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C. S. FRANCIS, JR

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TEXTILE PRODUCT

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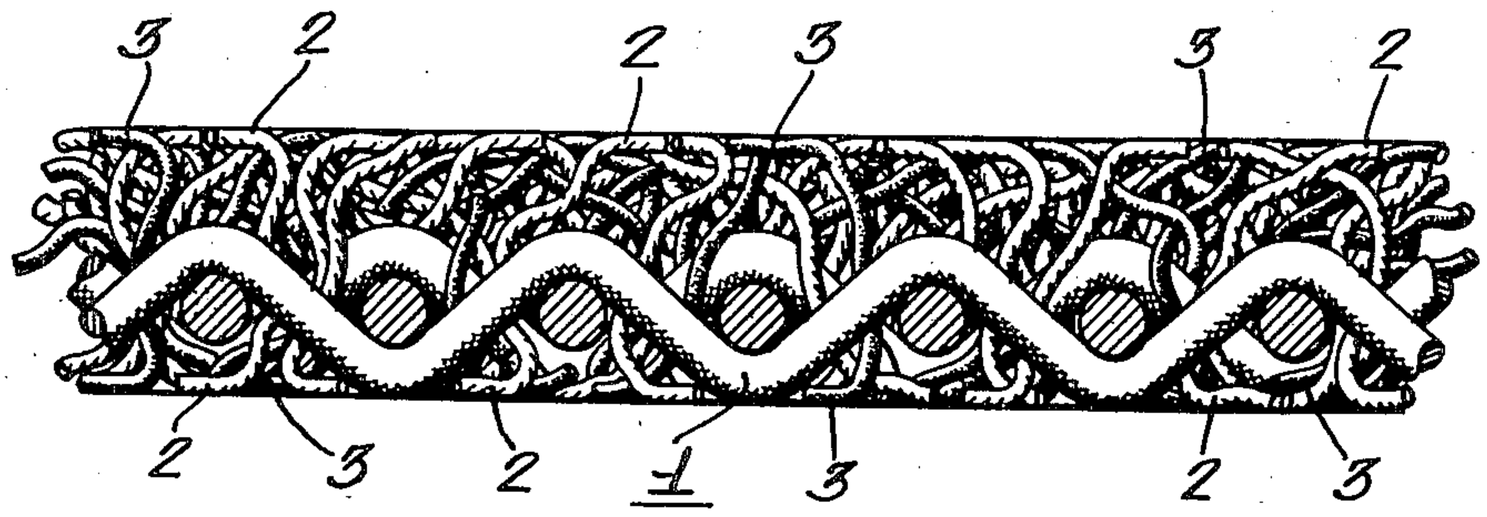

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TEXTILE PRODUCT

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4 Claims. (Cl. 154—54)

1

This invention relates, in general, to felted fibrous structures, and, in particular, to a process for producing felts and includes correlated improvements designed to enhance the properties, characteristics and to extend the uses of the felts so produced. This application is a division of my copending application Serial No. 300,876 filed October 23, 1939, now Patent No. 2,459,803, which in turn is a continuation-in-part of application Serial No. 157,018, filed August 2, 1937 (now Patent 2,253,000). This application is also a division of my copending application Serial No. 530,553, filed April 11, 1944 (now Patent No. 2,437,689).

It has previously been impractical to make felts from fibres other than wool and like fibres which have a substantial curl and, even more important, a rough surface. When attempts are made to produce felts from smooth-surfaced and relatively straight fibres such as artificial fibres, the products produced invariably lack strength, and in many cases are devoid of any felt structure whatever, because the smooth surface of the fibres and their relatively straight form prevents the fibres from interfelting and clinging together in the manner of wool fibres. Even when artificial fibres have been given an artificial crimp or curl, they do not make satisfactory felts because the smooth-surfaced fibres slide upon one another and are not fixed in position by the felting operation.

It is a general object of the present invention to provide a method for producing felts from relatively smooth surfaced and/or relatively straight fibres.

Another object of the invention is to provide an improved felt from smooth-surfaced and/or relatively straight fibres, such felts having certain desirable characteristics among which are increased strength and greater tenacity between component fibres and improved wet strength.

A specific object of the invention is to provide a shaped felted structure adapted for use as a substitute for woven fabrics and which may be manufactured according to the invention at less cost and with less expenditure of time than woven fabrics.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The single figure of the accompanying drawing is a sectional view of the structure to which the present application is particularly directed.

In accordance with the present invention, felts of substantial strength and high tenacity are made from a mixture of normally non-felting

2

fibre and synthetic resin fibres, the non-felting fibres being maintained in a felted condition by the thermal tackiness of the resin fibres. The process of the present invention may be carried out by mixing together normally non-felting fibres with synthetic resin fibres which are non-tacky at room temperature, but which become tacky below the temperature at which the non-felting fibres are damaged, felting the mixture of fibres, heating the felted mixture to a temperature at which the resinous fibres become tacky and cooling the felt to effect fibre adhesion. The resin fibres may be rendered tacky during or after the felting operation and the felt is preferably subjected to pressure while the resin is in an adhesive condition. The expression "felt" as used in the specification and claims is intended to include both textile felts and unwoven felted structures formed therefrom. Paper felts are not claimed herein since such felts are claimed in my copending U. S. application Serial No. 444,438, filed May 25, 1942, now Patent 2,526,125.

Thus the present invention enables improved felts to be made from various natural or synthetic fibres and filaments which are smooth-surfaced and/or relatively straight and which do not felt readily. Among the natural fibres which may be used are cotton, flax, jute, kapok, silk, and the like, or they may be synthetic fibres of cellulosic composition, such as a cellulose hydrate, cellulose derivatives, as cellulose esters, mixed cellulose esters, cellulose ethers, mixed cellulose ester-ethers, mixed cellulose ethers, cellulose hydroxy-ethers, cellulose carboxy-ethers, cellulose ether-xanthates, cellulose xantho-fatty acids, cellulose thiourethanes; natural and synthetic rubber and derivatives thereof; alginic acid, gelatine, casein; and mineral fibres such, for example, as spun glass, asbestos, mineral wool and the like, and fibres made of natural and synthetic resins which should be of such type that they are not rendered tacky when the potentially adhesive resin fibres are rendered tacky by heating; also fibres and filaments made by slitting, cutting or shredding non-fibrous films, such as waste cellophane.

The potentially adhesive resin fibre may be composed of a wide variety of materials, and may comprise any synthetic resinous material capable of being formed into fibres which have an inherent tackiness upon heating to a temperature below that at which the non-felting fibres are damaged or rendered tacky and which are non-tacky at room temperature such, for example, as the resins formed by the polymerization of vari-

ous organic compounds such as coumarone, indene hydrocarbons, vinyl, styrene, sterol aldehyde, furfural, ketones, urea, thiourea, phenol-aldehyde resins, either alone or modified with oils, urea-aldehyde resins, amine-aldehyde resins, sulfonamide-aldehyde resins, polyhydric alcohol-polybasic acid resins, drying oil-modified alkyd resins, resins formed from acrylic acid, its homologues and their derivatives, sulfur-olefine resins, resins formed from dicarboxylic acids and diamines (nylon type); fibres formed from synthetic or artificial rubber such for example as polymerized butadiene, olefine-polysulfides, e. g. "Thiokol," isobutylene polymers, chloroprene polymers and polyvinyl-halides, e. g. "Koroseal," fibres formed from a resin comprising the product of co-polymerizing two or more resins, such, for example, as co-polymers of vinyl halide and vinyl acetate, co-polymers of vinyl halide and an acrylic acid derivative, co-polymers of vinyl compound and styrol compound; and also fibres formed from a mixture of resins, such for example as a mixture of vinyl resins and acrylic acid resins or methacrylic acid resins, a mixture of polyolefine resins and phenol-aldehyde resins, or a mixture of two or more resins from the different classes just named.

The resins above mentioned may be classified as:

(*a*) Heat-non-convertible resins such for example as glycol polybasic acid resins, vinyl resins and the acid type phenol-aldehyde resins, and the like.

(*b*) Heat-convertible resins such for example as glycerol-polybasic acid resins, polyolefine resins, phenol-aldehyde resins and the like.

(*c*) An element-convertible resin (which becomes infusible through the action of certain elements, such as oxygen and sulfur) such for example as glycerol-polybasic acid-drying oils, resins and olefine sulfur resins.

For felts that are subjected to laundering or dry cleaning, the synthetic resin fibre should be insoluble in water and inert to the detergents used for laundering and dry-cleaning. The resins employed are preferably those which do not soften appreciably at temperatures reached in laundering and "blocking" (as in the making of hat felts), although softening during blocking is not objectionable.

In the now preferred embodiment there is used synthetic resin fibre comprising a co-polymer of vinyl acetate and vinyl chloride which fibres are made by suitable methods known in the art. This fibre resembles rayon and is similar thereto in many respects, but it differs therefrom since it becomes tacky when heated to a temperature of from 200° F. to 350° F. When heated, it becomes adhesive to other fibres in contact with it and adheres thereto upon cooling. It is tough and firm at ordinary temperatures, insoluble in water, and inert to the agents used in laundering and dry-cleaning and shows no substantial decrease in tensile strength on being wetted.

The ratio of synthetic resin fibre to other fibre may also vary widely depending on the properties of the two types of fibres and may be regulated to suit the purpose for which the felt is destined, but in general a minor proportion, preferably from 3 per cent to 20 per cent of the synthetic resin fibre will be employed. Where a greater degree of strength or a closer bonding of the component fibres is desired, the percentage will be relatively high, whereas in felts, such as papers of certain construction where it is desirable to

have a comparatively small amount of bonding of the component fibres, the percentage will be relatively small.

The synthetic resin fibre and the other fibre have been mixed by a method suitable to the production of a particular type of felt, for example, the fibres may be mixed by carding.

The inherent tackiness of the resin fibres is activated by heating the felt to an appropriate temperature, for example by the use of dry hot air, contact with heated surfaces, steam or hot water. The temperature of the heat-treatment will depend on the properties of the synthetic resin fibre and must necessarily be below that at which the felt is damaged. When the felt is cooled, the synthetic resin fibres become non-tacky and tough, and adhere to the other fibres, thus providing a felt which possesses increased strength and greater tenacity between component fibres.

Generally, it is preferred to immerse the felt in water at or approximating the boiling point, as it is found that the water carries the heat uniformly through the felt and accordingly reacts on the thermoplastic fibres throughout the entire felt. In certain cases, however, where it is desirable to obtain a surface-glazed effect on felts, wherein the thermo-plastic fibres are largely exposed on the surface thereof, it may be more desirable to heat the fabric by surface contact with heated metal, such as is practiced in the conventional heated calender. The method of heating may be carried out in whichever manner may be selected to conform most satisfactorily with the effect desired in the finished felt.

The tackiness of the resin fibres may be modified by heating the resin fibres in the presence of a suitable plasticizer depending on the particular type of resin. The plasticizer may be incorporated in or carried by the resin fibres and/or by the non-feltable fibres and may be incorporated in the fibres at any point prior to heating. In the preferred embodiment the plasticizer is incorporated in the resin mass prior to its formation into fibres and filaments. The plasticizer lowers the temperature at which the resin fibres are rendered tacky upon heating. After heating, the plasticizer is preferably removed by suitable means such as evaporation or extraction, thereby preventing the resin fibres from again being rendered tacky at the original activating temperature and rendering them capable of remaining non-tacky at ironing temperatures.

The mixture of fibres may be felted in a predetermined shape by use of a suitable mold, or the felt may be shaped and given a desired form. The shaping takes place in the case of paper felts, preferably by molding or shaping the wet paper sheet. In the case of textile felts, it is preferable to shape the felt after its initial formation and after the thermal activation of the potentially adhesive fibres and while such fibres are in an adhesive condition. The predetermined shape of both paper and textile felts may be permanently set by the deactivation of the adhesive or of the adhesive fibres. By this means there may be produced a wide variety of shaped, felted structures which may be used as substitutes for woven, knitted or netted fabrics and articles made from the same. As the felting and shaping process herein described involves no spinning, weaving, knitting or other similar textile operation, it is obvious that the shaped, felted structures can be produced at a very low cost.

The invention is applicable for making various

types of textile felts, such for example as "woven" felts, "needle" felts and pressed textile felts.

In the case of "woven" felts the basis is a woven construction having a full nap or pile which is felted until the woven structure is obscured. After the woven construction is shrunk and the nap felted in the usual manner, the felt is subjected to heat to render the resin fibres tacky which effects an adhesion or bonding of the felted nap fibres.

"Needle" felts are commonly prepared by placing a layer of unfelted fibres on one or both sides of a woven gauze and the fibres drawn partly through the gauze by means of barbed needles, after which the article is pressed. In this embodiment the layer of fibres comprises a mixture of unfeltable fibres and resin fibres. After the fibres are drawn into the gauze, the felt is subjected to heat and pressure to activate the inherent tackiness of the resin fibres to cause a permanent adhesion of the fibres in the layer and to effect an anchoring of the felted fibres to the gauze base. The structure thus produced is illustrated in the accompanying drawing wherein the woven base is shown at **1**, the non-adhesive fibres are shown at **2**, and the resin fibres are shown at **3**.

The present invention has special application to the manufacture of pressed textile felts such as are used for hats, chair pads, rug cushions, sound and shock absorbers and the like. In the formation of such felts, a mixture of the unfeltable fibres and resin fibres is prepared as by carding and shaped into a layer. The layer of fibres is placed between heavy sheets of fabric, such as canvas, preferably moistened with water and then placed between heated metal plates which are vibrated rapidly when in contact with the enclosed layer, thus causing the fibres to become matted together in a compact layer. If desired the layer of fibres may now be heated to render the resin fibres tacky and effect a permanent adhesion of the fibres in the felted condition, or this heating step may be carried out at a later time. The layer of felted fibres, before or after heating, may be folded and placed in the usual felting box provided with conventional hammers by which the layer may be pounded to a desired thickness, firmness, length, width, configuration, etc., after which the felt is heated, if desired, to render the resin fibres tacky and the felt is then finished in the usual manner. For smooth surfaced felts the layer is run through calenders which may be heated to render the resin fibres tacky.

As an illustrative embodiment of a manner in which the invention may be practiced, the following examples are presented:

Example I

A rayon staple may be cut to a length of 1.5 to 2 inches and a resinous fibre as a co-polymer of vinyl acetate and vinyl chloride may be cut to a corresponding length. The cut fibres may then be mixed in a suitable carding machine in the proportions of about 90% of cut staple rayon and 10% of the resin. A textile felt may then be formed from the mixture in a suitable manner, and the admixture is heated sufficiently to soften

the resin. As a rule a temperature of about 200° F. will serve to soften the resinous fibre, and hence such temperature preferably is used. While in a heated, softened condition, the resin fibre becomes adhered to the other fibres surrounding it, causing the fibres to cling together. On cooling, the resinous material becomes solid and non-tacky and tough, although still adhering to the fibre surrounding it, with the result that the fibres are substantially fixed in position, thus imparting strength and maintaining the shape of the felt.

Since certain changes in carrying out the above process, and certain modifications in the article which embody the invention may be made without departing from its scope, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. As an article of manufacture, a textile product comprising a prefabricated textile base, a layer of fibres on a face thereof and extending in part through said base, said layer of fibres being formed from a mixture of non-adhesive fibres and potentially adhesive fibres, fibres in said layer exhibiting a strong and substantially permanent adhesion to said textile base due to the binding action of said potentially adhesive fibres.

2. As an article of manufacture, a textile product comprising a woven fabric base, a layer of fibres on a face thereof and extending in part through said base, said layer of fibres being formed from a mixture of non-adhesive fibres and potentially adhesive fibres, fibres in said layer exhibiting a strong and substantially permanent adhesion to said textile base due to the binding action of said potentially adhesive fibres.

3. As an article of manufacture, a textile product comprising a woven textile base, a layer of fibres compressed on a face thereof and extending in part through said base, said layer of fibres being formed from a mixture of non-adhesive fibres and thermoplastic fibres, fibres in said layer exhibiting a strong and substantially permanent adhesion to said textile base due to the binding action of said thermoplastic fibres.

4. As an article of manufacture, a textile product comprising a woven textile base, a layer of fibres compressed on a face thereof and extending in part through said base, said layer of fibres being formed from a mixture of a major proportion of non-adhesive fibres and a minor proportion of thermoplastic fibres, fibres in said layer exhibiting a strong and substantially permanent adhesion to said textile base due to the binding action of said thermoplastic fibres.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
810,933	Goldman	Jan. 30, 1906
2,152,901	Manning	Apr. 4, 1919
2,277,049	Reed	Mar. 24, 1942