

Aug. 15, 1933.

W. S. LIBBEY

1,922,444

FABRIC AND METHOD OF MAKING THE SAME

Filed May 3, 1933

2 Sheets-Sheet 1

Fig. 1.

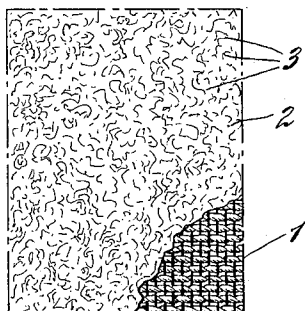


Fig. 3.

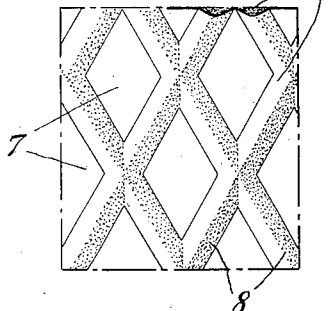


Fig. 4.

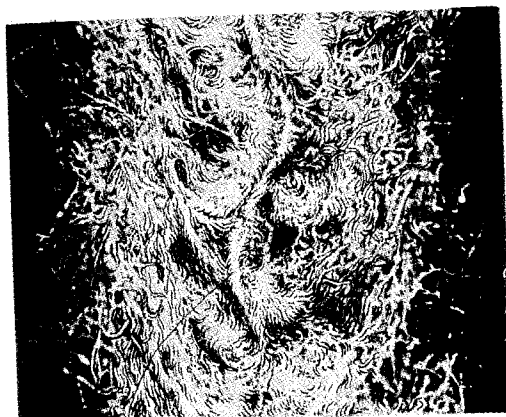
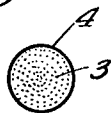


Fig. 2.

Fig. 5.



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2 Sheets-Sheet 2

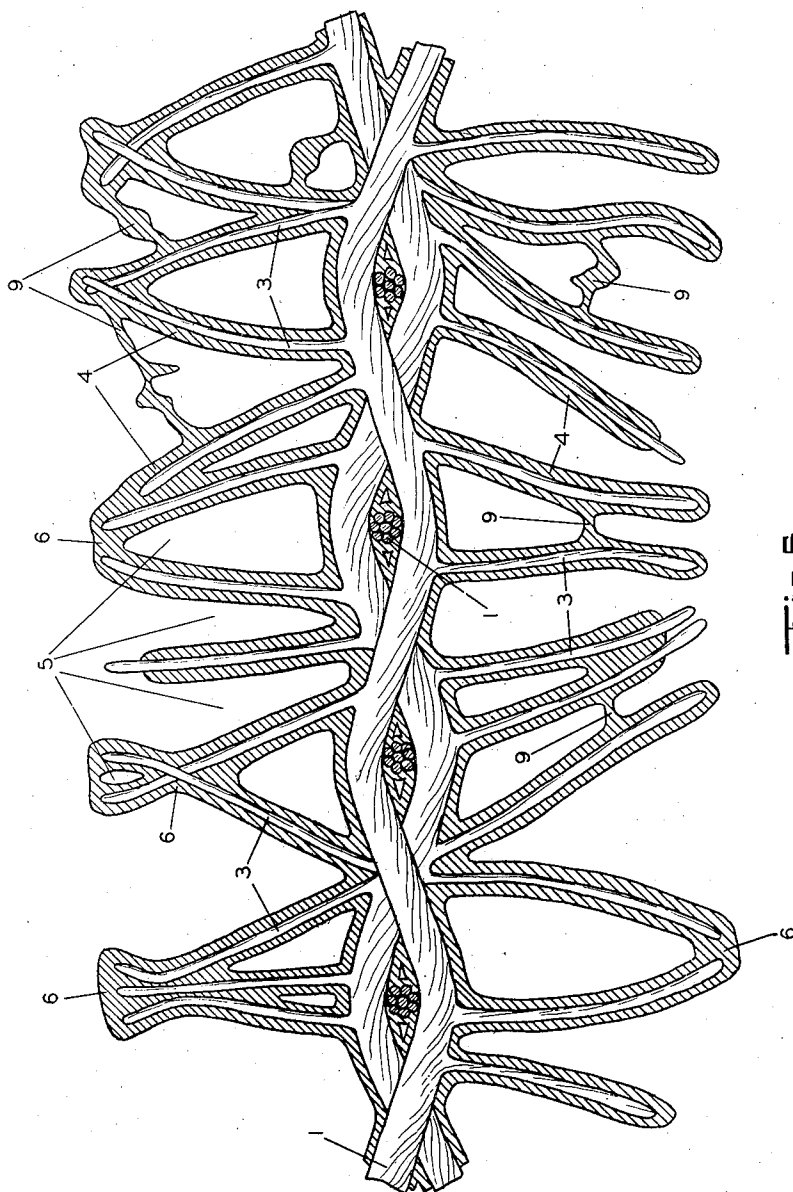


Fig. 2.

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FABRIC AND METHOD OF MAKING THE SAME

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Application May 3, 1933. Serial No. 669,160

12 Claims. (Cl. 91—68)

This invention relates to resilient, low-density, textile fabrics and methods of making the same, and my present application is a continuation in part of my copending application, Serial No. 587,327, filed January 18, 1932.

In general, the object of the invention is to provide novel and highly useful resilient porous textile fabrics and to provide novel and highly useful methods for their production.

With this general object in view, and such others as may hereinafter appear, the invention consists in the improved resilient porous textile fabric and methods of producing the same hereinafter described and particularly defined in the claims at the end of this specification.

In the drawings illustrating the preferred embodiment of the invention,

Fig. 1 is a plan view of a portion of material made by the novel process herein disclosed,

Fig. 2 is a view in vertical section taken on the line 2—2 of Fig. 1, upon a greatly enlarged scale,

Fig. 3 is a plan view of a modification,

Fig. 4 is a view similar to Fig. 2 of the untreated fabric,

Fig. 5 is a cross-sectional view of one of the component fibres, greatly enlarged, and

Fig. 6 is a greatly enlarged cross-sectional view of the fabric treated according to my invention.

There have been a number of well known materials on the market characterized by resiliency to compression, for instance sheet rubber, wool felts and sponge rubber. This characteristic is also present to a degree in cotton felts, cotton napped fabrics, blanket fabrics, and pile fabrics.

All of the above have many valuable properties; however, they also have many drawbacks. Rubber sheet is heavy, sponge rubber lacks resistance to tear, neither product can be sewed and neither is porous in the sense of providing ventilation. Wool felts, hair products and the like provide resilience to only a minor degree and the resilience has considerable lag and lacks the quick recovery characteristic of rubber when compression force is released. Even this degree of resilience is only present in the more expensive wool or hair products and is almost negligible in such products as cotton felts, cotton napped fabrics, jute needle felts and the like.

The present invention contemplates a novel and improved resilient porous textile fabric comprising as a base a fabric characterized by upstanding fiber, such as napped fabrics, blanket fabrics, pile fabrics, raised goods, teased goods,

needle felts, and the like, and in which the major portion of the upstanding fibers are individually coated with a vulcanized rubber coating conforming to the individual fibers whereby the fibrous appearance of the fabric is preserved and whereby the resiliency of the individual fibers is greatly increased. It should be understood that by upstanding fibers I do not necessarily mean vertically standing, but that the fibers lie at a considerable angle to the plane of the goods. The improved fabric is further characterized by a large number of air spaces distributed among the coated upstanding fibers whereby opportunity is afforded the resilient rubber coated fibers to flex individually under compression and thereby impart to the sheet a characteristic resiliency. The free ends of the coated fibers forming the surface or surfaces of the sheet are bonded together at points where they may contact by the rubber coating and are caused to retain their position in contradistinction to the tendency of those fibers at the surface of the uncoated fabric to rough up or disarrange themselves when the fabric is rubbed. In one form of the invention the sheet is provided with additional resilient reinforcement comprising particles of vulcanized rubber distributed among the coated fibers but preserving the air spaces and increasing the general resiliency of the sheet while preserving the strength and fibrous appearance of the fabric and still permitting individual flexing of the fibers.

The invention further contemplates a novel and improved method of producing the present fabric and in which a textile fabric of the character referred to as characterized by upstanding fiber has first applied to it a non-aqueous solution of vulcanizable rubber or rubber compound in a fluid condition and in an amount such as to permit the inherent resiliency in the upstanding fiber to cause the fluid rubber coating to conform to and coat a majority of the individual fibers and thus preserve a general fibrous characteristic and appearance. After the application of the fluid saturant, the inherent resiliency of the fibers causes them to spring apart sufficiently to form air spaces between the fibers, leaving the fluid conforming to the individual fibers as a coating. After application and coating of the individual fibers, the sheet is dried, preferably vulcanized, under heat to produce the present product. In addition to producing the individual coating of a majority of the fibers, the inherent resiliency of the upstanding fibers simultaneously produces a vast number of air

spaces distributed throughout the coated fibers. By varying the amount and nature of the rubber compound contained by the fabric, the characteristics of the coated fabric may be modified and the degree of resiliency increased or decreased according to the purpose for which the product is to be used. In addition, the degree or angle which the coated fibers are caused to assume in the final and complete coated fabric may also be varied to impart various degrees of thickness and resiliency to the ultimate product. Of course it is further understood that the treatment may, if desired, be applied to one side only of the fabric being treated.

Referring now to the drawings which, as stated, illustrate the preferred embodiment of the invention, 1 represents a fabric having a woven base having fibrous components designated generally by the reference character 2 and characterized by a considerable quantity of fibers 3 upstanding from one or both surfaces of the woven fabric base 1. Such a fabric may comprise a napped fabric, blanket fabric, pile fabric, raised goods, teased goods, needle felts, and the like, and by the term "upstanding" it is intended to include fibers which stand vertically with relation to the surface of the base and also at various angles relative thereto.

A majority of the upstanding individual fibers 3 are provided with individual coatings 4 of vulcanized rubber or rubber compound, and the individual coatings 4 conform to the individual fibers so that a general fibrous appearance and fibrous characteristics are present in the ultimate product. The individual coatings 4 for the fibers reinforce the same and materially increase their resiliency and ability to recover their upstanding position after having been flexed under compression. Because of the fact that the rubber coatings 4 conform to the individual fibers, the product is provided with a large number of air spaces or voids 5 distributed among the coated fibers. These air spaces or voids 5 may be of varying size and cooperate with the individual rubber coated fibers to enable their flexibility and resiliency to be availed of in giving to the complete fabric the desired characteristic and quick recovery. In Fig. 6 I have diagrammatically illustrated, on a scale enlarged many times, the individual rubber coated fibers 3 and the air spaces 5, and by reference to Fig. 6 it will be apparent that the air spaces comprise a very essential part of the structure of the present improved product because of the fact that were the spaces filled, there would be only limited opportunity for the rubber coated fibers to flex so that the characteristic resiliency and quick recovery would not be imparted to the ultimate product.

As illustrated in Fig. 6, a substantial number of adjacent fibers when rubber coated will bond together by reason of their close relation to one another as indicated at 6, and the bonded fibers form in effect a truss, the supporting members of which are resilient, thus adding to the resiliency of the complete product and imparting the desired quick recovery to the product when the latter is compressed. In addition, in some instances I may prefer to so regulate the amount of rubber retained in the fabric as to provide a certain amount of resilient solid reinforcement, which is illustrated in Fig. 6 by the rubber particles 9 distributed among certain of the fibers, and at the same time the air spaces 5 are preserved throughout the mass of fibers to

enable the desired flexing of the rubber coated fibers to take place when the fabric is subjected to compression.

Coated fabrics embodying the present invention are characterized by an absence of fraying, and I attribute this characteristic to the fact that many of the free ends of the fibers are bonded together at the surfaces of the sheet and at their points of contact by the rubber coatings, and are caused to lie down so that, even when brushed, little or no tendency exists for the free ends of the fibers to rise up or to fray, and this characteristic makes the fabric extremely useful for various commercial purposes.

While as above stated various textile fabrics having a woven base and which are characterized by upstanding fibers may be used for the production of various resilient products in accordance with the present invention, nevertheless, I have obtained a particularly useful product by the use of blanket fabrics as the base of my product. By the term "blanket fabric" I include those napped fabrics of any fiber or mixtures of fiber, the bulk of whose yarns are carded and spun on the woolen system. As is well known, yarns made in this fashion are of low density and the fibers in the yarns are not straightened out or laid parallel to each other as is the case with yarn spun on the cotton system. As a result, fabrics woven from such yarns are capable of being napped with a dense nap and the upstanding fibrous structure thus produced is particularly suitable for use in the production of products embodying the present invention. The elasticity of the fibers and of the fibrous structure is such as to enable the fibers to spring back into open or separated relation after the fabric is saturated with a rubber coating composition insuring the production of the desired air spaces.

In accordance with the preferred method, a fabric, and preferably one whose yarns are carded and spun on the woolen system, such as that designated 1 in the drawings, is run through a tank containing flowable rubber cement. The consistency of the rubber cement may be varied within rather wide limits, depending upon the inherent resiliency of the fibers of the particular fabric being coated, and the most desirable consistency can be readily obtained by experiment. It is believed sufficient to state that the consistency should be such as to permit the fibers after the saturant has been applied and the excess removed, to spring back into an upstanding and separated relation such as to permit the coating to conform to a majority of the individual fibers and to insure the production of a large number of air spaces. For this rubber coating solution any combination of vulcanizable rubber compound and rubber solvent will suffice, and the following is a formula which I have used with good results:

	Parts
Rubber	100
Sulphur	3 3/4
Accelerator e. g. Altex	1 1/2
Antioxidant e. g. Agerite white	1
Whiting	65
Zinc oxide	5
Stearic acid	1

Two pounds of this compound are dissolved in one gallon of naphtha, 72 degree naphtha with a low end point being satisfactory.

After the fabric has been dipped into the rubber coating composition, the excess solution is

squeezed out and the product may be dried for thirty minutes at 140° F. and then vulcanized for one hour at 260° F. in hot air. Suitable and known forms of apparatus may be employed for performing these operations.

In removing the excess of the saturating composition it is preferred to pass the fabric between closely set gauge or squeeze rolls, and in practice with ordinary blanket materials these rolls may be set within .020 of an inch. After passing through the rolls, and during the evaporation of the solvent from the rubber coating composition, the fibers spring back into an upstanding position and in separated relation so that a completed product is produced of a thickness which varies of course, within wide limits, but with ordinary blanket materials varies from one-eighth to three-eighths of an inch. I find that by passing the fabric between the squeeze or gauge rolls in such direction that the squeeze rolls act with the nap of the fabric, a thinner and less porous product may be produced, whereas by passing the fabric so that the rolls act against the nap a much thicker and more porous product may be produced. In addition, the adjustment of the squeeze rolls controls to a large extent the proportion of coating composition retained in the fabric, and in practice I have produced various types of products in which the amount of the coating composition retained varies from one-fourth of the weight of the untreated fabric up to four times the weight of the untreated fabric. Generally, those products in which the retained coating composition is equal to or less than the weight of the blanket fabric partake more of the nature of wool or hair felts, but may generally be characterized as having a rubber-like resiliency. By adjusting the squeeze rolls so that an amount of the rubber coating composition is retained in the blanket fabric of from two to four times the weight of the fabric, a resulting product is obtained having the characteristic resiliency of compression and rapid recovery of sponge rubber. This product is superior to sponge rubber for many uses because of its fitness for sewing, its strength, and its porosity in the sense of ability to provide ventilation.

In some instances it may be desirable to produce a sheet in which portions only of the sheet will be highly resilient to compression, and I have found that by utilizing a press for molding portions of the sheet it is possible to vulcanize under pressure applied to portions of the sheet, so that in the resulting product, as indicated in Fig. 3, by way of example, merely, the uncompressed or partially compressed portions 8 will be highly resilient while the compressed portions 7 will possess resiliency only to a limited degree.

As used throughout the specification and claims hereof, the terms "rubber" and "vulcanized rubber" are intended to include rubber compounds and synthetic rubbers, as well as other resilient coatings capable of imparting the described characteristic rubber-like resiliency to the present product.

I claim:

1. As a new article of manufacture, a resilient porous fibrous sheet comprising a fabric having a woven base and characterized by upstanding fibers and having a major portion of the upstanding fibers individually coated with vulcanized rubber conforming thereto and the amount of rubber contained in the fabric being

sufficient to increase the resiliency of the individual fibers, said sheet being further characterized by air spaces distributed among the coated upstanding fibers whereby opportunity is afforded the resilient individual rubber coated fibers to flex under compression and thereby impart to the sheet a characteristic resiliency.

2. As a new article of manufacture, a resilient porous fibrous sheet comprising a fabric characterized by upstanding fibers and having a major portion of the upstanding fibers individually coated with vulcanized rubber conforming thereto in such amount that the resiliency of the individual fibers is increased and the fibrous appearance of the fabric is preserved and so that, some of the coated fibers are bonded together by vulcanized rubber at points of contact whereby the resiliency of the sheet is further increased, the amount of rubber contained in said sheet forming air spaces among the coated upstanding fibers whereby opportunity is afforded the fibers to flex under compression and thereby impart to the sheet a characteristic resiliency.

3. As a new article of manufacture, a resilient porous fibrous sheet comprising a fabric having a woven base and characterized by upstanding fibers and having a major portion of the upstanding fibers individually coated with vulcanized rubber conforming thereto in such amount that the resiliency of the individual fibers is increased, and so that said coated fibers have a large number of air spaces distributed throughout and the free ends of a majority of the coated fibers are bonded together by the rubber coating whereby to prevent fraying.

4. As a new article of manufacture, a resilient porous fibrous sheet comprising a blanket fabric having the major portion of its upstanding fibers individually coated with vulcanized rubber conforming thereto in such amount that the resiliency of the individual fibers is increased and the fibrous appearance of the blanket fabric is preserved, the amount of rubber contained in said coated sheet being such as to form a large number of air spaces distributed throughout the coated upstanding fibers whereby opportunity is afforded the resilient individual rubber coated fibers to flex under compression and thereby impart to the sheet a characteristic resiliency.

5. The method of making a resilient porous fibrous sheet which consists in applying to a textile fabric characterized by upstanding fibers, a fluid solution of vulcanizable rubber composition, in such amount as to permit the inherent resiliency in the upstanding fibers to cause them to spring back and to separate after the application of such solution and thereby cause the coating composition to conform to and coat a major portion of the individual fibers and simultaneously form a large number of air spaces distributed among the coated fibers, and thereafter causing the coating to harden.

6. The method of making a resilient porous fibrous sheet, which consists in applying to a textile fabric characterized by upstanding fibers a fluid solution of vulcanizable rubber composition, in such amount as to permit the inherent resiliency in the upstanding fibers to cause them to spring back and to separate after the application of such solution, and thereby cause the coating composition to conform to and coat the individual fibers, and form a large number of air spaces distributed throughout the coated fibers, and thereafter vulcanizing the sheet.

7. As a new article of manufacture, a porous fibrous sheet having characteristic rubber-like resiliency, comprising a fabric having a woven base and characterized by upstanding fibers, and having a major portion of the upstanding fibers individually coated with vulcanized rubber conforming thereto, in such amount that the resiliency of the individual fibers is increased, the amount of rubber contained in said sheet being such as to form air spaces distributed between the coated upstanding fibers, whereby opportunity is afforded the resilient individual rubber coated fibers to flex under compression, said sheet being further provided with additional reinforcing particles of rubber between the coated fibers.

8. The method of making a resilient porous fibrous sheet, which consists in applying to a textile fabric characterized by upstanding fibers, a fluid solution of vulcanizable rubber composition, passing the sheet through squeeze rolls to remove the excess of the rubber composition, then drying the fabric thus treated and vulcanizing the coating, the amount of rubber contained in said sheet being sufficient to form a porous fibrous sheet characterized by the individual coating of the major portion of the fibers, by a large number of air spaces among the coated fibers, and by its rubber-like resiliency.

9. The method of making a resilient porous fibrous sheet, which consists in applying to a blanket fabric characterized by upstanding fibers a fluid solution of vulcanizable rubber composition, passing the sheet through squeeze rolls to remove the excess of the rubber composition, then drying the fabric thus treated and vulcanizing the coating, the amount of rubber retained in said sheet being such as to form a porous fibrous sheet characterized by the individual coating of the major portion of the fibers, by a large number of air spaces among the coated fibers, and by its rubber-like resiliency.

10. The method of making a resilient porous fibrous sheet, which consists in applying to a

textile fabric characterized by upstanding fibers a fluid solution of vulcanizable rubber composition, removing the excess of the rubber composition by passing the fabric between squeeze rolls in such direction that the rolls act with the fiber, then drying the coated fabric and vulcanizing the same, the amount of rubber retained in the sheet being such as to form a porous fibrous sheet characterized by the individual coating of the major portion of the fibers, by a large number of air spaces throughout the coated fibers, and by its rubber-like resiliency.

11. The method of making a resilient porous fibrous sheet, which consists in applying to a textile fabric characterized by upstanding fibers a fluid solution of vulcanizable rubber composition, removing the excess of the rubber composition by passing the fabric between squeeze rolls in such direction that the rolls act against the fiber, then drying the coated fabric and vulcanizing the same, the amount of rubber retained in said sheet being such as to form a thickened porous fibrous sheet characterized by the individual coating of the major portion of the fibers, by a large number of air spaces throughout the coated fibers, and by its rubber-like resiliency.

12. The method of making a resilient porous fibrous sheet, which consists in applying to a textile fabric characterized by having a major portion of the yarn thereof carded and spun on the woolen system and characterized by upstanding fibers, a fluid solution of vulcanizable rubber composition, in such an amount as to permit the inherent resiliency in the upstanding fibers to cause them to spring back and to separate after the application of such solution and thereby cause the coating composition to conform to and coat a major portion of the individual fibers, and to simultaneously form a large number of air spaces distributed throughout the coated fibers, and thereafter permitting the coating material to harden.

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