Dec. 1, 1942. B. H. FOSTER 2,303,534

ASBESTOS FABRIC

Filed Sept. 9, 1941 2 Sheets-Sheet 1

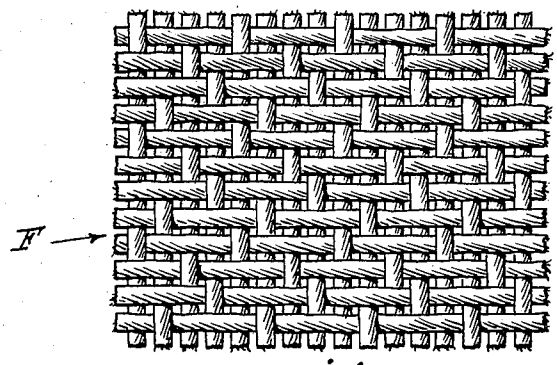



Fig. 1

UNTREATED ASBESTOS FABRIC

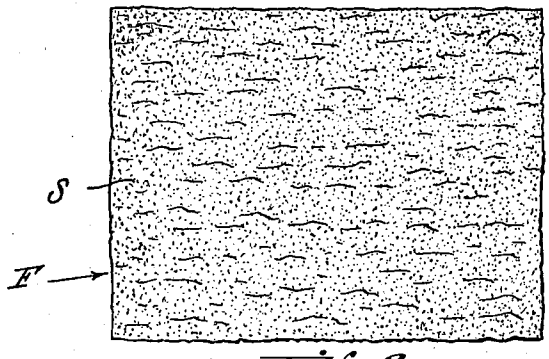



Fig. 2

TREATED ASBESTOS FABRIC




Fig. 3

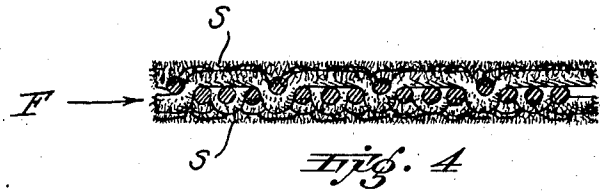



Fig. 4

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ASBESTOS FABRIC

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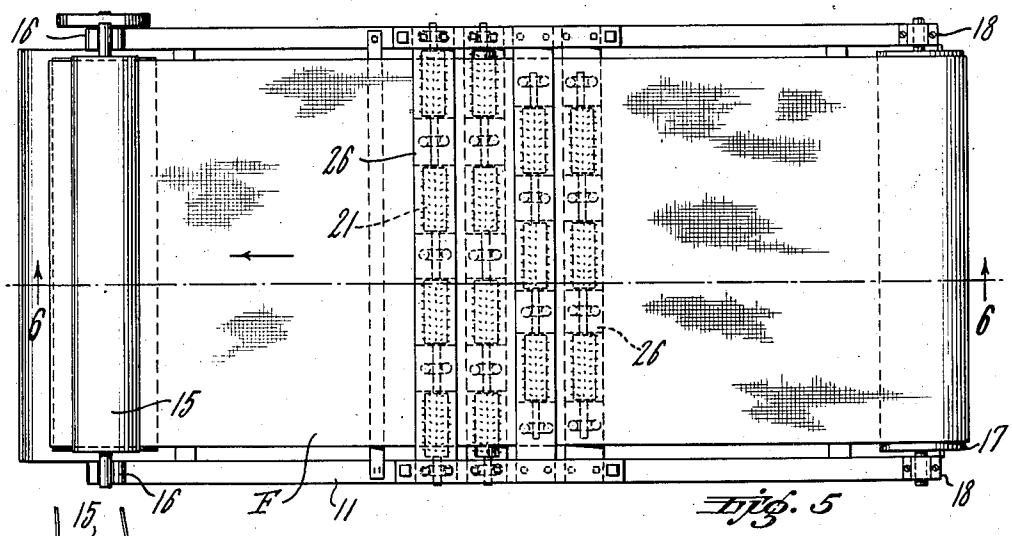



Fig. 5

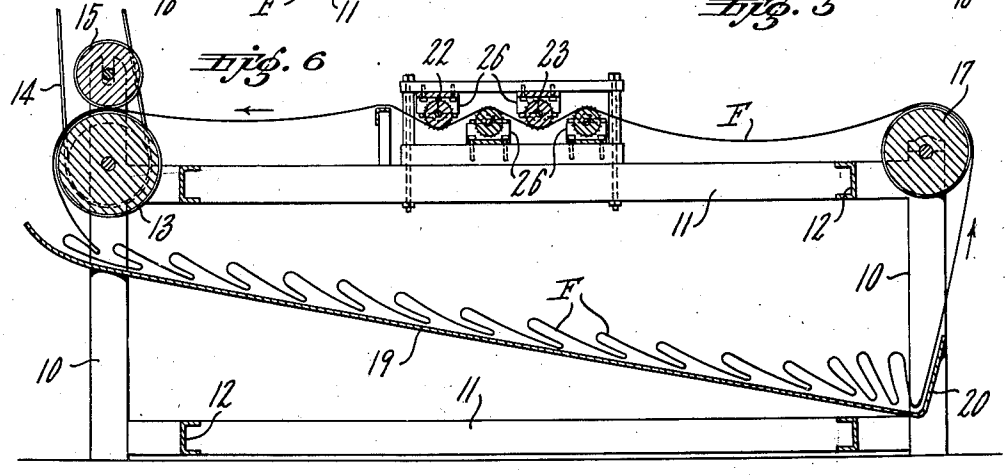



Fig. 6

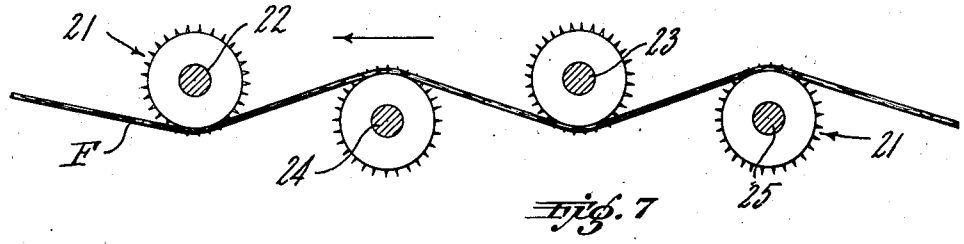



Fig. 7

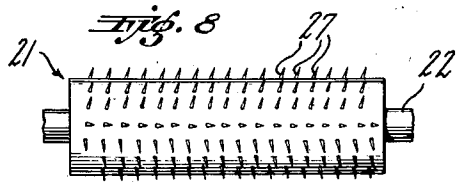



Fig. 8

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2,303,534

# UNITED STATES PATENT OFFICE

2,303,534

## ASBESTOS FABRIC

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Application September 9, 1941, Serial No. 410,148

8 Claims. (Cl. 28—79)

This invention relates to a woven asbestos fabric having a soft and relatively smooth and uniform suede or suede-like finish on one or both faces thereof.

Heretofore a suede finish has been imparted to leather, and to cotton, wool and other textile fabrics. This finish has been produced by raising the nap slightly over the surface of the leather or fabric by acting upon the surface with a sand or emery roll to separate and raise the surface fibers.

The fibers are separated and raised to a less degree in producing a suede finish than when a napped surface is provided, and the suede finish is produced by an abrasive operation whereas a napped surface is produced by a teaseling or brushing operation that raises the fibers a substantial amount from the surface of the fabric.

Suede finished fabrics are soft and pliable and their density is more uniform than that of unsueded fabrics of the same weave.

While a suede finish has been imparted heretofore to various types of finely woven textile fabrics, attempts to similarly treat woven asbestos fabric to impart a suede finish to the same have been unsuccessful. This is due to the fact that asbestos yarns have poor abrasive resisting properties and are rough and non-uniform in diameter as compared with most textile yarns, and fabrics woven of asbestos yarns are not as level as most textile fabrics and their abrasive resistance is poor. Therefore when the surface of a relatively fine asbestos fabric is acted on by a sand or emery roll in an effort to give the same a suede finish, the thick portions of the fabric will be raised first while the fibers upon the thin portions will not be raised at all, and this produces an objectionable blotchy finish. If the action of the sand or emery roll is continued long enough to act upon the thin portions of the fabric, either holes will be produced at the thick places or the fabric will be weakened to such an extent that it will have very little utility.

The present invention contemplates a woven asbestos fabric having a soft, smooth, uniform and highly satisfactory suede finish or suede surface produced thereupon in the manner which will now be described.

In carrying out the present invention the face of the woven asbestos fabric which is to have the desired suede finish imparted thereto is acted upon by free-running needle rolls. These rolls are provided with a number of sharp pins or needles which are spaced from each other sufficiently to permit them to penetrate through or well into the fabric as the latter is drawn past these rolls in engagement therewith. The arrangement is preferably such that the rolls will be rotated by the travel of the fabric so that the needles and fabric will be relatively at rest at the instant that the needles are normal to the plane of the fabric, but a slight angular movement of the needles relative to the fabric will occur as these needles enter and leave the fabric. The withdrawal of the needles from the fabric is utilized to draw the fibers outwardly from the interior of the fabric to the face thereof.

The needle treatment herein contemplated is more mild than the napping and abrasive operations employed heretofore, and it is therefore necessary to act on the fabric time and time again with the present needle rolls so that the needles will penetrate deep into all portions of the fabric to thereby separate, space laterally and raise the fibers of the warp and weft threads sufficiently to form the desired suede surface over the face of the fabric without materially reducing the strength of the warp or weft threads.

The repeated insertion of the needles deep into the fabric serves to displace the fibers laterally in the fabric to swell the threads and decrease the space therebetween and this materially softens the fabric. It also serves to form what may be called floats or bows of fibers that are anchored at both ends to their respective warp or weft thread, and many of which lie at the surface of the fabric. These unbroken floats prevent to a large degree the loss of fabric strength from the sueding operation.

For a further understanding of the invention reference is had to the accompanying drawings illustrating a fabric having the suede finish of the present invention, and one form of mechanism for producing the present fabric.

In the drawings:

Fig. 1 on an enlarged scale is a plan view of a piece of woven asbestos fabric adapted to be treated in accordance with the present invention;

Fig. 2 is a plan view of the fabric of Fig. 1 after the same has been treated in accordance with the present invention to give it a suede finish;

Fig. 3 is a sectional view through a piece of fabric such as shown in Fig. 1 having the suede finish herein contemplated imparted to one face thereof;

Fig. 4 is a view similar to Fig. 3 showing both faces of the fabric having the suede finish imparted thereto;

Fig. 5 is a top plan view of one type of machine which is well adapted to treat fabric in accordance with the present invention;

Fig. 6 is a sectional view taken on line 6—6 of Fig. 5;

Fig. 7 is a sectional view showing the cooperating needle rolls of Fig. 6 in approximately their full size; and

Fig. 8 is a side elevation in approximately


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full size of one of the needle rolls of Figs. 5, 6 and 7.

Heretofore when a fabric was to be napped it was usual to employ a low twist yarn in the weft, for example, so that the fibers might be more readily raised from the surface of the fabric during the napping operation, but this reduced the strength of the fabric in one direction. It is found that in carrying out the present invention, it is not necessary to use a low twist yarn in either the warp or the weft and that neither set of threads is unduly weakened by the sueding treatment herein contemplated.

The present invention has been developed more particularly for the treatment of fine woven asbestos fabrics, and the woven fabric shown in Fig. 1 of the drawings is enlarged a number of times in order to more clearly show the broken twill construction of a weave which is well adapted for the present treatment. It is to be understood, however, that fabrics of various weaves may be treated in accordance with the present invention to impart to one or both faces thereof the desired suede finish such as indicated by S in Figs. 2, 3 and 4.

Various types of rolls having wires, pins, or hooks projecting from the surface thereof have been employed heretofore to act upon cotton and wool fabrics to raise the nap thereupon, but these devices are designed to act upon the surface of the fabric to separate and raise the fibers and are too severe in their action for use upon fine asbestos fabrics. When such napping rolls or sand or emery rolls are used on an asbestos fabric the tendency of such rolls is to act so severely on the high spots of the fabric surface as to unduly wear the fabric away at these points before the low portions are reached.

In accordance with the present invention an entirely different operation is employed whereby the thick and thin spots of the fabric are subjected alike to the suede producing treatment without unduly wearing away any portion of the fabric.

The suede finish herein contemplated is produced by employing one or more rolls having spaced pointed needles or pins projecting from the face thereof so that these needles may penetrate deep into the fabric or entirely through the same.

The repeated forcing of these needles into the fabric and withdrawing them therefrom serves to displace the fibers laterally from the warp and weft threads to thereby swell these threads and fill up the spaces between the threads to increase the softness of the fabric and render it more opaque. It also serves to form fiber bows or floats both ends of which remain rooted to the threads from which they were formed. At the same time the slight angular movement of the needles in the fabric, due to the roll rotation, serves to raise these floats and other fibers to the surface, and to draw fibers outwardly from deep within the fabric.

The fibers that are separated from each other and from their threads at the surface of the fabric and those drawn outwardly from the interior of the fabric together form the desired smooth soft suede surface. The fact that these fiber bows or floats, or many of them, remain anchored at both ends to their respective threads prevents the warp and weft threads from undergoing a substantial loss of strength by the needle treatment.

Various means may be employed to subject the fabric to the treatment herein contemplated and various size needle rolls may be used, but it is deemed preferable to use needle rolls of relatively small size, say an inch or less in diameter to cause the needles to enter and leave the fabric frequently, and to employ power driven means to advance the fabric repeatedly past the pin rolls acting thereupon.

The means disclosed in Figs. 5 and 6 of the drawings for imparting the desired suede finish to the asbestos fabric F comprises a frame having the uprights 10 which are connected by the longitudinally extending rails 11 and transversely extending rails 12. This frame is made wide enough to accommodate the width of the fabric F to be treated and is provided at one end with a power driven roll 13 supported at the desired elevation and adapted to be rotated by the belt 14. Mounted above this roll to cooperate therewith is the idler roll 15 which is retained in place upon the roll 13 to rest thereupon by the notched bearings 16. The arrangement is such that rotation of the roll 13 in a contraclockwise direction, viewing Fig. 6, will serve to advance the fabric F in the direction indicated by the arrow from the free turning roll 17 journaled in bearings 18 at the opposite end of the supporting frame. As this fabric passes downwardly about the roll 13 it will be deposited in folds upon the inclined floor or platform 19 as will be apparent from Fig. 6, to move downwardly along this floor toward the upturned end 20.

The fabric F may have any desired length and its ends are preferably sewed or otherwise secured together to form an endless sheet to thereby facilitate the continuous treatment of the fabric by the pin rolls 21 to be described. As the fabric F is advanced by the power driven roll 13 and cooperating floating roll 15 it will pass downwardly about the roll 13 onto the inclined platform 17 where the slack in the fabric will accumulate in the folds as shown in Fig. 6, and these folds upon reaching the end plate 20 will be drawn upwardly around the roll 17. The arrangement is such that the upper run of the fabric F will advance in more or less of a horizontal direction between the rolls 17 and 13.

Along the upper run of this fabric F are supported by the machine frame a number of pin rolls 21 each having the construction of Fig. 8, and these rolls are preferably positioned both above and below the fabric, as shown in Fig. 7, so as to impart the desired suede finish to both faces of the fabric F. These pin rolls 21 are arranged above the fabric F for free turning movement upon the upper transversely extending shafts 22 and 23, and below the fabric upon the lower transversely extending shafts 24 and 25. The rolls upon the upper and lower shafts are disposed in staggered relation to each other as will be apparent from Fig. 5, to thereby subject both faces of the fabric throughout its entire width to the desired treatment. The rolls 21 preferably rotate freely on their respective shafts and these shafts are retained in place upon the supporting frame by the supporting blocks 26 which serve to maintain the rolls 21 in the desired spaced relation to each other along their shafts as will be apparent in Fig. 5. Each roll 21 has projecting therefrom a number of pointed pins 27 but these pins are spaced sufficiently from each other to facilitate their penetration entirely through the fabric, as shown

in Fig. 7. These pin rolls may be variously constructed but the pin roll 21 illustrated in Fig. 8 of the drawings is what is known in the trade as a "Dutcher temple roll."

It will be noted that the pins 27 are inclined slightly to radial lines extending from the roll. This slight inclination is deemed desirable as helping to separate and draw the fibers outwardly from the interior to the surface of the fabric. The action of these rolls as the fabric passes therebetween along the zig-zag path, shown in Fig. 7, is to cause the pins to penetrate through the fabric as the rolls are rotated by the travel of the fabric, and to be withdrawn from the fabric at a slightly different angle from which they enter. The effect of this is to spread the fibers laterally and gradually draw the fibers outwardly to the surface of the fabric from points deep within the body thereof and this action is very mild so that the fabric may be subjected time and time again to the action of these rolls without appreciably weakening the fabric structure. In imparting the suede finish to both faces of the fabric as shown in Fig. 4 of the drawings the fabric was fed past these rolls for over 1500 complete cycles to cause the pins 27 to act substantially uniformly upon every portion of the fabric. This action however could be speeded up by using two or more times the number of rolls shown in Fig. 5.

In order to compare a cotton fabric of well known construction having a suede finish imparted to one face thereof by acting thereupon by a sand or emery roll, with that of an asbestos fabric having a suede finish imparted to both faces thereof by the apparatus herein described, the following table is given:

*Table I*

| | Cotton fabrics | | Asbestos fabrics | |
|---|---|---|---|---|
| | Before sueding | After [1] sueding | Before sueding | After [2] sueding |
| Ends per inch | 44 | 46 | 31 | 31 |
| Picks per inch | 48 | 48 | 30 | 30 |
| Warp yarn | 20.6/1 | 20.7/1 | 20 Cut/1 | 20 Cut/1 |
| Filling yarn | 16/1 | 15.1/1 | 20 Cut/1 | 20 Cut/1 |
| Gauge | .0145" | .019" | .040" | .040" |
| Wt. ozs. per sq. yd. | 3.96 | 3.96 | 20.0 | 20.0 |
| Warp strength lbs. | 36.4 | 34.2 | 110 | 80 |
| Filling strength lbs. | 56.8 | 24.6 | 110 | 80 |

[1] Sueded on one side only.
[2] Sueded on both sides.

It will be noted that the filling of the cotton fabric lost over 50 per cent. of its strength by the sueding treatment used heretofore, whereas the asbestos fabric when treated in accordance with the present invention lost considerably less strength.

In order to compare the properties of an asbestos fabric treated in accordance with the present invention with the same fabric when untreated, and when treated with an emery roll, the following table is given. The fabrics in columns 2 to 5 inclusive had all received an equivalent degree of sueding treatment as far as could be determined.

*Table II*

| | Untreated woven asbestos fabric | Sueded both sides by emery roll | Sueded by method of present invention | | |
|---|---|---|---|---|---|
| | | | Sueded on one side | Sueded on both sides | Sueded on both sides with burr points |
| Wt. ozs. sq. yd. | 16.5 | 15.75 | 16.3 | 16.1 | 16.2 |
| Loss in wt. due to sueding percent | | 4.55 | 1.21 | 2.42 | 1.82 |
| | W. F. | W. F. | W. F. | W. F. | W. F. |
| Strength in lbs. | 71.8 78.8 | 45.3 41.9 | 65 69.1 | 64.5 62.9 | 64.3 68 |
| Percent loss in strength due to sueding | | 37 46.8 | 9.5 12.3 | 10.2 20.2 | 10.5 13.7 |

In this table W. stands for warp and F. for filling. In column 5 the needles were burred very slightly at their ends, the hooks thus produced could not be seen with the unaided eye but could be felt with the finger. This table brings out the small loss in weight caused by the present treatment as compared to the emery roll treatment, and also the slight loss in strength by the present treatment as compared with the emery roll treatment.

Should it be desired to impart the suede finish herein contemplated to only one face of a fabric then the upper pin rolls, for example shown in Figs. 5, 6 and 7 of the drawings, might be replaced by smooth rolls, in which case the upper face of the fabric would remain smooth and the lower face would be given a suede finish due to the action of the lower rolls supported by the shafts 24 and 25. It will be noted that in Fig. 3 some of the fibers are shown as extending outwardly from the central plane of the fabric. This particular construction may be produced by employing pins that do not penetrate entirely through the fabric, for if the pins penetrate entirely through the fabric the fibers may be lifted from a greater depth within the fabric than is shown in Fig. 3.

In some cases it may be desirable to impart an ornamental appearance to the surface of the fabric by arranging the rolls 21 so that they will form suede bands extending lengthwise of the fabric. This may be done by omitting certain rolls acting upon the desired face of the fabric.

In order to treat an asbestos fabric as herein contemplated it is merely necessary to pull the fabric by hand through the machine shown and then fasten the ends of the sheet F together to form an endless sheet. Whereupon the driving power may be applied to the roll 13 to cause the entire length of fabric F to travel in a complete cycle repeatedly through the machine so that the rolls 21 will act time and time again upon each portion of the fabric to gradually separate the fibers from their respective threads and draw the fibers from the centre of the fabric outward to the surface thereof to produce the soft suede surface.

This treatment will greatly increase the softness and flexibility of the fabric and will render it more opaque to increase its filtering action and decrease the penetration of light therethrough. This increased smoothness and softness will also improve the heat insulating prop-


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erties of the fabric. The suede fabric is well adapted for use as a cover for flat press ironers and for covering the rolls of roller ironers, and when so used will avoid marking the goods and the formation of press marks.

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

1. A woven asbestos fabric, at least one face of which has a soft suede surface formed of fibers of the woven warp and weft threads, and a large percent of which surface-forming fibers are separated slightly from the warp and weft threads as floats both ends of which remain rooted to their respective threads.

2. A woven asbestos fabric, at least one face of which has a soft suede surface formed of fibers of the woven warp and weft threads, a large percent of these surface-forming fibers being separated slightly from the warp and weft threads as floats both ends of which remain rooted to their respective threads, and said threads also having many of their fibers displaced laterally in the fabric to swell the threads and decrease the space between adjacent threads.

3. A woven asbestos fabric, at least one face of which has a soft suede surface formed of fibers that are separated slightly from their respective warp and weft threads of the fabric, and said threads also having many of their fibers throughout the body of the fabric displaced laterally from their respective threads to swell the threads and decrease the space between adjacent threads to render the fabric more opaque.

4. A woven asbestos fabric having a relatively uniform suede surface formed of fibers that are partly separated from their respective warp and weft threads of the fabric, and wherein many of the fibers forming said suede surface extend outwardly from adjacent the central plane of the fabric, and a substantial percentage of the fibers of the warp and weft threads are displaced laterally from their individual threads in the body of the fabric to increase the softness and flexibility of the fabric.

5. A woven asbestos fabric both faces of which have a soft suede surface formed of fibers of the woven warp and weft threads, and a large percent of which surface-forming fibers are separated slightly from the warp and weft threads as floats both ends of which remain rooted to their respective threads.

6. An asbestos fabric formed of interwoven asbestos warp and weft threads having approximately 30 or more threads to the inch in the warp and weft, and provided with a suede surface formed of fibers of the warp and weft threads that are partly separated therefrom to lie at the face of the fabric, and also having many of the fibers of the warp and weft threads displaced laterally from their individual threads in the body of the fabric to increase the softness and flexibility of the fabric.

7. A woven asbestos fabric having a suede surface formed of fibers that are partly separated from their respective warp and weft threads to lie at the face of the fabric in an unoriented condition, and also having many of the fibers of the warp and weft threads attached to but displaced laterally from the individual threads in the body of the fabric to increase the softness and flexibility of the fabric.

8. A woven asbestos fabric having soft suede surfaces formed of fibers that are separated slightly from their respective warp and weft threads and lie at the face of the fabric, and also having many of the fibers of the warp and weft threads displaced laterally from their respective threads in the body of the fabric whereby the softness of the fabric throughout the depth of the same is increased.

BOUTWELL H. FOSTER.


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