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FIBROUS DOORMAT

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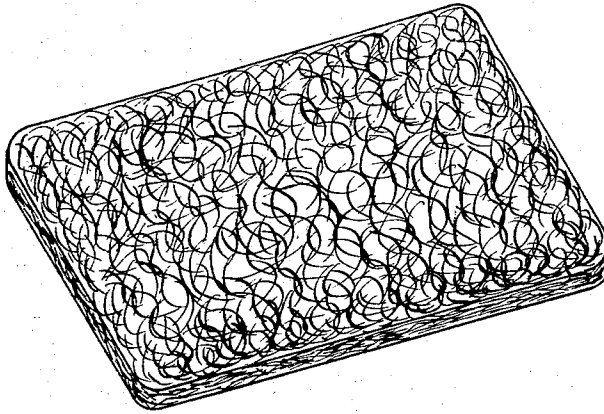


Fig. 1

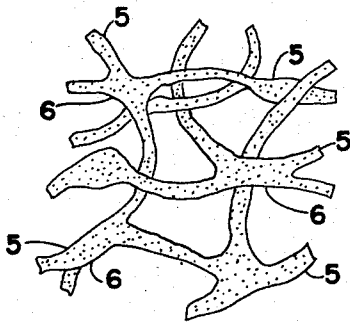


Fig. 2

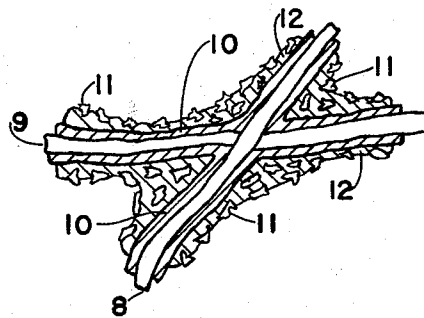


Fig. 3

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FIBROUS DOORMAT

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This invention relates to doormats and is particularly concerned with flexible, resilient, lightweight, fibrous doormats of open, porous construction.

Hitherto fibrous doormats have been formed from vegetable fibers such as coconut fiber and have been characterized by a densely woven backing or base having a thick nap on the upper surface thereof. Such doormats, when new and dry, are efficient in cleaning the soles of shoes. However, the coconut fiber is quite easily wetted and absorbs considerable moisture. When wet, the nap fibers become matted and the whole doormat becomes soggy with water. Further, because of the dense nature of the base or backing, doormats formed from coconut fibers accumulate dirt in the backing. This dirt is very difficult to remove. In fact, to clean such mats usually requires prolonged use of a hose stream and the mat is consequently soaked with water so that prolonged drying is necessary.

It has now been found that an efficient doormat may be formed from curled animal hair.

It is, therefore, an object of the present invention to provide a fibrous doormat which is flexible, resilient, and of lightweight construction.

Another object of the invention is to provide a fibrous doormat of the character described which has an open, porous structure.

Another object of the invention is to provide a fibrous doormat of the character described which is not easily clogged with dirt and which is easily cleaned.

A further object of the invention is to provide a fibrous doormat of the character described which is reversible so that either side may be used.

Another object of the invention is to provide a fibrous doormat of the character described which is durable and is not deteriorated by exposure to the elements.

Other objects and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a perspective view of a fibrous doormat in accordance with the present invention;

FIGURE 2 is a fragmentary, enlarged view of a portion of the doormat shown in FIGURE 1; and

FIGURE 3 is a more highly enlarged sectional view of a portion of the doormat shown in FIGURE 1.

As stated above the novel fibrous doormats of the present invention are formed from curled animal hair. Curled animal hair or "curled hair" as it will often be referred to herein is widely used for upholstery padding, packing, and the like. The designation "curled" does not mean merely curved or curly but signifies that the natural hair filaments have been given a three-dimensional curvature by a special curling process. Such curling processes are well known and form no part of the present invention. However, as mentioned, they result in the hair filaments having a three-dimensional curl whereby a random distribution of curled hair on a flat surface will produce a stereoreticular mass thereon which may be treated with adhesive and compressed to give a web of curled hair in which the hair filaments are securely bound together at their points of contact even though the web has a density of only about 60 oz./ft.³. Pads of any desired size and/or shape may be cut, for

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example by a dyeing operation, from the webs thus produced.

Since the animal hair most commonly used in curled hair products is that obtained from hogs and cattle, which has an average diameter in the range from about 3 mils to 9 mils, the porosity of such pads is above 90%, i.e. the pads contain less than 10% solids by volume and over 90% by volume of voids or interconnected air spaces that have irregular shapes. Thus the basic structural component of the present novel doormats is a flexible, lightweight, non-woven pad of substantially uniform thickness having an open, three-dimensional, porous structure formed of curled hair filaments randomly arranged and firmly secured together with an adhesive at their points of contact. Because of the three-dimensional curl of the hair filaments and their random arrangement the pad is not felted, i.e. the fibers do not tend to lie in planes parallel to the base of the pad, and is characterized by exceptional resilience. The curled hair filaments are substantially coated with the adhesive employed for bonding the filaments at their points of contact and are accordingly given substantial protection from water and other deleterious agents.

Doormats according to the present invention comprise a flexible, lightweight, non-woven pad, as above described, which has been provided with a non-slip coating over the adhesive used to cover and secure together the curled hair filaments. Such non-slip coatings preferably comprise fine granular material in an adhesive vehicle and are preferably applied to the web before the pads are cut therefrom. Since the webs have such a low density, non-slip coatings are essential to prevent shifting of the doormats in use.

The open, three-dimensional, porous structure of the novel doormats of the invention will be apparent from the drawings which accompany this application, although the drawings are not to scale. In FIGURE 1 there is shown a conventionalized, perspective view of a mat according to the invention. The open, three-dimensional characteristics are more clearly indicated in FIGURE 2 which is a greatly enlarged view representing a small area of the mat shown in FIGURE 1 and illustrating the manner in which the curled hair filaments, which have non-slip coatings 5 thereon are interlaced and bonded together at their points of contact 6. It is clearly evident that, even though the hair filaments carry coatings of substantial thickness, there are large, irregular, three-dimensional, interconnecting pores or voids within the structure. FIGURE 3 depicts, in greater enlargement, a sectional view through a crossing or point of contact between two curled hair filaments 8 and 9, the film or coating of adhesive on the filaments being designated by the numeral 10 and the non-slip coating which contains granules 11, being designated by the numeral 12. It will be seen that both the coating of adhesive and the non-slip coating are of substantial thickness.

In making doormats according to the invention quite satisfactory results are obtained using pads in which the curled hair comprises a mixture of hog hair and cattle hair in a ratio of about 4:1. It has been determined, however, that this ratio may be varied by increasing the proportion of curled cattle hair to as much as 50% or more of the mixture or by eliminating the cattle hair. It is also possible to use other types of curled animal hair either alone or in mixtures.

The adhesive binder employed in making the curled hair webs used in carrying out the present invention is preferably a flexible one. Elastomers such as rubber, natural or synthetic, and rubber-like materials such as neoprene are useful when applied in liquid form, pref-

erably as latices. Because of its resistance to oils and grease and to deterioration by weathering, neoprene latex has been preferred for this purpose.

Many types and kinds of granular materials may be employed in the non-slip coating provided on the curled hair filaments. However, most satisfactory results are obtained with a granular material which is rather hard and is in particles which present a plurality of sharp points. It will be evident that unless the particles have sharp points they will not grip or bite into the surface on which the doormat is placed and a material having a hardness of at least about 7 on Mohs' scale of hardness is desirable to prevent rapid wear of the points of the particles when they are in contact with surfaces of metal, stone, concrete and the like. Materials which have been found to be particularly suitable include quartz, other forms of silica, and natural and synthetic abrasive materials such as silicon carbide, garnet, corundum and the like. Preferably the granular materials are relatively finely divided to prevent excessive scratching of polished surfaces. It has been found that satisfactory non-slip properties are obtained without excessive scratching of the floor surface if the particle size of the granular material is within the range from 180 to 360 mesh, i.e. the largest particles will pass a 180 mesh/in. screen and the smallest will be held on a 360 mesh/in. screen. In most cases a particle size in the range from about 200 to 280 mesh is preferred.

The adhesive by which the granular material is held on the elastomer-coated curled hair may be of a number of types. In general the adhesive should have adequate strength to hold the granular material in place while at the same time being sufficiently flexible that the coating of granular material does not crack and shatter when the doormat is flexed in use. Suitable properties are found in such types of resinous adhesives as rubber-modified phenolic resins, plasticized melamine and urea resins, urethane resins, plasticized polyvinyl chloride resins, polyvinyl butyral resins, and epoxy resins. It will be understood that the properties of these and other suitable resinous adhesives can be modified by well known procedures to obtain the desired balance between flexibility and hardness or strength. Preferably the adhesive and granular material are applied as a fluid mixture since the obtaining of an even coating is thus facilitated. The amount of adhesive used will vary in accordance with the amount and particle size of the granular material and the strength of the adhesive. In general the minimum amount of adhesive will be used which is consistent with complete coating of the curled hair filaments and satisfactory bonding of the particles of hard material in such manner that they are firmly held yet stand out sufficiently to provide the desired non-slip characteristics.

Having described above the general nature and construction of the present novel doormats more specific details of the way such doormats may be produced will be described in the following example.

EXAMPLE

A web of a loose, randomly distributed mixture of curled hog hair and curled cattle hair approximately 1½ inches in thickness is formed on a conveyor belt and passed beneath spraying apparatus which applies to the top of the web neoprene latex in sufficient amount to penetrate through at least the upper half of the web and to coat the hair filaments therein. Preferably enough latex is used to coat and bind together the hair in the upper 60%-70% of the web thickness. After drying the adhesive latex coating sufficiently to render it non-sticky the web is passed between calender rolls which compress the web to a substantially uniform thickness of one inch. The web is then inverted and the hair filaments in the other half of the web are coated with the neoprene latex by another spraying treatment. After the second applica-

tion of neoprene latex the web is heated to cure the neoprene latex, a temperature of from about 270° F.-325° F. being employed. Only a few minutes is required and there is then obtained a web in which the curled hair filaments are coated with neoprene and are secured together therewith at their points of contact.

The neoprene-coated web is then passed beneath spraying apparatus by which there is applied to the upper portion thereof a liquid mixture of granular material and binder. Such a mixture may be formed from preplasticized polyvinyl chloride and finely divided (about 220 mesh) flint, a suitable mixture comprising about 100 parts by weight of flint, 100 parts by weight of resin, and 500 parts by weight of water. Sufficient of the liquid mixture is applied to cause penetration of the upper half of the web and to form a coating on the neoprene-coated curled hair therein. The coating is dried sufficiently to eliminate tackiness and the web is then inverted and sprayed with the liquid adhesive-granular material mixture on the other side, substantially the same amount of coating mixture being used. Thus the curled hair throughout the entire thickness of the web is covered with the mixture and the hard, granular non-slip material is distributed relatively evenly over the curled hair filaments.

The coated web is then heated to convert the dispersion of polyvinyl chloride in plasticizer to solid, firmly adherent, tough films on the filaments of curled hair. The heating is preferably at about 260° F. for at least 5 minutes. Enough of the non-slip coating mixture is used to give a total coating weight (dry basis) of about 2 oz./ft.² of the web.

Doormats of the desired shape and size are then cut from the web. These mats have a total weight of about 7 oz./ft.² and tensile strengths in the weakest direction of at least 10 lbs./in. width.

The weight of the mats will, of course, vary somewhat in accordance with the types and amounts of the coatings on the curled hair. It will be realized that such amounts are subject to considerable variation. Thus, if a hard material of higher specific gravity than silica is used the weight of the non-slip coating may increase markedly and the amounts of resin and hard material may also vary in accordance with other factors. Similarly the weight of the flexible adhesive coating on the hair filaments may vary. It is preferred to apply from about 1 oz. to 1¼ oz./ft.² of neoprene latex per side of the web where the final thickness of the web is to be about 1 inch. However, the thickness of the coating can vary depending on concentration and other factors.

If coloring of the mats is desired, as is usually the case, suitable dye and/or pigment can be added to either the neoprene coating or the non-slip coating or, preferably, to both.

Doormats according to the present application have been found to be resistant to water, acid solutions, alkali solutions, and oil. This is illustrated in the following table showing the loss in strength of samples after immersion for the stated period in these agents.

Table A

Agent	Period days	Loss in strength percent
Water -----	1	37
H ₂ SO ₄ solution (pH 3) -----	1	37
NaOH solution (pH 11) -----	1	37
Cutting oil -----	2	23

In use the novel doormats of the present invention present a number of advantages. Among the most important advantage is that when exposed to the elements the mats are durable for extended periods. In addition they do not have a nap which will mat or pack down, particularly when wet, and do not become soggy when wet.

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Another important advantage is that the structure of the present doormats is open or porous. This prevents the accumulation of dry dirt or dust in the mat and makes it very easy to keep clean. A vacuum cleaner may be conveniently employed to pick up the dirt which falls through the mat. If the mat is very dirty it can be sprayed with a hose or even agitated in a container containing a washing fluid. In the event liquids are used for cleaning the mats, they are quickly dried because of their high porosity and are again ready for use within a short time.

Other advantages of the curled hair doormats are their lightness, their even resilience, and their reversibility. The last-mentioned point is an important one. Coconut fiber mats are normally made in such manner as to be usable only one way, i.e. with the napped side up. The novel doormats described above, however, are the same on both sides and may therefore be used with either side up. This results in greatly increased durability since wear can be distributed over both sides of the mat.

I claim:

1. A flexible, resilient, lightweight, fibrous doormat which comprises an open, porous pad of randomly oriented curled animal hair, said pad being held under slight compression by a deposit of cured elastomeric adhesive that covers the individual hair filaments and secures them together at their points of contact, and having thereon a film of a non-slip coating, said coating containing a tough resinous adhesive and covering the deposit of elastomeric adhesive over said hair filaments substantially evenly throughout the entire thickness of said pad.

2. A fibrous doormat as defined in claim 1 in which said non-slip coating comprises a tough resinous adhesive containing finely divided hard material dispersed therein.

3. A fibrous doormat as defined in claim 2 in which said hard material has a hardness of at least 7 on Mohs' scale of hardness and the particles thereof have sharp points.

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4. A fibrous doormat as defined in claim 2 in which said elastomeric adhesive is neoprene.

5. A fibrous doormat as defined in claim 2 in which said pad is composed of a mixture of curled hog hair and curled cattle hair.

6. A fibrous doormat as defined in claim 2 which is alike on both faces and may be reversed in use.

7. A fibrous doormat as defined in claim 3 in which said hard material has a particle size within the range from 180 to 360 mesh.

8. A fibrous doormat as defined in claim 7 in which said hard material is silica.

9. A fibrous doormat as defined in claim 8 in which said elastomeric adhesive is neoprene.

10. A fibrous doormat as defined in claim 8 in which said non slip coating includes a polyvinyl chloride resin.

11. A fibrous doormat as defined in claim 3 in which said hard material is silica.

12. A fibrous doormat as defined in claim 11 in which said elastomeric adhesive is neoprene.

13. A fibrous doormat as defined in claim 11 in which said non slip coating includes a polyvinyl chloride resin.

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