March 8, 1938. E. V. ASTEN 2,110,388

POROUS TEXTILE FABRIC

Filed June 11, 1935

Fig. 3.

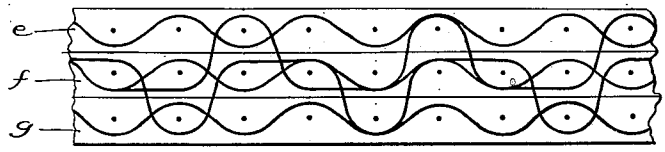


Fig. 1.

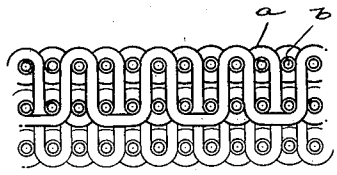
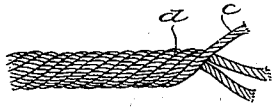


Fig. 2.



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POROUS TEXTILE FABRIC

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Application June 11, 1935, Serial No. 26,069
In Germany April 29, 1932

11 Claims. (Cl. 139—383)

This invention relates to absorbent fabrics adapted to absorb moisture from materials with which they are brought into contact, and especially dryer felts used in drying machines. The essential purpose of the invention is to provide an improved fabric which while having adequate absorbent properties will readily yield the moisture absorbed, which will last longer without rotting, and which has increased heat resistant properties.

In the drying portion of pulp and paper machines the dryer felt consisting of a textile fibre fabric serves to apply the drying paper firmly against the drying cylinder which supplies the heat necessary for evaporating the water present in the paper. On contact of the felt with the paper web the felt itself takes up water as a result of the great pressure. This water taken up by the felt is partially evaporated on the heated paper drying cylinder (or roller) but the remainder is retained by the felt and must be removed by a felt dryer or with hot air.

The absorptive capacity of the dryer felt is based on capillarity, and this is dependent on the size of the pores present in the fabric. The larger pores absorb the water to a greater degree and more rapidly than the smaller pores, and the water can be dried out therefrom more easily. The larger pores are those resulting from the crossed threads and are hereinafter termed fabric pores. The smaller pores are the cavities in the textile fibres (fibre pores) and those between the textile fibres in the spun filaments (filament pores) which comprise the threads. These small pores are objectionable because the moisture penetrating thereinto is not easily dried out by reason of the small size of the pores but continually remains in the felt and exerts a cooling action. The larger fabric pores do not involve the same difficulty because while they absorb water to a greater degree their capillary attraction is lower and as a consequence moisture absorbed by the fabric pores is readily given up when the felt is dried.

By way of further explanation it may be pointed out that in the operation of the felt moisture is taken up from the paper at the operating side in both the large fabric pores and the small fibre pores. Because of the high capillarity of the small pores which serve to attract the moisture, there is a high degree of penetration inwardly from the operating surface of the felt which is greater than would be the case if the fibre pores were non-existent. By reason of the tendency of the fibre pores to absorb and retain moisture it is difficult to dry the felt even though the highly absorbent fabric pores, because of their low capillary attraction, readily give up their moisture.

The invention relates to an absorbent fabric which contains only large fabric pores and wherein the pores of the threads—the capillaries of the textile fibres and filaments—are partly or wholly closed. Such fabric is produced by saturating the fabric, or better still, the individual filaments or fibres used for the production thereof, with a rubber solution (latex preparation). Thus, in the case of a paper dryer felt, the water from the paper is prevented from penetrating into the filaments and fibres. The paper water penetrates only into the large fabric pores, which absorb it, and, by reason of the good evaporating capacity, easily give it off again. Further, the reduction in capillarity by treatment of the threads retards or decreases the depth to which moisture penetrates the fabric through the fabric pores, and for this reason also the moisture is more readily and more quickly yielded up. Such felt thus dries much more rapidly than the known felt and lasts longer, because saturating it with rubber tends to prevent the rotting action of the moisture on the fibres. In any case the fabric must be of substantial thickness to possess good absorbent properties and the invention is not limited to dryer felts for paper machines.

Saturating with rubber solution provides another important advantage for the felt. Such felt is better protected against heat which, as known, destroys the drying felt. The heat conductivity of rubber is 0.14—practically equivalent to that of the materials used for drying felt, asbestos 0.14, wool 0.05, cotton 0.06, these values being determined according to the formula

$$\frac{\text{K cal (German thermal unit)}}{\text{meter.hour.degree Celsius}}$$

However, the heat conductivity through the drying felt is not caused by the material of which it is composed, but chiefly through the water in the felt—heat conductivity 0.6—which is a relatively good conductor of heat. However, as the water does not penetrate into the interior of the fibres in the felt of the present invention, it provides a very good protective agent against heat for the fibres. The heat resistant properties of the felt may be further increased by the addition of casein to the latex solution. Since rubber is also a good protective agent against the action of acids the fibres are prevented from being injured through chemical action. Finally, the mechanical wear on the felt is greatly re-

duced because the filaments treated with rubber are more elastic and at the same time are protected from superficial mechanical damage.

For the purpose of enabling a clear understanding of my invention I have indicated the application thereof in the accompanying drawing, wherein:

Fig. 1 is a fragmentary sectional view of one type of multiply woven fabric such as used in a dryer felt;

Fig. 2 is a view greatly enlarged of an individual thread of which the fabric of Fig. 1 is woven, illustrating a plural strand construction and showing the pores produced in the thread between adjacent twisted strands; and

Fig. 3 is a more or less diagrammatic view generally corresponding to Fig. 1.

It will be evident that with a fabric such as illustrated in Fig. 1 considerable difficulty will be encountered in drying once a substantial quantity of moisture has been absorbed and there will be the danger of rotting. To preserve the felt against the deteriorating influences of the moisture the invention contemplates that the rubber or equivalent preservative coating be applied to protect the individual threads. Considering the thread as shown in Fig. 2, it will be realized that the fibres making up each strand *c* involve minute pores open to moisture. Also additional pores, or cracks, are presented at *d* between the various twisted strands which normally would permit moisture to penetrate to the interior of the thread. It is these several kinds of pores that the coating will close, rendering the various threads constituting the fabric invidually impermeable. To maintain the porosity of the fabric as a whole, it is important that the openings—fabric pores—formed by the interweaving of the warp threads *a* and the weft threads *b* as in Fig. 1 should not be closed. Hence the coating should not be applied in the form of a surface which will overlie the whole surface area of the fabric; that is to say, the fabric should not be rendered impermeable but only the individual threads and the fibre strands making up the threads.

By the manner of treatment indicated the fabric will readily absorb moisture through penetration thereof into the fabric pores. The threads, however, will be protected so that moisture can not penetrate the same but only contact their surface. Furthermore, the threads will be rendered more heat resistant, either by the latex alone or with the addition of casein, and this is important in drying machines which operate at elevated temperatures to which the fabric is exposed.

It is not necessary to the success of the invention that all plies of the thick fabric be treated in the manner described, and it will probably be found most convenient to treat the threads in less than the full number of plies. In practice I prefer to coat merely the exposed threads at the operating surface of the fabric, which surface is the one coming into direct contact with the material from which moisture is absorbed.

Thus assuming that the fabric, as in Fig. 3, is composed of three plies, *e*, *f*, and *g*, the exposed threads of surface ply *e* may alone be treated. In explanation it is pointed out that the greatest concentration of moisture will be at and just below the operating surface of the fabric and the moisture is readily yielded up by the large fabric pores. Also the decreased capillarity obtained with the threads in the treated ply lowers the amount of moisture penetrating to the interior of the thick fabric and the depth to which it penetrates so that the farther threads are from the operating surface the less is their tendency and opportunity to absorb moisture into their thread and fibre pores.

Since a dryer felt must be capable of withstanding high temperatures as well as constant exposure to moisture, it should have marked heat resistant properties. I, therefore, propose to make the operating surface ply *e* of asbestos thread, preferably that made according to my prior Patent No. 1,638,721, dated August 9th, 1927. This asbestos surface thread will be impregnated as herein described. The treatment serves not only to waterproof the same, but also to increase their resistivity to the deteriorating effects of heat. A still further advantage is that the brittle asbestos fibres of the threads are laid flat and are better preserved against breaking off. The threads therefore last longer and provide a smoother operating surface than one coated with less durable conventional sizes.

While the operating surface ply *e* will desirably be composed of asbestos thread and treated as described, the other plies *f* and *g* need not be of asbestos. Their primary purpose is as a reinforcement and to give the fabric sufficient thickness to have the required absorptivity. They may therefore be constituted of durable cotton or other thread which may or may not be treated with latex.

The method of saturating textile fabrics with rubber solutions does not form the subject of the present invention, but the use of such fabrics for drying felt wherein the saturation, as stated, produces a surprising result.

This application is a continuation in part of my prior application Serial No. 668,465, filed April 28th, 1933.

I claim:

1. An absorbent integrally woven multiply fabric so woven as to provide moisture absorbing fabric pores adapted to absorb moisture from materials placed in contact therewith, and in which the individual threads at least at the operating surface of the fabric are waterproofed to lessen the capillary attraction of the fabric pores and thereby decrease the extent of penetration of moisture into the interior of the fabric through the fabric pores.

2. An integrally woven multiply fabric having moisture-absorbent properties and adapted to absorb moisture from materials placed in contact therewith, said fabric being so woven as to provide moisture-absorbing fabric pores and including an operating surface ply of asbestos thread, the individual threads of at least the asbestos ply being waterproofed so as to be impermeable to moisture taken up by the fabric pores.

3. An absorbent dryer felt composed of multiply fabric so woven as to provide moisture absorbing fabric pores and in which threads of the surface ply are treated with a moisture proof composition which renders said threads individually resistant to moisture taken up by the fabric pores.

4. An absorbent dryer felt composed of multiply fabric so woven as to provide moisture-absorbing fabric pores, the threads of the operating surface ply being treated with a moisture-resistant composition closing the thread and fibre pores and rendering said surface ply threads impermeable to moisture taken up by the fabric pores.

5. An absorbent dryer felt composed of multiply fabric so woven as to provide moisture-absorbing fabric pores and in which the threads at the operating surface are treated with a waterproof material closing the thread pores but leaving open the fabric pores said material serving to reduce capillarity and tending to decrease the depth to which moisture is absorbed into the body of the felt through the fabric pores.

6. An absorbent dryer felt composed of thick multiply fabric so woven as to provide moisture-absorbing fabric pores, at least one ply of the fabric being composed of waterproofed fibre threads having moisture repellent properties tending to retard penetration of moisture to the full depth of the fabric pores between the surfaces of the felt and enabling the felt after use to more readily yield up its absorbed moisture.

7. A dryer felt composed of absorbent thick multiply textile fabric so woven as to provide moisture-absorbing fabric pores and having a porous operating surface composed of asbestos threads treated with latex waterproofing material.

8. An absorbent dryer felt composed of thick multiply textile fabric so woven as to provide moisture-absorbing fabric pores and having a heat resistant porous surface ply in which the threads and thread fibres are waterproofed and non-absorbent of moisture taken up by the fabric pores.

9. An absorbent dryer felt composed of multiply textile fabric so woven as to provide moisture-absorbing fabric pores and in which the porous operating surface ply of the felt comprises waterproofed and heat insulated coated fibrous threads.

10. An absorbent thick multiply textile fabric so woven as to provide moisture-absorbing fabric pores and having a porous operating surface ply composed of fibrous threads having a waterproofing and heat resistant coating.

11. An absorbent dryer felt composed of thick fabric so woven as to provide moisture-absorbing fabric pores and having a heat resisting surface of asbestos thread, said asbestos threads being waterproofed to render them individually non-absorbent of the moisture taken up by the fabric pores and thereby lessening the depth of penetration of the absorbed moisture into the fabric pores.

EDUARD v. ASTEN.