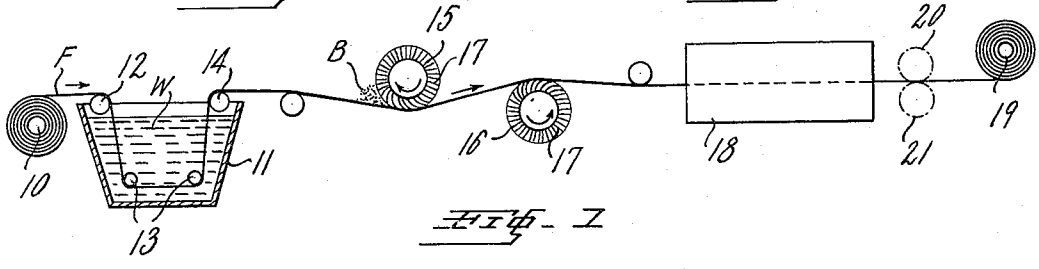


Fig. 1

Published by AsbestosClaims.Law
asbestosclaims.law/library/23860/1

United States Patent Office

2,993,261

Patented July 25, 1961

2,993,261

WET BRUSHING OF WOVEN ASBESTOS FABRIC

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Filed June 16, 1955, Ser. No. 515,820

17 Claims. (Cl. 28—76)

This invention relates to a method of treating fabrics formed predominantly of asbestos fibers to make the fabric smoother, and whiter, and to give it a softer hand and the appearance of a finer weave than are characteristic of the conventional asbestos fabrics of the same construction made heretofore. The invention also relates to the product produced by the hereinafter described method.

Because of the nature of asbestos fibers and the relatively short length of the commercially available fiber, conventional fabrics made heretofore of asbestos fibers are relatively coarse, even though a percentage of a carrier fiber, for example, cotton, is included in the fiber blend, which is customarily done in commercial fabrics. For example, a fabric weighing approximately 14 ounces per square yard, and woven with 30 warp threads per inch and 24 picks per inch of 23 cut asbestos-cotton blend yarns, is considered a lightweight asbestos fabric. By comparison with most fabrics made of other textile fibers such as cotton, wool or the synthetic yarns, however, this is a coarse weave.

The natural color of asbestos fiber in the form in which it is conventionally used in textiles, is grey-white, and sometimes it has a tinge of brown. This color is not noticeably changed by conventional textile bleaching.

A slight further whitening of an asbestos fabric may be obtained by coating or impregnating it with a liquid dispersion of a white pigment, for example, titanium dioxide. However the degree of whitening which may be obtained by such pigmentation is limited particularly because of the end use requirements of the fabric. A binder must be used to hold the pigment on the fabric, and the addition of the pigment in such a binder to the fabric causes a loss of flexibility in the fabric. For many fabrics, it is required that they retain their flexibility substantially unchanged, and consequently this method of whitening the fabrics cannot be employed. Even when it is permissible to use this method of whitening fabrics, the expense of doing it increases the cost of the finished product, and the finished product is inferior because of its diminished flexibility.

It is a primary object of this invention to provide a method whereby a conventional asbestos fabric can be made smoother and whiter, yet in which the finished product will have a softer hand and the appearance of a finer weave than a fabric of the same construction but not treated in accordance with this invention. It is a further object of this invention to provide a fabric having these characteristics. Still a further object of this invention is to provide a relatively inexpensive method of improving the appearance of asbestos fabrics.

In accordance with this invention there is provided an asbestos fabric formed of interlaced yarns composed predominantly of asbestos fibers. For example, a conventional woven asbestos fabric formed of yarns comprising a major proportion of asbestos fibers and a small proportion of a carrier fiber, such as the conventional cotton asbestos blends, is provided. This asbestos fabric is then thoroughly wetted as by immersing it in an aqueous bath. After the fabric has been thoroughly wetted and before it has had an opportunity to dry and before it is otherwise treated, the fabric is brushed. This may be done in numerous ways such as by hand brushing, mechanical brushing, etc., and in one practical commercial embodiment the fabric is advanced in contact with

two rapidly rotating cylindrical brushes that are positioned to brush each face of the fabric. After the fabric has been thoroughly brushed, it is dried, preferably without further treatment and preferably without squeezing any water out of the fabric. Conveniently the fabric may be dried by advancing it through a tenter drier.

The product after it has dried will be found to possess a greatly enhanced luster and whiteness. The weave of the fabric will be substantially closed up so that the finished product has the appearance of a much finer weave than a fabric of precisely the same construction but not treated in accordance with this invention and the fabric appears to become more supple after treatment.

It appears that by the wet brushing operation, many of the short lengths of asbestos fibers which normally protrude from the yarns are broken off and deposited in the spaces between the interlaced yarns. Apparently there is also some breakage of fibers in the yarns, because the quantity of short fibers deposited in the interstices between the yarns appears to be greater than that of the originally protruding ends. Upon drying, the deposited fibers adhere tightly to each other and to the interlaced yarns, for the fabric will withstand a considerable degree of distortion and flexing without dislodging them.

Although the deposited fibers are rather firmly held in the fabric, they can be dislodged by severely distorting the fabric. This can be substantially prevented by the use of a small amount of binder, such as starch, thermosetting resins, thermoplastic resins, etc. Desirably the binder may be incorporated in the fabric at the wetting bath by including in the bath a small proportion of binder, such as that disclosed in my U.S. Letters Patent 2,382,830, granted August 14, 1945.

It is characteristic of fabrics produced in accordance with this invention that the fibers deposited in the interstices between the interlacings of the yarns bridge these interstices to such an extent that the air permeability of a fabric in accordance with this invention is reduced as much as 40 to 90% and more from that possessed by a fabric of identical construction but not treated in accordance with this invention. Because of this bridging of the interstices, the fabric has the appearance of a finer weave after treatment. The treatment also enhances the natural luster of the asbestos fibers. A fabric produced in accordance with this invention has a markedly increased whiteness and luster as compared with a fabric of identical construction but untreated in accordance with this invention. The product of this invention also has a smooth, white satiny appearance reflecting highlights. The brushing apparently also removes or covers up most of the bits of foreign matter normally accompanying a cotton carrier fiber, and consequently any blemishes due to this foreign matter are not so apparent in the finished product. The finished product also possesses a remarkably soft hand.

It is essential to achieve the ends of this invention that the asbestos fabric be brushed while wet and thereafter dried. Wetting and drying alone produces relatively little change in the appearance of the fabric; the protruding fiber ends are to some extent held down against the yarns, but they do not noticeably tend to bridge the interstices. Brushing the fabric while dry merely increases the fuzziness of the fabric, presumably by breaking some of the bound fibers in the yarns.

Preferably none of the water is squeezed out of the fabric either before or after brushing. If the fabric is squeezed before being brushed, the effects of the brushing are reduced, and if it is squeezed after being brushed, part of the short asbestos fibers on the surface of the fabric adhere to the squeeze rolls. It appears that the usefulness of the process is confined to fabrics formed of interlaced yarns formed predominantly of asbestos fibers.

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The product may be used in any application in which it is not subjected to mechanical stresses sufficiently severe to dislodge the deposited fibers. The product is especially useful in those applications which require a smooth surfaced asbestos fabric, and in those applications where the appearance of the fabric and its hand is important. For example, the product is especially useful in such applications as cover fabrics for home ironing boards, commercial laundry fabrics, oven mitts, pot holders, safety clothing and insulation jacketing for steam pipes and air ducts.

In many applications it will be found desirable to calender the asbestos fabric after processing in accordance with this invention and after it has been thoroughly dried.

For a better understanding of the nature of this invention, reference should be had to the following detailed description of specific embodiments thereof when read in conjunction with the accompanying drawings forming a part of this application.

In the drawings:

FIG. 1 is a schematic side elevation of apparatus which may be employed to practice the method of this invention and illustrating this method;

FIGS. 2 and 4 are plan views of small samples of fabric treated in accordance with this invention; and

FIGS. 3 and 5 are plan views of fabrics identical with FIGS. 2 and 4 respectively but which have not been treated in accordance with this invention.

In the drawings there is illustrated one form of apparatus suitable for carrying out the method in accordance with this invention. A suitable asbestos fabric F is passed in open width through an aqueous bath W. The fabric F is supported by a beam **10** rotatably mounted adjacent the tank **11** containing the bath W. The fabric F is unrolled from the beam **10** by pulling it forward from the beam **10** to pass over a free running roller **12** and be directed downwardly into the bath W where it is thoroughly wetted. In the bath W, the fabric F passes under the spaced free running rollers **13**. After the thoroughly wetted fabric F leaves the bath W, it passes over the free running roller **14** and is directed to a pair of rotatably driven cylindrical brushes **15, 16**.

In the embodiment shown, these brushes **15, 16** are spaced vertically and horizontally from each other so that the fabric may be led thereabout in a tortuous path to have one side of the fabric wrapped partly about the first brush **15** and the other side of the fabric wrapped partly about the second brush **16**. Using this arrangement of brushes, the fabric F is thoroughly brushed on both sides by the bristles **17** of the brushes **15, 16**.

As illustrated in FIG. 1, a small roll B of wet fibers may accumulate ahead of the brushing rolls. This roll of fibers is very desirable in treating the fabrics in accordance with this invention as this bead forms an excess supply of fibers from which fibers may be forced into the interstices of the fabric. Such a roll of fibers can be achieved by a suitable setting of the brush **15**.

After the fabric has been thoroughly brushed it is then dried as by advancing it through a tenter drier shown schematically at **18**. Thereafter the fabric may be wound in a roll **19** for storage or use. However if desirable the fabric may be calendered after it has dried, and in the drawing there is shown in dot-dash lines a pair of calender rolls **20, 21** that are adapted to calender the fabric as it emerges from the tenter drier to further smooth the product.

The aqueous bath W may be a water bath, and desirably may have added thereto a small percentage of binder adapted to hold the small fibers in the fabric as heretofore described. A water bath containing 7.5% by weight of polymethymethacrylate binder has been found to be highly satisfactory.

The type of brush, direction of rotation, speed of brushing, and the pressure of the fabric against the brushes may be varied. For example, the fabric may be brushed

by moving, flexible, vanes extending the width of the fabric; long narrow strips of rubber fixed to rotating cylinders may be used. Preferably however brushes having long, soft bristles are employed to brush the fabric at high brushing speed with light contact with the fabric. An apparatus employing cylindrical brushes of 7 inches overall diameter, containing 7.85 tufts per square inch, each square inch having approximately 4700 nylon bristles of 0.008 inch in diameter and 1½ inches in length, which brushes rotate at a speed of 400 to 600 revolutions per minute, has proved highly satisfactory. Desirably one brush may rotate at a slightly greater speed than, or in opposite direction to, the other so as to produce a face for the fabric having different characteristics from the back of the fabric.

The fabric produced in accordance with this method has the interstices provided by the interlacings of the yarns forming the same partially or completely bridged by short asbestos fibers which give to the fabric the appearance of a finer structure and markedly increases the whiteness of the fabric. The brushing also has an incidental advantage in that it may tend to eliminate unevenness in the interlacing, such as the unevenness of woven fabrics which is commonly known as reed marks.

Characteristically the air permeability, as tested in accordance with the well known Frazier Permeability test, of fabric treated in accordance with this invention is reduced as much as 40% to 90% and more from that possessed by a fabric of the identical construction but untreated in accordance herewith, because of the bridging of the interstices of the fabric by the short asbestos fibers.

As further illustrating the products produced by this method, the following specific examples are given.

Table I

Fabric Analysis	A	B	C	D	E
Weight/square yard.....oz.	27.33	22.15	15.72	13.42	11.5
No. Warp thds./inch	31	24	16	36	18.7
No. Filling thds./inch	30	12	17	19	18
Weave	Sateen	Plain	Plain	Twill	Plain
Size Warp Yarn	22/2	22/2	27/2	51/2	42/2
Size Filling Yarn	42/2	22/2	27/2	51/2	42/2
Air Permeability [1] (off loom)	30.5	96.0	174	88	217
Air Permeability (after wet brushing)	1.0	28.5	4.1	5.5	2.3
Reduction in air permeability.....percent	96.6	70.2	97.7	93.7	98.8

[1] Frazier method (cubic feet/square foot/minute).

The fabrics of the above table were treated using a water bath containing the binder disclosed, the apparatus illustrated in the drawings and the preferred nylon brushes described above. The brushes are arranged to have the fabric in contact with each brush through about 3 inches of their circumference with the fabric displaced about 1½" from a straight line. The tension was adjusted on the fabric to compress the nylon bristles about ⅜".

An important characteristic of the finished product produced in accordance with the method of this invention is its decreased air permeability as shown in Table I. Characteristically the air permeability is reduced 40% and more, and for many fabrics it is reduced as much as 90% and more. The precise value of the reduction in air permeability will vary with such factors as fabric weave, yarn employed etc. The degree of brushing may be varied to achieve different desired end products, and this will also affect air permeability. The fabrics shown in the tables had their air permeability reduced from 70% (Fabric B) to in excess of 98% (Fabric E), and most had the permeability reduced more than 90%.

Another characteristic change wrought in the fabrics after treatment in accordance with this invention is an increase in the abrasion resistance of the fabrics. This is shown in the following table which shows the abrasion resistance of some of the fabrics of Table I, as measured on the U.S. Testing Co. Weartester developed by the U.S. Testing Co.

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Table II

Fabric	Cycles Before Treatment	Cycles After Brushing	Percent Increase in Abrasion Resistance
B	269	458	70
C	362	865	139
D	392	646	64
E	255	302	18

It appears this increase in abrasion resistance may be due to the filling up of the interstices of the fabric.

A most important characteristic of the product is the increase of whiteness of the fabric over the same fabric untreated. FIGS. 2–5 of the drawing partially illustrate this change in appearance of the product. These figures are full scale drawings of substantially the same size specimens of fabric which drawings were prepared from photographs of the fabric resting on a dark background. FIG. 5 is a view of the fabric untreated, and as will be apparent the dark background shows through the fabric in the interstices of the weave. Unevenness of the weave also is apparent as at 31. Referring to FIG. 4 there is shown an identical view of a specimen of the same fabric shown in FIG. 2 but treated in accordance with this invention. By a comparison of FIGS. 4 and 5, and despite the shadows produced in printing the drawing from the photograph, it will be noted that the apparent whiteness of the product is greatly enhanced, the weave appears to be made much finer and blemishes in the fabric due to weaving have apparently disappeared. Although the fabric of FIG. 5 may appear darker than the fabric of FIG. 4 because the dark background shows through the interstices of the fabric, this method of illustration indicates with considerable accuracy the change in appearance wrought in the fabric itself. In the fabric itself, voids would be visible in the fabric of FIG. 4 which would tend to show the fabric darker as illustrated. Similarly the shadows appearing in these interstices make the fabric appear grayer so that it appears a dull gray as compared with the bright white fabric appearance achieved after treating it in accordance with this invention as illustrated in FIG. 5. Although the showings of FIGS. 2–5 are photographic in character, it is not possible to reproduce accurately the increased whiteness which is achieved in the fabric and which apparently is due to the effect of brushing on the asbestos fibers themselves in the fabric. It appears that these fibers are whitened somewhat so that the overall whiteness of the finished product is greatly enhanced by the treatment in accordance with this invention.

FIGS. 2 and 3 are views similar to FIGS. 4 and 5 but of a more open construction of fabric. Similar dark areas will be noted in the fabric of FIG. 3, as appear in the fabric of FIG. 5, and by comparing FIG. 2 with FIG. 3 it will be noted that these dark areas are not present in the finished product.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

1. A method of producing asbestos fabrics which comprises providing a fabric formed of interlaced yarns made predominantly of asbestos fibers, wetting said fabric, brushing the fabric continuously while wet and thereafter drying the fabric.

2. A method of producing asbestos fabrics which comprises providing a fabric formed of interlaced yarns made predominantly of asbestos fibers, wetting the fabric, depositing a binder on the fabric, brushing the fabric continuously while wet and thereafter drying the fabric.

3. A method in accordance with claim 2 including the step of calendering the fabric after it has been dried.

4. A method of producing asbestos fabrics which comprises, providing a woven asbestos fabric of warp and weft yarns made predominantly of asbestos fibers, wetting the fabric by advancing the fabric through an aqueous bath, brushing the fabric continuously while wet and thereafter drying the fabric.

5. A method in accordance with claim 4 wherein the fabric is brushed by advancing the fabric as it leaves the aqueous bath in continuous contact under substantial pressure with rotating cylindrical brushes.

6. A method in accordance with claim 4 wherein the fabric is advanced through an aqueous bath containing a binder capable of binding any free asbestos fibers to the fabric.

7. An asbestos fabric formed of interlaced yarns made predominantly of asbestos fibers, said fabric having asbestos fibers disposed in the interstices between said interlaced yarns to close up said interstices sufficiently to reduce the air permeability of said fabric to a value that is less than 60% that possessed by the same fabric off-the-loom, said fibers having been deposited in the interstices by brushing the fabric when wet.

8. A smooth surfaced, lustrous asbestos fabric formed of interwoven warp and weft yarns made predominantly of asbestos fibers, and fibers from said yarns disposed in the interstices between the warp and weft yarns to close up the interstices of said fabric sufficiently to reduce the air permeability of said fabric to a value that is less than 60% that possessed by the same fabric off-the-loom, said fibers having been deposited in the interstices by brushing the fabric when wet.

9. A smooth surfaced lustrous asbestos fabric formed of interwoven warp and weft yarns formed predominantly of asbestos fibers, and fibers from said yarns filling the interstices of said fabric sufficiently to close up and obscure the weave of the fabric sufficiently to reduce the air permeability of said fabric to a value that is less than 10% that possessed by the same fabric off-the-loom, said said fibers having been deposited in the interstices by brushing the fabric when wet.

10. A smooth surfaced asbestos fabric formed of interwoven warp and weft yarns formed predominantly of asbestos fibers, and fibers from said yarns being brushed into the interstices between said yarns, said fibers obscuring the weave of said fabric to give the fabric an appearance of a finer weave than that possessed by the fabric off-the-loom, the surface of said fabric reflecting highlights, said fibers having been deposited in the interstices by brushing the fabric when wet.

11. A method of producing asbestos fabrics which comprises providing a fabric woven of warp and weft yarns made predominantly of asbestos fibers, wetting said fabric with water containing a small percentage by weight of a binder adapted to bind fibers in the fabric, while the fabric is wet advancing at least one of its surfaces continuously in contact with a brush of flexible bristles rotating to brush said fabric as it passes the brush, and thereafter drying said fabric.

12. A method of producing asbestos fabrics which comprises providing a fabric woven of warp and weft yarns made predominantly of asbestos fibers, wetting said fabric with water containing a small percentage by weight of a binder adapted to bind fibers in the fabric, while the fabric is wet advancing at least one of its surfaces in contact with and partially wrapped about a brush of flexible bristles rotating in a direction counter to the fabric advance to brush said fabric as it passes the brush, maintaining a roll of wet fibers brushed from the fabric in the nip between the fabric and brush where the fabric advances to the brush, and drying the fabric after it has been brushed.

13. A method of producing asbestos fabrics which comprises providing a fabric woven of warp and weft yarns made predominantly of asbestos fibres, wetting said fabric with water containing a small percentage by weight of a binder adapted to bind fibers in the fabric, while the fabric is wet advancing it under tension so that it has an upper surface in contact with and partially wrapped about a brush of flexible bristles several inches in di-

ameter rotating at several hundred r.p.m. in a direction counter to the fabric advance to brush said fabric as it passes the brush, maintaining a roll of wet fibres brushed from the fabric in the nip between the fabric and said brush where the fabric advances to the brush, brushing the lower surface of said fabric by wrapping said fabric partially about a brush of flexible bristles several inches in diameter rotating at several hundred r.p.m. in a direction counter to the fabric advance, and drying the fabric after it has been brushed.

14. A method of producing asbestos fabrics which comprises providing a fabric woven of warp and weft yarns made predominantly of asbestos fibers, wetting said fabric with water containing a small percentage by weight of a binder adapted to bind fibres in the fabric, while the fabric is wet advancing said fabric under tension so that it has an upper surface in contact with and partially wrapped about a brush of flexible bristles several inches in diameter rotating at several hundred r.p.m. in a direction counter to the fabric advance to brush said fabric as it passes the brush, maintaining a roll of wet fibres brushed from the fabric in the nip between the fabric and said brush where the fabric advances to the brush, brushing the lower surface of said fabric by wrapping said fabric partially about a brush of flexible bristles several inches in diameter rotating at several hundred r.p.m. in a direction counter to the fabric advance, drying the fabric after it has been brushed, and calendering the brushed fabric.

15. A method of producing asbestos fabrics which comprises providing a fabric formed of interlaced yarns made predominantly of asbestos fibres, wetting said fabric, while the fabric is wet advancing at least one of its surfaces in contact with a rotating brush to brush said fabric as it passes the brush, maintaining a roll of fibers brushed from the fabric in the nip between the fabric and brush where the fabric advances to the brush, and drying the fabric after it has been brushed.

16. A method of producing asbestos fabrics which comprises providing a fabric woven of warp and weft yarns made predominantly of asbestos fibers, applying water to said fabric, while the fabric bears the water contacting at least one of its surfaces with a brush of flexible bristles rotating to brush said fabric as it passes the brush, and thereafter drying said fabric.

17. A method of producing asbestos fabrics which comprises providing a fabric woven of warp and weft yarns made predominantly of asbestos fibers, applying water to said fabric, advancing the fabric with at least one of its surfaces continuously in contact with a rotating brush of flexible bristles to brush said fabric while it carries the water as it passes the brush, and thereafter drying said fabric.

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