Patented Aug. 19, 1941 2,253,000

UNITED STATES PATENT OFFICE

2,253,000

TEXTILE AND METHOD OF MAKING THE SAME

Carleton S. Francis, Jr., New York, N. Y.

No Drawing. Application August 2, 1937, Serial No. 157,018

12 Claims. (Cl. 28—1)

This invention relates to an improved fabric of novel construction and properties, and to a novel method of making same.

One object of the invention is to provide an improved fabric or cloth having certain desirable characteristics among which are the ability to resist creasing and wrinkling, increased strength and greater tenacity between component threads or fibres.

Another object of the invention is to provide a fabric which is a marked improvement over prior fabrics and which may be manufactured according to the invention at less cost and with less expenditure of time than prior fabrics.

The invention is applicable generally to any fabric whether it be knitted, woven, or matted as in the case of felt or paper, as will be set forth more particularly hereinafter.

It is well known to the art that desirable qualities, such as resistance to creasing and improved wearing qualities, may be imparted to a fabric by impregnating the fabric with certain synthetic resinous materials. The resins most frequently used are those known as the urea-formaldehyde resins. The practice, however, of using resins for the purpose has heretofore been limited to an after-treatment or, in other words, a finish-treatment after the fabric has been made. This practice is carried out by impregnating the fabric with a solution containing the resinous material. The fabric is thereafter dried and is then heat-treated to cure the resin.

The present invention employs an entirely different means of introducing the resinous material into the fabric, and contemplates the association of fibres of synthetic resinous material with the fibres from which the fabric is to be made prior to the manufacture of the fabric. Thus, the synthetic resin fibres are mixed or combined with the fibres and the fabric then constructed therefrom. The fibres employed with the synthetic resin fibres may be natural fibres such as wood pulp, wool, cotton, linen, silk, asbestos, and the like, or they may be synthetic fibres such as rayon, cellulose acetate, spun glass, mineral wool, and the like, which synthetic fibres are well known to be inherently smooth-surfaced. In the production of woven or knitted fabrics, the association of the two types of fibres is brought about prior to the completion of the spinning of the yarn and preferably by mixing the fibres thoroughly together, which mixing is easily accomplished during the preliminary textile operations normally employed, for example, the carding step. However, the association of the synthetic resin fibre and the other fibre may be accomplished by twisting the resin fibre around thread or yarn of the other fibre or by twisting the thread or yarn of the other fibre around the resin fibre. In the case of matted fabrics such as felt or paper, the two fibres are mixed in the equipment used in the production of the fabric. The expressions "mixing" and "mixture" as used herein include all methods of associating the two types of fibres wherein the association takes place prior to the completion of the spinning of the yarn, in respect of fabrics made of spun yarns, and prior to the fabrication of fabrics not made of spun yarns.

After the synthetic resin fibre and the other fibre have been mixed or combined, the fabric is produced by the steps and the machines normally employed in the manufacture of the particular fabric. Thereafter, the fabric is subjected to a heat-treatment, either with or without pressure, to cause the synthetic resin fibre to soften and become tacky or adhesive. 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 fabric is damaged. When the fabric is cooled, the synthetic resin fibres become non-tacky and tough, and adhere to the other fibres, thus providing a fabric which resists creasing and wrinkling and possesses increased strength and greater tenacity between component threads or fibres.

The synthetic resin fibre may be composed of a wide variety of materials, and any synthetic resinous material capable of being formed into fibres which tacky at temperatures below that at which the fabric is damaged and which, at room temperature, are non-tacky and sufficiently tough for the purpose may be used. The resin may be of the thermosetting or thermoplastic type, although the latter is preferred, and may be colored or colorless depending on the type of fabric produced. For fabrics that are subjected to laundering, the synthetic resin fibre should be insoluble in water and inert to the acids and alkalies used in laundering. If the synthetic resin fibres are thermoplastic and soften during the laundering or subsequent ironing, it is not disadvantageous since the heat of the iron is equivalent to the heat-treatment originally employed in the production of the fabric. 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 fabric is destined, but in general 5% to 20% of the synthetic resin fibre

will be employed. Where a greater degree of strength or a close bonding of the component fibres is desired, the percentage will be relatively high, whereas in fabrics 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.

A typical example of a synthetic resin fibre which is particularly advantageous for use is a fibre of a copolymer of vinyl acetate and vinyl chloride. This fibre resembles rayon and is similar thereto in many respects, but it differs therefrom since it softens when heated to a temperature of approximately 200° F. When heated, it becomes adhesive to other fibres in contact with it and retains the adhesion upon cooling. It is tough and firm at ordinary temperatures, insoluble in water, and inert to the acids and alkalies used in laundering. This resin fibre is produced by methods well known in the art and standard equipment, such as is utilized in the production of cellulose acetate yarn, is generally employed. Examples of other synthetic resinous fibres which may be used are polystyrene (vinyl benzene), vinyl acetate, polymers of acrylic acid, and acrylates, or mixtures or copolymers of two or more such resins including the copolymer of vinyl acetate and vinyl chloride, urea-formaldehyde resins, glyptal resins, and the like.

The heat-treatment may be accomplished by any one of a number of methods—dry hot air, exposure to heated metal surfaces, steam or hot water. Generally in a treatment of fabrics for wearing apparel it is preferred to immerse the fabric in water at or approximating the boiling point, as it is found that the water carries the heat uniformly through the fabric and accordingly reacts on the thermoplastic fibres throughout the entire fabric. In certain cases, however, where it is desirable to obtain a surface-glazed effect on fabrics wherein the thermoplastic 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. In any event it is the purpose of the invention to utilize the adhesive qualities of the synthetic resinous fibres to create a bond between the component fibres of the fabric. The method of doing so may be carried out in whichever manner may be selected to conform most satisfactorily with the effect desired in the finished fabric.

As an example, in the manufacture of spun rayon fabrics, the rayon staple is cut to a length of 1½ to 2 inches, providing the yarns are being spun on what is conventionally known as the cotton system, or in lengths that may vary from 3 to 5 inches if the yarns are being spun on what is conventionally known as the worsted system. Following the same procedure, the resinous fibre is cut to the same length. Approximately 10% of the resinous fibre, for example, is then substituted for 10% of the cut staple rayon and thoroughly mixed therewith. Using this mixed stock, the fibres are then carded and spun in the conventional manner. The yarn thus produced may then be woven or knitted to form the fabric in the conventional manner. The term "textile" employed herein and in the claims includes the spun yarn, whether single or plied, as well as threads, cords and fabrics of all kinds produced therewith.

As a step in the finishing operation, the fabric is exposed to heat at a sufficient temperature to render the resinous fibre tacky. As stated above, a temperature of 200° F. will serve to render tacky the resinous fibre which is preferably used. While in a heated, tacky condition, the resinous fibre becomes adhered to the other fibres surrounding it, causing the fibres to cling together. On cooling, the resinous fibres become noncementitious and tough, although still adhering to the fibre surrounding them, with the result that the fabric has imparted to it a desirable firmness and tenacity.

If paper fibres are employed in the production of the fabric, synthetic resin fibres, insoluble in water, may be mixed with the pulp in the heater, or merely added to the head box of the paper machine, and during the fabrication of the paper sheet, the synthetic resin fibres are distributed through the pulp fibres. The subsequent heating of the fabricated sheet may take place on the driers if they are heated sufficiently, but preferably the paper is subjected to sufficient heat and pressure in a heated calender.

As above stated, the invention is not only applicable to knitted or woven fabrics and paper but it may be employed in materials such as felt. Heretofore, it has been impractical to make felt of spun rayon and similar smooth-surfaced fibres. By means of the present invention, however, it is possible to make felt employing synthetic resinous fibres in conjunction with smooth-surfaced fibres, such as rayon, since the activated adhesiveness of the synthetic resinous fibres causes sufficient adhesion between the fibres. In the manufacture of felt, wherein synthetic fibres such as cut staple rayon are employed, it is found that if approximately 15% of the resinous fibres are substituted for an equivalent amount of the base fibre used, and the fibres carefully mixed, for example in the standard mixing box, so that the resinous fibres are uniformly distributed, this mixed stock may then be processed on a felting machine in the normal manner wherein it is exposed to heat and pressure, it being essential only that the temperature equals or slightly exceeds the heat of incipient fusion or softening of the resinous fibre. Obviously, if desired, the heat-treatment may be carried out after the manufacture of the felt. The adhesion between the fibres thus created by the resinous fibre serves to bind all of the fibres in the fabric, and thereby greatly improves the strength and quality of the product.

The felted products, including paper, and the methods of producing the same, described herein, are the subject matter of my copending application Serial No. 300,876, filed October 23, 1939, as a continuation-in-part of the present application.

In its application to the formation of composite yarn, the invention contemplates broadly the combining of the synthetic resin fibre with other fibres in the yarn. As previously pointed out, methods other than those above described may be employed. For example, a thread or yarn may be formed by twisting together a filament of the synthetic resin with a textile fibre or yarn. The synthetic resin fibre may be twisted around the textile fibre, or the textile fibre may be twisted around the synthetic resin fibre. If the principal object is to merely adhere the components of the composite yarn together, the textile fibre should be twisted around the synthetic resin fibre. On the other hand, it may be desirable in some instances to have the various yarns of the finished fabric adhere to one an-

other, in which case the synthetic resin fibre should be twisted around the textile fibre. This method and the resulting product is the subject matter of my copending application, Serial No. 402,812, filed July 17, 1941, as a continuation-in-part of the present application.

In the appended claims the expression "fibres" is intended to include staple fibres and/or continuous filament wherever the sense permits.

From the foregoing description, it will be seen that the invention contemplates the manufacture of the woven or knitted cloth, felt, paper, and other fabrics, by associating predetermined proportions of synthetic resinous fibres and the fibres, particularly textile fibres, from which the fabric is to be produced, and by treating the associated fibres in accordance with conventional methods to produce the desired fabric. As a step in the manufacture of the fabric, or thereafter, the fabric is subjected to a heat-treatment to activate the adhesiveness of the synthetic resinous fibres. It will be understood, of course, that the description herein given is for the purpose of disclosure only and is not to be considered as a limitation upon the invention.

The expression "stabilized" textile as used in the appended claims designates a textile resistant to abrasion and laundering and in which the fibres are substantially fixed in position and the yarn twist stabilized.

I claim:

1. The method of making a stabilized textile, which comprises mixing together, prior to the completion of spinning, at least two types of fibres of textile-making length one of which is a synthetic resin fibre having an inherent tackiness upon heating, spinning said mixture of fibres into yarn, subsequently rendering said resin fibres tacky by heat to effect a strong and substantially permanent adhesion between the fibres without rendering the textile non-porous.

2. The method of making a stabilized textile fabric, which comprises mixing together, prior to the completion of spinning, at least two types of fibres of textile-making length, one of which is a synthetic resin fibre having an inherent tackiness upon heating, spinning said mixture of fibres into yarn, fabricating said yarn into fabric, subsequently heating said fabric to render said resin fibres tacky to effect a strong and substantially permanent adhesion between the fibres without rendering the fabric non-porous.

3. The method of making a stabilized textile, which comprises mixing together, prior to the completion of spinning, at least two types of fibres of textile-making length, one of which is a synthetic resin fibre having an inherent tackiness upon heating, spinning said mixture of fibres into yarn, subjecting the textile to treatment with hot water to render said resin fibre tacky to effect a strong and substantially permanent adhesion between fibres without rendering the textile non-porous.

4. In a method of making a stabilized textile which is to be subjected to heat to effect a strong and substantially permanent adhesion of the component fibres, the steps comprising mixing together, prior to the completion of spinning, at least two types of fibres of textile-making length, one of which is a synthetic resin fibre capable of being rendered tacky upon heating below the temperature at which the other type of fibre is damaged, and spinning said mixture of fibres into yarn.

5. As an article of manufacture, a stabilized textile comprising yarn formed from a mixture of at least two types of fibres of textile making length, one of which is a synthetic resin fibre having an inherent tackiness upon heating, the fibres in the textile exhibiting a strong and substantially permanent adhesion due to the thermal tackiness after heating of said synthetic resin.

6. A stabilized textile as claimed in claim 5 wherein the synthetic resin fibres comprise thermoplastic resin fibres.

7. A stabilized textile as claimed in claim 5 wherein the synthetic resin fibres comprise thermosetting resin fibres.

8. A stabilized textile as claimed in claim 5 wherein the synthetic resin fibre is present in an amount of from 5% to 20% by weight of the fibres.

9. As an article of manufacture, a singles yarn for use in stabilized textiles which are to be subjected to heat to effect a strong and substantially permanent adhesion between component fibres, comprising a mixture of at least two types of fibres of textile-making length, one of which is a synthetic resin fibre having an inherent tackiness upon heating which will effect said adhesion.

10. In a method of making a stabilized textile fabric which is to be subjected to heat to effect a strong and substantially permanent adhesion of the component fibres, the steps comprising mixing together, prior to the completion of spinning, at least two types of fibres of textile-making length one of which is a synthetic resin fibre capable of being rendered tacky upon heating below the temperature at which the other type of fibre is damaged, spinning said mixture of fibres into yarn, and fabricating a fabric from said yarn.

11. As an article of manufacture, a stabilized textile yarn formed from a mixture of at least two types of fibres of textile-making length, one of which is a synthetic resin fibre having an inherent tackiness upon heating, the fibres in the yarn exhibiting a strong and substantially permanent adhesion due to the thermal tackiness after heating of said synthetic resin.

12. As an article of manufacture, a textile fabric which is to be subjected to heat to effect a strong and substantially permanent adhesion between component fibres, said fabric comprising yarns formed from a mixture of at least two types of fibres of textile-making length one of which is a synthetic resin fibre having an inherent tackiness upon heating which will effect said adhesion.

CARLETON S. FRANCIS, JR.