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F. W. CLARK

2,400,487

COMPOSITE SHEET MATERIAL

Filed Feb. 28, 1942

Fig.1.

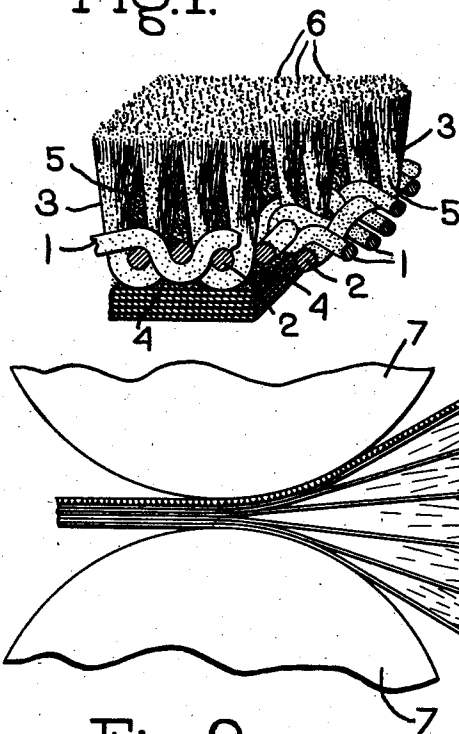


Fig.2.

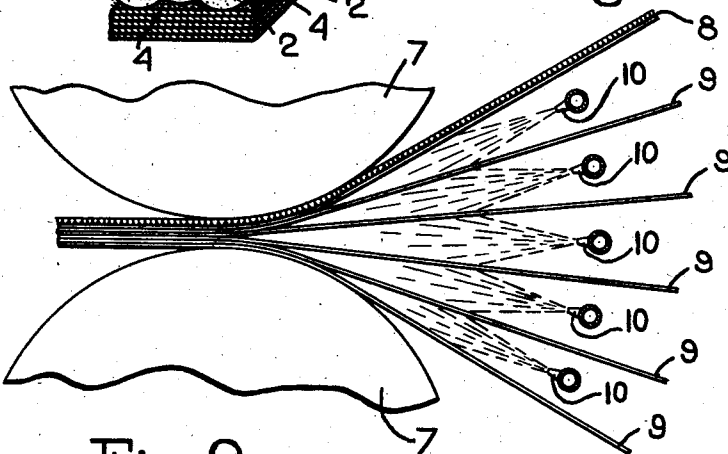


Fig.3.



Fig.4.

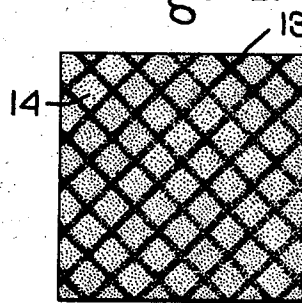
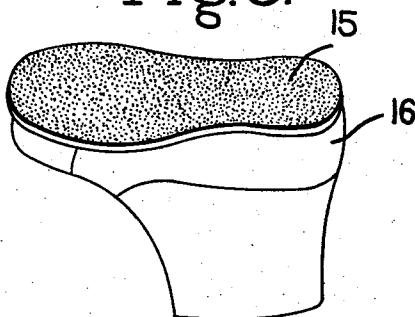


Fig.5.



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UNITED STATES PATENT OFFICE

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COMPOSITE SHEET MATERIAL

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 mesne assignments, to Goodall-Sanford, Inc.,
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Application February 28, 1942, Serial No. 432,807

3 Claims. (Cl. 154-46)

This invention resides in a composite sheet material for shoe soles and other articles where it is desirable or essential to resist wear and slippage and the object of the invention is to provide a highly efficient material for such purposes.

The composite sheet material of this invention comprises a face layer of woven pile fabric in which the body of the pile is filled with a continuous body of tough, flexible rubber material superposed upon the ground of the pile fabric and adherent to the ground and with the pile embedded in and inherent to the rubber material. The construction is such that the pile stands substantially upright and forms with the rubber material a flexible, tough, durable mass with fibres of the pile projecting at the face. There is thus presented by the combination of the rubber material surface and the hairy fibres projecting therefrom, a highly wear-resistant, non-slip surface. The material also comprises one or more layers of flat flexible fibrous material, preferably a plurality of layers of flat woven textile fabric, superposed on the back of the ground of the pile fabric with intermediate layers of adhesive binding material impregnating the ground of the pile fabric and the said superposed layers and adhesively bonding all together in a solid, flexible sheet of the required thickness.

The material is particularly desirable for use for shoe soles. It is readily cut to the required shape and readily attachable in place in the shoe by sewing, by nailing, or by cementing in accordance with the usual shoe making procedure. The material is waterproof and when metallic nails are not employed, presents high electrical insulating qualities so that when used as a shoe sole, it protects the wearer against electric shock.

The material of this invention, by reason of the aforesaid characteristics, is highly useful among other purposes for the soles of shoes worn by soldiers and sailors in military tanks, on naval vessels, and elsewhere as well as by employees in manufacturing establishments.

The material of the invention may also be employed, with its wear-resistant face uppermost, as a covering for floors and for other purposes where its characteristics are useful.

The nature and objects of the invention will appear more fully from the accompanying description and drawing and will be particularly pointed out in the claims.

The material of this invention embodies as one element a woven textile pile fabric. The ground of such a fabric made up of warp and filling yarns

is usually and preferably formed of cotton for strength, durability, and economy. The pile for the purposes of this invention is preferably formed of mohair which, by reason of its essential characteristics, is highly resistant to wear and readily maintains an upright position with fibres projecting from the rubber material referred to. Wool fibre is also satisfactory for the pile and mixtures also of mohair, wool and rayon may be employed.

While the weave of the pile fabric may vary, the best results are secured with what is known as the V-pile weave, woven without stuffer warps. This type of fabric, with a light coating of adhesive binding material upon the back of the ground, has long been employed in the manufacture of upholstery pile fabric. In this type of material, the construction is such that the pile normally stands upright and the pile is uniformly and evenly distributed throughout.

In the drawing:

Fig. 1 is a view in perspective of a portion of composite sheet material embodying a preferred form of the invention with the elements considerably distorted and enlarged for purposes of illustration.

Fig. 2 is an illustrative, more or less diagrammatic, view of a means employed for applying adhesive binding material and securing the bonding together of the various layers making up the completed material.

Fig. 3 is a view in perspective, also enlarged and distorted, to illustrate one construction by which the non-slip character of the material is increased by the shape of the face.

Fig. 4 is a plan view of a portion of the material embodying the invention illustrating another construction in which the wear-resistant and non-slip characteristics are increased.

Fig. 5 is a view in perspective illustrating a shoe with a sole embodying the invention embodied therein.

The face layer of the composite sheet material of this invention, as already pointed out, comprises a woven textile pile fabric, and, as above noted, preferably of the V-weave type with the pile formed of mohair or other suitable fibre and the ground of cotton. In Fig. 1, the ground is illustrated as comprising the ground warps 1 interlaced with the filling yarns 2. The pile tufts 3 are formed of the pile warp and cut in the usual way and, as illustrated, present V's with each V engaging a ground weft 2. Thus, the body of pile formed by the V tufts stands upright and is evenly and uniformly distributed throughout the

fabric. This fabric is coated on the back with a light coating 4 of adhesive binding material which acts to secure the V-pile tufts firmly in place but which leaves the ground flexible and porous. Pile fabric thus woven and coated on the back has long been manufactured and employed for upholstered material and is described in the patent of Nutter, No. 1,778,196, October 14, 1930.

After the pile fabric has thus been coated, it is preferably scoured to remove any grease remaining in the pile.

The pile fabric has then applied to the pile, as by a spreader or by frictioning in, rubber material so that the entire body of pile is filled in with this rubber material with the rubber material superposed upon and adhering to the ground, and with the pile embedded throughout in the rubber material and adhering thereto. This rubber material is indicated in Fig. 1 at 5 not only extending between the tufts of pile but also extending into and through the pile tufts themselves. This rubber material, as thus applied, forms a continuous body extending from the ground of the pile fabric upward to the surface but leaving fibres 6 of the pile projecting from the surface.

The term "rubber material" as employed herein and in the claims is used to include either latex, natural rubber, reclaimed rubber, artificial or synthetic rubber when properly compounded in the usual way as required for the purpose. It must be flexible, tough, and durable so that it will not crack or break when the sheet material is in use. A wide variety of rubber compounds for this purpose may be made up by anyone skilled in the rubber-coating art. Simply as an illustration, and when latex is available, a suitable compound for this purpose is as follows: in parts by weight.

Rubber (as normal latex) -----	100
Zinc oxide -----	3
Phenyl-beta-naphthylamine -----	2
Sulfur -----	1.25
Zinc salt of dibutyl dithiocarbamic acid -----	.75
Casein -----	1.00

As another illustration as for example when reclaimed rubber is employed a suitable compound may be as follows:

Rubber as an aqueous dispersion -----	100
Zinc oxide -----	1
Phenyl beta naphthylamine -----	2
Sulfur -----	2
Di-pentamethylene-thiuram tetrasulphide -----	1

In any of the compounds suitable pigments preferred instead of dyes, may be added to give any desired color effect for decoration or other purposes.

The sheet material must next be completed by building up the ground to present the required thickness. While under some conditions, this may be done in the process of manufacturing a shoe or similar article, it is preferably done at the outset so that the composite sheet material is a finished product subsequently applied to the shoe or to any other purpose for which it is useful.

The building up of the ground is secured by one or more layers of flat flexible fibrous material suitable for constituting a shoe sole or other article and is illustrated as a plurality of layers of flat woven textile fabric such as cotton sheet-

ing superposed on the back of the ground with intermediate layers of suitable adhesive binding material impregnating the ground and these layers of fabric so as adhesively to bond all together in a solid flexible sheet. Any adhesive binding material suitable for this purpose may be employed. Concentrated latex of about 60% is highly satisfactory, but if not obtainable, reclaimed rubber dispersions are satisfactory.

The adhesive binding material for bonding the layers together must thoroughly penetrate the ground of the pile fabric and the superposed layers of fabric, and for this purpose, pressure is employed and the binding material is applied at such a consistency that under the resultant pressure, it is forced into and through the interstices of the fabric. A preferred and simple method for securing this result is illustrated in Fig. 2, wherein pressure is indicated as applied by a pair of pressure rolls 7 while the pile fabric with its pile face filled with the rubber material is indicated at 8 and a plurality of layers of flat woven textile fabric at 9. Before these enter the pressure rolls, they are held separated so that a plurality of spray nozzles 10 may be located in transverse rows between them. As the several layers pass to the pressure rolls, the adhesive binding material is sprayed from the nozzles 10 onto the opposed surfaces of the layers and as the layers come together and are subjected to pressure by the rolls, this binding material, thoroughly distributed over the surfaces by the spray nozzles, is forced into and through the interstices of the fabric layers. The result is that all the layers are adhesively bonded together in a solid flexible sheet, the thickness of which depends primarily upon the number of layers of flat woven material, such as sheeting, employed.

The entire sheet material is dried and vulcanized by the ordinary methods.

The face of the composite sheet material is normally flat as indicated in Fig. 1 because the height of the pile is normally uniform. Since the pile is maintained and held by the rubber material substantially erect, the wear takes place transversely of the pile fibres and strands and is thus highly resisted especially with mohair and the non-slip characteristic is very high. The non-slip character of this tread face of the material is, however, increased in this invention by a construction in which the height of the pile and the thickness of the embedding rubber material coincidentally vary in some predetermined plan, as for example, by presenting a series of alternating grooves and ridges or some other pattern of depressions and elevations. This may be secured either by varying the height of the pile during the weaving of the pile fabric or by varying the height of the pile by a shearing operation. When the embedding rubber material is applied by the spreader or by frictioning into the pile fabric with the height of the pile thus varying, its thickness is readily caused to vary coincidentally with the height of the pile and thus the non-slip character of the tread face is increased.

In Fig. 3 composite sheet material embodying the invention is shown in which the height of the pile and the thickness of the embedding rubber coincidentally vary to form alternating ridges 11 and grooves 12 while in Fig. 4 a pattern variation is formed in which the darker portions 13 represent pile and embedding rubber higher than the lighter portions 14.

The composite sheet material of the invention is shown as cut to form a shoe sole 15 applied

to a shoe 16 in Fig. 5 and, as already pointed out, may be sewed, nailed or cemented in place. But whether used for this purpose, for floor covering, or for any other purpose, it presents a tough, flexible, durable material highly resistant to wear and presenting a surface highly resistant to slippage. The fibrous pile and the rubber material forming a solid mass act jointly to secure the wear-resistant and non-slip functions.

Normally the pile fibres project substantially from the face of the rubber material but even after extended usage, these fibres still project to some extent and along with the rubber material act to resist wear and at all times the surface of the combined materials acts to resist slippage.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is:

1. Composite sheet material for shoe soles and other articles required to resist wear and slippage comprising a face layer of woven textile fabric having a ground and a body of upstanding pile with a continuous body of tough flexible rubber material superposed upon and adherent to the ground with the pile wholly embedded in and adherent to the rubber material except that the fibers of the pile project from the surface of the rubber material to form with said surface a non-slip tread face, and with the height of the pile and the thickness of the embedding rubber material coincidentally varying in a predetermined plan, thereby to increase the non-slip character of the tread face.

2. Composite sheet material for shoe soles and other articles required to resist wear and slippage comprising a face layer of woven textile fabric having a ground and a body of upstanding pile with a continuous body of tough flexible rubber material superposed upon and adherent to the ground with the pile wholly embedded in and adherent to the rubber material except that the fibers of the pile project from the surface of the rubber material to form with said surface a non-slip tread face, and with the height of the pile and thickness of the embedding rubber material coincidentally varying to form alternating grooves and ridges acting to increase the non-slip character of the tread face.

3. Composite sheet material for shoe soles and other articles required to resist wear and slippage comprising a face layer of woven textile fabric having a ground and a body of upstanding pile with a continuous body of tough flexible rubber material superposed upon and adherent to the ground with the pile wholly embedded in and adherent to the rubber material except that the fibers of the pile project from the surface of the rubber material to form with said surface a non-slip tread face, and with the height of the pile and the thickness of the embedding rubber material coincidentally varying in a pattern of depressions and elevations acting to increase the non-slip character of the tread face.

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