March 9, 1954 U. GIANDOMENICI 2,671,475

HEAT-RETENTIVE NAPPED FABRIC AND METHOD OF MAKING THE SAME

Filed April 13, 1951

FIG-1-

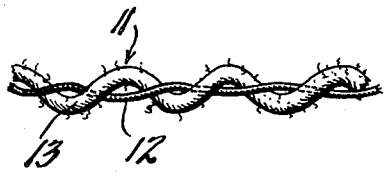


FIG-2-

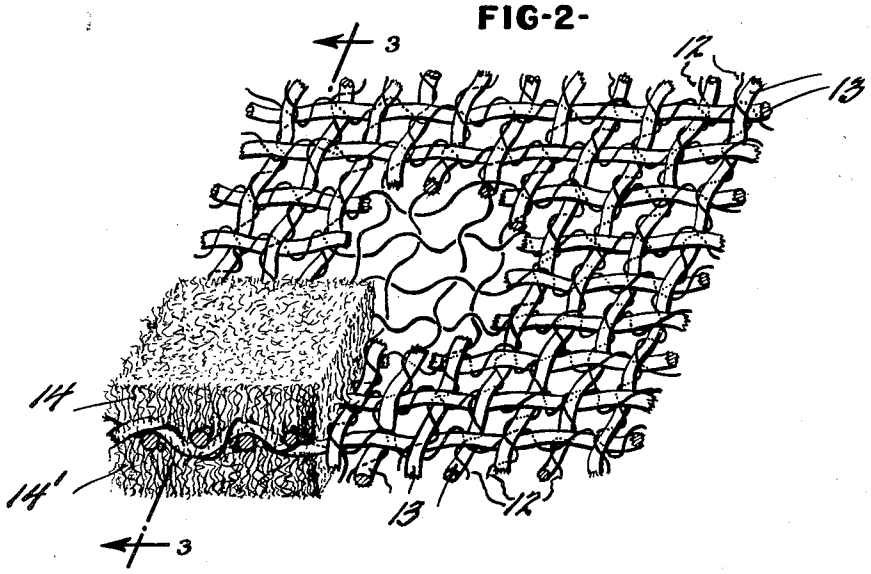
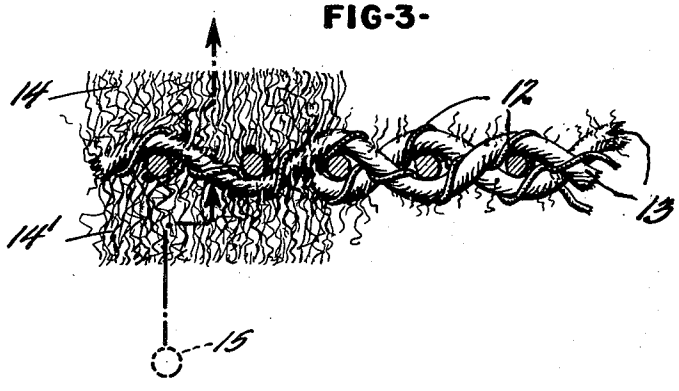


FIG-3-



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HEAT-RETENTIVE NAPPED FABRIC AND METHOD OF MAKING THE SAME

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2 Claims. (Cl. 139—391)

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This application relates to fabrics having high heat-retentive power and methods for producing the same.

The broad object of the present invention is to provide a fabric having superior insulating properties, said fabric being characterized by a reticulate system of relatively fine yarns or strands with which is permanently associated a system of coarse nappable yarns, the thus assembled coarse and fine yarns having been subjected to a napping operation to raise fibers from the coarse yarns and form a napped covering on at least one side of the reticulate system.

A further object of the invention is to provide a fabric particularly resistant to the loss of heat in which the fabric is formed by associating together in a plying operation a relatively fine yarn and a coarse yarn, weaving the composite yarn into fabric, and subjecting the fabric to a napping operation to furnish either one or both sides of the fabric with a napped covering, the covering consisting of fibers raised from the coarse yarn.

Other and further objects and advantages will be apparent from the following detailed description when read in connection with the accompanying drawings in which

Figure 1 is an enlarged view of a short length of the composite yarn from which the fabric of the present invention is preferably woven;

Figure 2 is an enlarged composite view, the major portion of which illustrates the fabric formed from the composite yarn of Figure 1 prior to subjection to a napping operation, the lower left-hand portion of which shows the fabric after having been subjected to a napping operation and the center portion of which shows the unnapped fabric with the coarse strands cut away to clearly reveal the reticulate network of fine strands which forms an essential feature of the invention; and

Figure 3 is a sectional view substantially along lines 3—3 in Figure 2 showing in cross-section both the napped and unnapped portions of the fabric shown in Figure 2.

Turning now to the drawings for a detailed description of the invention, there is shown in Figure 1 a short length of the composite yarn 11 from which my improved fabric may be constructed. This composite yarn is formed by twisting together a fine yarn 12 and a coarse yarn 13 in a conventional plying step. It is desirable that the fine yarn be made from material having considerable tensile strength. The coarse yarn, on

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the other hand, may be made from any staple fiber material which is ordinarily used in the weaving of napped-type fabrics, it being essential, of course, that such material possess the necessary resilience, body, length of staple and other properties which make it suitable for napping.

In accordance with the preferred construction of the fabric of the present invention, the composite yarn of Figure 1 is woven as both warp and filling into a fabric which in the final analysis consists of interlaced reticulate systems or networks of coarse and fine yarns, as is clearly apparent from the main and center portions of Figure 2. The weave employed in the formation of the fabric may be any known or generally used in connection with production of napped-type fabrics, for example, linen cloth, and the like. Since the final result of the invention is a fabric having on at least one surface thereof a napped finish, it will be obvious that the coarse strands must be spaced sufficiently close together in the woven fabric to provide when napped a fluffy covering substantially co-extensive with the surface of the fabric.

As is inferred above, the fabric which is produced by weaving the composite yarns is thereafter subjected to a napping operation. This may be accomplished by means of any of the usual napping machines, for example, a double-action napper of the type disclosed in U. S. Patent No. 2,012,184 in which the fabric is passed under a series of pairs of oppositely rotating rolls provided with obliquely bent sharp-pointed teeth. By virtue of the action of the napping machine, certain of the fibers which make up the coarse thread are pulled or lifted away from the body of the thread and raised to form a fluffy covering or nap over the face of the fabric. Such a fluffy covering may be imparted to either or both of the fabric surfaces, as desired.

In the lower left portion of Figure 2 and the left portion of Figure 3 there is shown the finished fabric which has been subjected on both sides to a napping operation, the fluffy layers or nap masses being designated 14 and 14', respectively. From a consideration of the specified portions of these figures, it will be apparent that the fabric as finished comprises the upper and lower layers 14 and 14' and a much more compact layer intermediate these layers. This compact layer is made up of the reticulate system of fine yarns together with that part of the fibers constituting the coarse yarns which are unraised

by the napping operation either because of their being in a position inaccessible to the teeth of the napping machine or by being held down or restrained against being raised by the entwined relationship of the fine yarns with respect to the coarse yarn. The function of the intermediate layer is to act as a barrier against the loss of heat by conduction through the fabric, retarding the penetration of the fabric by currents of warm air.

Now, if it be supposed that the fabric as just described is assembled into coverings, garments or the like and arranged to enclose all or a portion of a heat-producing body, such as the human body, such body will be provided with three-fold protection against the loss of heat. The heat as it comes from the body will first find its way into the inner fluffy layer by which it will be retarded. After passage substantially entirely through the inner fluffy layer, the heat encounters the compact intermediate layer which tends to block or even more effectively retard the penetration of the fabric by the heat so that the heat tends to collect underneath and against the inner layer. As the heat finally makes its way through the intermediate layer, it is once more caught up in a fluffy mass, this time on the outer surface of the fabric and its course is again retarded. The aforegoing explanation is illustrated in a somewhat fanciful manner in Figure 3, the numeral 15 designating a thermal source (shown in dotted lines) and a heavy dot-dash line indicating a current of warm air issuing from the thermal source. As the current of warm air enters the lower nap layer or fluffy mass 14', its course through this portion of the fabric will be slowed down as indicated by the tortuous path it takes through the portion. When the compact inner layer is encountered by the air current, its movement is barred and it collects underneath this layer as indicated by the arrowhead. Upon eventual passage through the layer, it must once more take a tortuous path through the upper fluffy mass 14 before it can finally emerge free of the fabric and become lost in the surrounding atmosphere.

Where only one side of the fabric is napped, the function is essentially the same with the exception that the omitted fluffy mass does not contribute to the retarding action and the thermic effect of the fabric is two-fold rather than three-fold.

The precise reason why the fine yarn network and the portion of the coarse yarn system adjacent thereto contribute to the thermal efficiency of my improved fabric is not clearly understood since, as will be appreciated by those skilled in the art, it is virtually impossible to analyze the course of an invisible current of air through a complex fibrous mass such as that disclosed herein. It is known, however, that fabric formed in accordance with the present invention offers a much more effective barrier against the loss of heat than does a napped fabric formed in the conventional manner.

The essence of the invention apparently resides in the combination of a relatively fine mesh reticulate array or network of fine yarns with a system of nappable coarse yarns, the coarse yarn system being bound to the fine yarn network during weaving by means of yarns from such network, the disposition of the coarse yarns with respect to the network being such that after a napping operation the fabric will be provided on at least one of its two surfaces with a fluffy covering or nap extending substantially over the full area thereof.

I wish it understood that where the terms "nap," "napped," or "napping" are employed herein, they are used in their strict sense to mean a fluffy surface on a fabric formed by raising fibers from the yarns which make up the fabric or the method of producing such surface and they should not be construed as including the formation of pile-type fabrics which have no relation to the present invention.

Those skilled in the art will appreciate that certain modifications and variations can be made without departing from the spirit of the invention, for example, the composite yarn which includes the coarse strand from which the nap is formed may be employed only in the weft direction with fine yarns being used solely in the warp direction. For that reason, I do not choose to be limited to the specific embodiment of the invention illustrated and described but only by the scope and spirit of the claims hereunto appended.

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

1. A method of forming a fabric having high heat-retentive properties comprising plying together a strand of a relatively strong fine yarn and a strand of a coarse yarn of nappable staple fiber material, weaving said plied strands into fabric, said plied strands being employed in both warp and weft, subjecting said fabric to a napping operation to produce on at least one side thereof a covering of fibers raised from said coarse strand, a portion of the fibers of said coarse strand being unraised by said napping operation and constituting with the interwoven system of fine yarn a compact layer resistant to the loss of heat.

2. A fabric having high heat-retentive properties, said fabric being woven in both the warp and weft from a doubled strand of strong fine yarn and coarse yarn of nappable staple fiber material, said fabric having on at least one side thereof a nap formed of fibers raised from said coarse yarn, a portion of the fibers of said coarse yarn being unraised and constituting with said interwoven system of fine yarn a compact layer resistant to the loss of heat.

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