IMITATION SLIVER KNIT PILE FABRIC

Donald C. Spann, Greenville, S.C., assignor to
Phillips Petroleum Company

Filed Nov. 16, 1970, Ser. No. 89,898
Int. Cl. B32b 5/06, 7/08; D04b 11/00
U.S. Cl. 161—64

9 Claims

ABSTRACT OF THE DISCLOSURE

A layer of nonwoven staple fibers is needle punched into a thermoplastic film. The fibers on one side of the film are thermally bonded to the film. The fibers on the opposite side of the film are then subjected to napping and shearing operations. The film is preferably an oriented polypropylene film which fibrillates during the needling operation. The fabric is useful as a lining in coats.

This invention relates to a process for making an imitation sliver knit pile fabric, the resulting fabric, and the use thereof as a garment liner.

The characteristics of sliver knit pile fabrics have been found desirable in numerous applications; however, the cost thereof has been a significant drawback. Several imitation sliver knit pile fabrics have been proposed which are made by needling the staple fiber through a backing fabric and then napping and shearing the fibers on at least one side. However, the napping operation places significant stresses on the fibers, resulting in the pulling of the staple fibers from the backing fabric in the absence of a significant level of bonding of the fibers to the backing fabric. The addition of a coating of a rubber cement or resinsinous material to the back side of the fabric to anchor the fibers in place has been proposed. Such a coating is expensive from the standpoint of the material and of the coating equipment. Care must be taken to prevent the material from going through the backing fabric to the pile face. Moreover, such coatings significantly reduce the flexibility of the fabric while increasing the weight. Such coatings also reduce, if not eliminate, the breathability of the fabric. The rubber cement coatings are also subject to serious deterioration.

It is an object of the invention to provide an improved imitation sliver knit pile fabric while avoiding the disadvantages of the prior art. It is an object of the invention to provide a lighter pile fabric having a softer hand. Another object of the invention is to simplify the processing equipment and to reduce the cost of an imitation sliver knit pile fabric. Another object of the invention is to provide a garment having an improved liner fabric.

Other objects, aspects and advantages of the invention will be apparent from a study of the specification, the drawings and the appended claims to the invention.

In the drawings, FIG. 1 is a block diagram of a process in accordance with the present invention; FIG. 2 is an elevational view in cross section of an imitation sliver knit pile fabric in accordance with the invention; and FIG. 3 is an enlarged view of a portion of the back side of the fabric of FIG. 2.

Referring now to FIG. 1, a nonwoven layer or batting of staple fibers is brought into contact with one face of a flexible thermoplastic film and subjected to a needle punching operation. The needling in step 1 causes a portion of the fibers to project through said film and outwardly from the opposite face thereof. The needle punching operation will generally effect at least 100 punches per square inch of the film, and preferably at least about 300 punches per square inch of film. One side of the needle punched fabric is then heated in step 2 to thermally bond the portion of the fibers on that side to the film. It is presently preferred to conduct the needle punching operation so that between about 5 percent and 40 percent, more preferably between about 10 percent and 20 percent, of the weight of the fibers projects through the film and outwardly from the second face. The back side of the needle punched fabric, that is the portion projecting outwardly from the second face of the film, can then be the side which is thermally bonded to the film. The stated ranges provide for a sufficient portion of the fibers to be thermally bonded to the film to securely anchor the remaining portion of the fibers in the fabric, while minimizing the cost. The use of the lower percentages of the fiber weight on the back side of the fabric also maximizes the softness and flexibility of the bonded side of the fabric. The thermal bonding can be accomplished by a conventional technique, one example being passing the needle punched fabric between a pair of nip rolls with one roll being heated to a temperature sufficient to effect the thermal bonding of the back side portion of the fibers and the other roll being at ambient temperature or being cooled to prevent any fusing of the face portion of the fibers. The temperature for the heated roll will generally be in the range of about 280° F. to about 380° F. when polypropylene film is employed.

While the thermoplastic film can be formed of any suitable thermoplastic material, for example polyolefins, polymers, polystyres and the like, a polypropylene film having a very predominant direction of orientation and a thickness in the range of about 0.1 mm to about 2 mils has been found to be particularly suitable, with a thickness in the range of about 0.4 mil to about 1.4 mil being presently preferred. With polypropylene film having a very predominant direction of orientation, the needle punching operation can cause fibrillation of the film resulting in greater flexibility and a softer hand. The fibrillation also increases the breathability of the fabric. The fibers can be of any suitable material, but are preferably thermoplastic, synthetic organic fibers. The fibers can be of the same material as the film to provide a greater thermal bond. The thermoplastic fibers are preferably formed of a material different from the film with either a higher or a lower softening temperature than the film. The staple fibers will generally have a denier per filament in the range of about 1 to about 18, with the range of 3 to 6 being preferred. The length of the staple fibers will generally be in the range of about 2 inches, preferably in the range of about 2 to about 6 inches. The batting of staple fibers will generally have a weight of about 0 to about 9 ounces per square yard.

After the fiber ends on one side of the fabric have been thermally bonded to the film, the free fiber ends on the opposite, or face, side of the fabric are subjected to a nipping operation. This can be effected in accordance with conventional techniques, but is preferably accomplished by subjecting the free fiber ends to two tyinging steps in sequence. In one process the face side of the needle punched and thermally bonded fabric is contacted with a first tyinging surface having heavy gauge needles and then with a second tyinging surface having lighter gauge needles to thereby increase the nap density obtained.

After the napping operation, the raised free ends of the fibers are sheared in step 4 to a substantially uniform thread height above the film to produce a napped fabric having a substantially uniform nap height. If desired, the fabric can be polished in step 5 by conventional techniques to cause the free fiber ends to lie in a particular direction or pattern and to increase the sheen. In one embodiment of the present process, the electrostatic field is adjusted to a temperature in the range of about 150° to about 230° F., preferably around 200° F., and is rotated at a speed in the range of about 600 to about 1100 r.p.m., prefer-
ably about 900 r.p.m., and the fabric is fed to the polish-
er roll at a rate of about 4 to about 20, preferably about 8,
yards per minute.

Referring now to FIG. 2, which is a magnified illus-
tration of a very small portion of an imitation sliver knit
pile fabric in accordance with the invention, the free ends
11 of the staple fibers 10 project upwardly from the first,
or face, side of the film 12 to a substantially uniform
height. For sake of simplicity, only four bunches of fibers,
resulting from four needle punches, have been illustrated.
The other ends 13 of the staple fibers, which originally
extended downwardly from the second, or back, side of
film 12, have been compressed against the second side
of film 12 and thermally bonded thereto. FIG. 3 is a
simplified or idealized representation of the back side of
a portion of the napped fabric of FIG. 2 showing the
bonded fiber ends 13 and splits 14 in the film 12 result-
ing from fibrillation of the film 12 effected in the needle
punching operation. If desired, the film can be subjected
to other fibrillation techniques prior to or subsequent to
the needling operation.

Thus, I have developed an imitation sliver knit pile
fabric which is inexpensive to manufacture and which is
lighter, more flexible and softer than prior imitations.
This fabric is particularly suited for utilization as the lin-
ing for garments, for example, women's coats.

Reasonable variations and modifications are possible
within the scope of the foregoing disclosure, the drawing
and the appended claims to the invention.

I claim:

1. A process for forming an imitation sliver knit pile
fabric which comprises

contacting the first face of a thermoplastic film with a
nonwoven layer of staple fibers,

needle punching said layer of staple fibers into said
thermoplastic film to cause a portion of said staple
fibers to project outwardly from the second face of
said thermoplastic film,

heating one side of the resulting needle punched fabric
to thermally bond the portion of said staple fibers on
that side of said thermoplastic film to said thermo-
plastic film, then subjecting the portion of said staple
fibers on the opposite side of said needle punched
fabric to a napping operation to raise the free ends of
said staple fibers, and

shearing the raised free ends of said staple fibers to a
substantially uniform height above said thermoplas-
tic film to produce a napped fabric having a sub-
stantially uniform nap height.

2. A process in accordance with claim 1 wherein said
thermoplastic film is a flexible film of a polymer of at
least one 1-olefin having 2-6 carbon atoms per molecule,
and said fibers are formed of the same polymer as said
film.

3. A process in accordance with claim 1 wherein said
thermoplastic film is a flexible polypropylene film which
has been oriented in one direction.

4. A process in accordance with claim 3 wherein said
needle punching operation is conducted under conditions
which cause a significant degree of fibrillation of the poly-
propylene film, thereby increasing the breathability and
the flexibility of the resulting fabric and providing a softer
hand.

5. A process in accordance with claim 4 wherein the
napping operation is effected by subjecting the portion of
said staple fibers on the opposite side of said needle
punched fabric to at least two tigering steps in sequence
to increase the density of the nap.

6. A process in accordance with claim 5 further com-
prying polishing the sheared nap by passing the sheared
nap side of the fabric into contact with a heated serrated
surface.

7. A process in accordance with claim 6 wherein said
one side of the resulting needle punched fabric is the
portion which projects outwardly from said second face
of said thermoplastic film.

8. An imitation sliver knit pile fabric produced in ac-
cordance with the method of claim 1.

9. A garment having a lining of an imitation sliver
knit pile fabric produced in accordance with the method
of claim 1.

References Cited

UNITED STATES PATENTS

3,205,342 9/1965 Smith et al. .......... 156—148
3,366,529 1/1968 Olson ................. 156—148
3,205,342 9/1965 Smith et al. .......... 156—148

WILLIAM J. VAN BALEN, Primary Examiner

U.S. Cl. X.R.

161—67; 156—72, 148