United States Patent Office 2,698,816 Patented Jan. 4, 1955

2,698,816

COATED FABRIC AND METHOD OF MAKING SAME

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No Drawing. Application March 14, 1952, Serial No. 276,692

4 Claims. (Cl. 117—103)

This invention relates to the production of a breathable and water vapor-permeable but waterproof coated fabric which is particularly adapted to be fabricated into rainwear.

The principal object of the present invention is to provide an improved breathable, water vapor-permeable and waterproof coated fabric particularly adapted to be manufactured into raincoats and the like, and a method of making the same. It is an object of our invention to provide such a coated fabric which exhibits a better combination of the required properties of breathability, water vapor-permeability and waterproofness than previous fabrics of this general type. Another object is to provide such a coated fabric which is more attractive and which is more suitable for the manufacture of rainwear than previously available fabrics of this general type. Another object is to provide a coated fabric exhibiting good breathability, good water vapor-permeability and good waterproofness coupled with good flexibility. Another object is to provide a method of plasticizing or softening the rubber used in the coating without adversely affecting the characteristics of breathability, water vapor-permeability and waterproofness. Another object is to provide a method of making coated fabrics of the foregoing type which is sufficiently simple and economical to be used commercially and which is capable of giving reproducible results. Numerous other objects of the invention will more fully hereinafter appear.

We have found that the foregoing objects can be accomplished in a commercially feasible manner by calendering upon one side of a textile fabric a coating of a putty-like mixture of rubber, multifilamentary cellulose flock, a water-repellent material for the flock, and a volatile organic solvent for the rubber and for the water-repellent material, drying the calendered coating by evaporating the solvent therefrom, and curing the resulting coating.

In practicing our invention, it is of the essence that the mixture of rubber, flock and water-repellent material which is calendered upon the surface of the textile fabric be of a consistency resembling window putty or modelling clay. The formation and application of such a putty-like mixture is responsible for the new results achieved by the invention. The putty-like mixture is easily obtained by limiting the amount of solvent employed to from 10 to 20% by weight of the mixture.

Another essential feature of our invention is the use of multifilamentary cellulose flock. Monofilamentary flock, e. g., monofilamentary nylon or rayon flock, will not give satisfactory results, causing the coating obtained to be deficient in one or more of the essential characteristics required of the coated fabric. It is thought that the interstices within the particles of the multifilamentary cellulose flock form minute canals for the transmission of air and water vapor through the fabric of our invention and that these intra-particle canals are essential to the attainment of our new results.

The preferred cellulosic flock for use in our invention is the finely divided, purified wood cellulose which is commonly referred to as "alpha flock," being described in an article entitled "Wood Cellulose in Rubber Compounding" by Goodloe et al. which appeared in the September 1947 issue of The Rubber Age, N. Y. This material is known commercially as "Solka-Floc." Alternatively we can use cotton flock.

In a typical method of making a breathable, water vapor-permeable and waterproof coated fabric in accordance with our invention, we proceed as follows: We take neoprene synthetic rubber of a type which can be readily broken down upon mastication and which when thus broken down to a Mooney viscosity of 15 and dissolved in toluene to 20% solids forms a solution having a viscosity less than 650 centipoises. Such neoprene gives better breathability than the others which are commercially available. Examples of suitable neoprenes are those known commercially as neoprene GN, GNA, W and KNR. We break this selected neoprene down on a rubber mill or in a Banbury mixer to a Mooney viscosity of 30 or lower. Milling for 20 minutes on a tight cold mill is adequate to give this degree of breakdown. It is very important that the particular type of neoprene be broken down to the extent indicated since our invention depends upon our discovery that our new results are achieved in part by breaking down the neoprene to a low viscosity rather than relying upon a large amount of solvent to make the mixture sufficiently mobile to permit coating on the fabric by conventional coating methods such as spread-coating. The preliminary mastication of the neoprene breaks its nerve so that when the putty-like mixture containing it is calendered onto the fabric it is not nervy and does not compress; such compression would reduce the breathability and water vapor-permeability of the fabric. By breaking down the neoprene in the manner indicated we obtained a putty-like mixture which is very "dead" and which does not return after deformation.

We next compound this broken down neoprene with multifilamentary cellulose flock in an amount ranging from 1.0 to 2.0 times the weight of the neoprene, wax or silicone oil or both as a water-repellent material for the flock, and a limited amount of a volatile organic solvent for the neoprene and for the water-repellent material for the flock, to form the dead putty-like mixture which is to be calendered on to the fabric. In preparing this mixture, we typically incorporate conventional curing and compounding ingredients for the neoprene such as zinc oxide, curing accelerators, anti-oxidants and pigments as desired. We prefer to incorporate at this point in the process a substantial amount of a softener for the neoprene so that the resulting coated fabric will not be unduly stiff but on the contrary will display good "drape" and flexibility. Conventional plasticizers or softeners for neoprene can be used in the customary amounts for this purpose. Typically we use a liquid softener such as the substantially non-volatile oils which are well-known rubber softeners. Instead of a liquid softener we can use Butyl rubber in conjunction with the neoprene. We typically employ an amount of softener (either liquid or Butyl) ranging from 15 to 40 parts per 100 parts of neoprene.

The amount of wax used typically ranges from 2 to 5% by weight of the flock. Although any suitable type of wax can be used, we prefer to employ wax comprising a major proportion of paraffin wax because of the cheapness, effectiveness and availability of paraffin wax. The paraffin wax may embody so called "micro-crystalline wax." Instead of paraffin wax, we can use other waxes such as carnauba wax, beeswax, ozocerite, mineral wax such as that known as Casper wax, montan wax, japan wax, etc. Mixtures of the named waxes may be used. We particularly prefer to employ a blend of paraffin wax and Casper wax in proportions ranging from 25 to 75 per cent of each component, an example being "sunproof" wax which is a common rubber compounding material. Instead of true waxes we can also use those higher fatty acids which have the physical properties of waxes, such as stearic acid. We prefer that the wax used have a melting point of 60° C.

The use of wax as a water-repellent material for the flock is highly desirable because the wax blooms to the surface of the coating giving a coating which is more water-resisting because the wax film prevents liquid water from wetting the surface of the coating.

In adidtion to the wax, we much prefer to employ a silicone fluid in amount ranging from 1 to 3% by weight of the flock.

Silicone fluids are known liquid to grease-like mixtures of low molecular weight linear polymeric organo siloxanes. The preferred silicone fluids are the com-

mercial polymeric dimethyl siloxanes or liquid to grease-like polymeric dimethyl silicones which have the formula

$$CH_3[(CH_3)_3SiO]_xSi(CH_3)_2$$

where x is 2 to 11. These silicone fluids or fluid polymeric dimethyl silicones are generally mixtures of a predominating amount of one polymer of dimethyl siloxane with minor amounts of other polymers of dimethyl siloxanes within the range of the above formula. The viscosities of the methyl silicone oils range between 0.5 and 1000 centistokes at 25° C., and the specific gravities range between .760 and .975 at 25° C. Other liquid polymeric silicones or silicone oils than the methyl silicone oils which can be used are the ethyl silicone oils or the other lower alkyl silicone oils as well as the alkyl-aryl silicone oils, e. g. polymeric methyl-phenyl siloxanes and polymeric ethyl-phenyl siloxanes. For a further description of the silicone oils, reference is made to "Chemistry of the Silicones" by E. G. Rochow, 2nd edition, 1951, John Wiley & Sons, Inc., New York, particularly chapter 6 thereof entitled "Properties of the Specific Silicone Polymers."

The polymeric dimethyl silicones can be prepared by the methods shown in Rochow U. S. Patents 2,258,218 and 2,286,763 and by the process of McGregor et al. U. S. Patent 2,384,384. The liquid polymeric dimethyl siloxanes used are generaly obtained by hydrolyzing a substantially pure dimethyl silicon compound contain-ing two hydrolyzable groups such as dimethyl silicon dihalide. Other relevant patents are Hyde 2,377,689, Wilcock 2,491,843 and Patnode 2,469,888.

Silicone fluid must be used judiciously because if an excess amount is incorporated it will undesirably reduce the rate of moisture vapor transmission. We prefer to add the silicone fluid and thoroughly incorporate it with the rubber before incorporating the flock to avoid a local high concentration of silicone in the flock. If an excess of silicone is deposited on a portion of the flock due to poor distribution, the moisture vapor transfer in that area of the fabric coated therewith will be poor.

The foregoing ingredients are incorporated with a suitable volatile organic solvent for the neoprene and for the water-repellent material (wax and silicone fluid) for the flock. For this purpose we prefer to employ chlorobenzene, toluene or xylene, but we can use other solvents, e. g. benzene, carbon tetrachloride, etc. The amount of the solvent is carefully controlled, generally ranging from 10 to 20% by weight of the final mixture, so as to give a mixture of putty-like consistency which can be calendered at room temperature. If the amount of solvent exceeds 20% the final mixture does not have the desired putty-like consistency required for good results. On the other hand, if the amount of solvent is less than 10% the coating obtained is not sufficiently breathable or water vapor-permeable.

Typically, the broken down neoprene, softener, wax, and the curatives and compounding ingredients for the neoprene are commingled with the solvent in any suitable manner to give a lump-free "cement." The silicone fluid, if used, is then uniformly incorporated with this "cement" after which the flock is incorporated to form the putty-like mixture. Care should be taken in the mixing to avoid the application of excessive pressure which might drive the neoprene solution into the flock to a substantial extent resulting in unduly low breathability and water vapor-permeability.

We prefer that the flock have a rather wide particle size distribution, say from 25 to 100 microns. For example, we often use approximately 40% of flock having average particle size of about 35 microns, 97% passing a 100 mesh screen and 78% passing a 200 mesh screen and about 60% of flock having an average particle size of about 90 microns, 65% passing the 100 mesh screen and 40% passing the 200 mesh screen.

The resulting putty-like mixture is now calendered onto any suitable textile fabric backing using care to avoid any substantial compression of the mixture which would excessively drive the mixture into the interstices of the fabric and which would drive the neoprene into the interstices of the flock thereby destroying breathability. Typically we employ a three-roll calender, forming a layer of the putty-like mixture around the second roll by the action of the top roll in the conventional manner and applying this layer to the fabric which is passed between the middle and bottom rolls. An even-speed

calendering operation is used. The resulting coated fabric preferably is withdrawn downwardly to prevent any tendency for the coating to stick to the middle roll. The calender rolls are unheated, i. e., they are at room temperature (75–90° F.). The putty-like mixture is so plastic that little work is required to be exerted upon it in order to film it and calender the film onto the fabric so that there is no need for extraneous cooling of the rolls. Those skilled in the art will know that the stock temperature should be reduced, or other precautions taken, if there is any tendency to stick to the calender rolls.

The temperature of the stock, i. e. the coating mixture, does not rise above 100° F. during the calendering. This is advantageous because it prevents substantial volatilization of the solvent and because it prevents excessive penetration of the coating mixture into the interstices of the flock. Such penetration would reduce breathability unduly. The new results of our invention are attributed to the fact that for some reason the rubber of the putty-like mixture does not penetrate materially into these interstices while the water-repellent material is selectively carried into such interstices and effectively renders the flock particles highly water-repellent without closing the interstices whereby the breathability and water vapor-permeability of the coated fabric would be impaired.

The coated fabric should not be rolled up prior to the drying step because the coating is soft and easily compressible. Any undue pressure, such as that imparted during rolling up, will compress the coating and obliterate the voids to an undesirable extent.

The coated fabric is next passed through a drying zone where it is heated to a moderately elevated temperature for a time sufficient to substantially completely drive off the solvent. The drying is typically carried out at temperatures ranging from 150 to 190° F.

The dried but uncured coated fabric is now cured at an elevated temperature. It is preferred to drape the coated fabric in the curing zone. It is also preferred to carry out the curing at as low a temperature as possible because it has been found that higher temperatures seriously impair the desired physical properties of the cured product, particularly reducing the breathability and moisture vapor transmission. We prefer to cure the coated fabric at a temperature ranging from 200 to 250° F.

We have described an operation in which drying and curing are performed separately. Such an operation is particularly useful where the final article, i. e., a raincoat, is fabricated from the dried but uncured fabric and is thereafter cured.

If desired, the coating may be dried and vulcanized substantially simultaneously, typically by heating it in an oven at 230–250° F. for 2 hours.

Instead of neoprene, we can use other rubbery materials, such as natural rubber, rubbery copolymers of butadiene and styrene (known as GR–S) and Butyl rubber. Such other rubbers do not have to be broken down in advance as described above for neoprene. We can also use mixtures of rubbery materials for example a blend of neoprene and Butyl or a blend of natural rubber and GR–S. The solvent used must of course be chosen with reference to the particular rubbery material used. Thus, with natural rubber, GR–S or Butyl, we prefer to use gasoline as the solvent. The use of Butyl in combination with neoprene is particularly satisfactory because the Butyl plasticizes the neoprene and makes unnecessary the use of oily softeners. The Butyl seems to accept loading readily and gives a very flexible coating.

The above-described procedure results in impregnation of the flock with the wax and silicone fluid so that the flock is water-repellent in the final coating yet the flock particles are not impregnated to any substantial extent with the rubber which would destroy the breathability and water vapor-permeability of the coating. Although we usually render the flock water-repellent during the course of the processing, we can pre-treat the flock with the wax or the silicone fluid or preferably with both by impregnating the flock with a solution of the water-repellent material in a volatile organic solvent and evaporating the solvent to give water-repellent flock which can then be incorporated with the "cement" containing the rubber and other compounding ingredients to give the putty-like dough which is calendered on the fabric.

We can use wax alone or silicone fluid alone as the water-repellent material for the flock but we prefer to use

both wax and silicone oil. If either is to be omitted, we prefer that it be the silicone oil since we get better results using the wax and omitting the silicone oil than by using the silicone oil and omitting the wax.

In practicing our invention, any of the fabrics commonly used as backing for coated waterproof fabrics can be employed. The preferred base fabric is open weave sheeting ranging from 4 to 6 ounces per square yard in weight. So long as the fabric is quite loosely woven it will not have any effect on the breathability or moisture vapor transmission of the coated product.

As the softener for the rubber component, we obtain best results using a mixture of a rubber softener known as "Kenflex L" which is an oily hydrocarbon product of a condensation reaction between formaldehyde and an aromatic petroleum fraction, of the type defined in U. S. Patent 2,464,455, having a specific gravity of 1.01, a drop melting point of 30° F., a flash point of 360° F. and an initial boiling point at 2 mm. of 330° F., and a light-colored naphthenic hydrocarbon oil such as the rubber softening oil known in the trade as "G. B. Process Oil." We often prefer to use 8 parts of the former and 10 parts of the latter per 100 parts of rubber.

The use of a softener is most desirable when the rubbery component is neoprene because neoprene is the stiffest of the rubbers operable in this invention. The softener can be dispensed with in the case of rubbers other than neoprene.

The thickness of the applied coating can vary widely but typically will range from 0.005 to 0.025 inch. The thickness of the coating has very little effect on the breathability although in general the Suter water-resistance value increases and the moisture vapor transmission decreases as the thickness of the coating increases. Many factors other than coating thickness are much more important insofar as breathability is concerned.

The coated fabric of our invention has the necessary combination of breathability, water vapor-permeability and waterproofness together with other properties of flexibility, drape, appearance, etc., required of rain wear fabrics. The most important properties are those of breathability, water vapor-permeability and waterproofness, it being essential that each of these be present to the desired extent simultaneously.

Breathability, which is a measure of the air-permeability of the coated fabric, is conveniently expressed as the time required to draw 450 cc. of air at atmospheric temperature and pressure through a sample of the coated fabric 1½ inches in diameter. This test can conveniently be carried out by clamping the sample of the fabric above a suitable chamber connected to a vertical 30 mm. glass tube containing water and noting the time required for the level of water in the tube to drop, under the action of gravity, to an extent corresponding to withdrawal of 450 cc. of water, the water being withdrawn through a suitable opening at the bottom of the tube. For adequate breathability, a time of less than 100 seconds is required. A time of less than 60 seconds is even more satisfactory. At values below 60 seconds it is readily possible to blow tobacco smoke with the mouth through the coated fabric. The fabric of our invention can easily be made to have a value less than 60 seconds.

Water vapor-permeability, which is a very different property from and is not directly inter-related with air-permeability or breathability, is determined by the conventional method well known in the art and is expressed as the grams of water vapor transmitted per hour per square meter of coated fabric. Values of at least 15 grams per hour per square meter are required. Values of at least 20 grams per hour per square meter are even more suitable. It is sometimes convenient to determine the water vapor-permeability of the uncoated fabric and to express the water vapor-permeability of the coated fabric as a percentage of that of the uncoated fabric. When using a conventional raincoat fabric, moisture vapor transmission equal to at least 50% of that transmitted by the fabric alone is required and values of at least 65% are even more suitable. Our invention makes it readily possible to produce coated fabrics exhibiting a water vapor-permeability of at least 20 grams per hour per square meter and at least 65% of the value exhibited by the uncoated fabric. Values approaching that of the uncoated fabric can be attained in the case of loosely woven fabrics.

Waterproofness is preferably measured by the standard Suter test which is described in detail in the 1941 Yearbook of the American Association of Textile Chemists and Colorists, volume 18, pages 239–241, published 1941 by Howe's Publishing Company. At the present time, Suter values of at least 70 centimeters of hydrostatic head of water are considered necessary for adequate water resistance. Our invention makes it easily possible to attain such values.

With our invention, it is easily possible to prepare a coated fabric having a breathability value of less than 60 seconds by the above test (it should be pointed out that the smaller the number of seconds the higher the breathability of the fabric), a moisture vapor-permeability of at least 15 grams per hour per square meter and equal to at least 65% of the moisture vapor permeability of an ordinary uncoated raincoat fabric, and a Suter value for water resistance of at least 75 centimeters of water.

From the foregoing description, many advantages of our invention will be apparent. It will be seen that the objects set forth above are readily accomplished in a simple and economical manner by the present invention. Another advantage of our invention is that only a single coat of the putty-like mixture is required in contrast to the multiple coating operations required when the prior art mixtures were employed. Another advantage is that the invention enables the use of a softener or plasticizer for the rubber in such amounts as to give a coated fabric which is pliable and flexible, without lowering the breathability and water vapor-permeability below the permissible limits. Another advantage is that no sanding or abrading of the surface is necessary to give breathability and moisture vapor-permeability. Numerous other advantages of the invention will be obvious to those skilled in the art.

The following examples illustrate the invention more fully. All parts are by weight. The silicone oil used in certain of the examples was "Dow-Corning 104," a 65% of oily solution polymeric dimethyl siloxane in perchloroethylene as furnished by the manufacturer, and the designated parts thereof refer to the solution, rather than the actual silicone content thereof.

Example 1

The following materials were mixed together in a Banbury mixer:

	Parts
Neoprene type GN (ground on cold mill to Mooney viscosity of 15)	100
"Kenflex L" (softener for neoprene sold by Kenflex Corp.)	8
"G. B. Process Oil" (light-colored naphthenic hydrocarbon oil, softener for neoprene)	10
"Neozone D" (phenyl-beta-naphthylamine)	2
"Micronex Black" (carbon black)	1
2-mercaptoimidazoline (accelerator)	0.5
"Sunproof" wax (mixture of paraffin wax and Casper wax)	5
Zinc oxide	12

After an intimate homogeneous mixture had been obtained in the Banbury mixer, this mixture was commingled with 48 parts of toluene to make a lump-free "cement." There were then intimately incorporated 3 parts of silicone oil followed by incorporation of 60 parts of the fine purified wood cellulose flock known as "Solka-Floc BW 200" having an average particle size of 35 microns (97% passing a 100 mesh screen and 78% passing a 200 mesh screen) and 90 parts of a coarser flock known as "Solka-Floc BW 40" having an average particle size of 90 microns (65% passing a 100 mesh screen and 40% passing a 200 mesh screen). The ingredients were commingled in a churn-like mixer using care not to continue mixing beyond the point of uniform mixture and not to compress the mixture unduly which would result in driving the rubber cement into the flock to an excessive extent. The mixture was thus converted to a very thick dough having a consistency of window putty or modelling clay. A single coat of the putty-like mixture was applied by an even-speed calendering operation as described above to open weave sheeting (4–6 ounces/sq. yd.). The coating was approximately 0.007" thick before drying. The coated fabric was then dried at 180° F. and the dried fabric was then drape-cured by heating for two hours at 235° F. The resulting coated fabric (which had an

over-all thickness of 0.017") was ideally adapted to the manufacture of raincoats. It had good drape, good flexibility and good appearance. The coated fabric had a breathability of 15 seconds, a moisture vapor permeability of 34.255 grams per hour per square meter and a Suter value of 86 centimeters. The coated fabric transmitted water vapor to the extent of about 68% of that passed by the fabric alone.

Example 2

Example 1 was duplicated except that the formulation employed was as follows:

	Parts
Pale crepe natural rubber	100
"Sunproof" wax	5
"Micronex Black"	1
"Kenflex L"	8
"G. B. Process Oil"	10
Zinc oxide	5
Sulfur	0.75
Tetramethylthiuram monosulfide (accelerator)	2
Gasoline	68
"Solka-Floc BW–200"	60
"Solka-Floc BW–40"	90

These ingredients were compounded to a putty-like mixture in the same way as in Example 1 and the mixture was calendered onto fabric as in that example. The over-all thickness of the coated product was 0.017". The product had a breathability of 23 seconds and a Suter value of 73.6 centimeters. The moisture vapor transmission of the product was 29 grams/hour/sq. meter.

It will be noted that this example utilized natural rubber and omitted the silicone fluid. The softeners ("Kenflex L" and "G. B. Process Oil") used in this example can be omitted because natural rubber does not give the undesirable stiffness inherent in neoprene alone.

Example 3

Example 1 was duplicated except that the following formulation was used:

	Parts
Butadiene-styrene rubbery copolymer (GR–S 50)	100
"Sunproof" wax	5
Titanium dioxide	20
Other pigments	3.2
Zinc oxide	5
Sulfur	1.5
Tetramethylthiuram disulfide	2
Gasoline	77
"Solka-Floc BW–200"	60
"Solka-Floc BW–40"	90
Silicone oil	3

These ingredients were compounded to a putty-like mixture and applied to fabric and cured in the same manner as in Example 1. The thickness of the coated fabric was 0.016". The final coated product had a breathability of 64 seconds, a water vapor transmission value of 21 grams per hour per square meter and a Suter value of 84 centimeters.

Example 4

	Parts
Butyl (GR–I 25)	100
"Micronex Black"	1
Sulfur	2.5
Selenium diethyl dithiocarbamate	2.0
Tetramethyl thiuram disulfide	2.0
Zinc oxide	5.0
"Sunproof" wax	5.0
"Solka-Floc BW–200"	60
"Solka-Floc BW–40"	90
Gasoline, sufficient to yield a putty.	

These ingredients were commingled in the same way as in Example 1 and the resulting putty was applied to fabric and cured in the same way as in that example. The over-all thickness of the final product was 0.017". The product had a breathability of 32 seconds, a moisture vapor permeability of 31 grams/hour/square meter and a Suter value of 104 centimeters. It will be noted that the silicone fluid was omitted from the formulation of this example.

Example 5

Example 4 was duplicated exactly except that the 100 parts of Butyl was replaced with a mixture of 75 parts of neoprene type GN (which had been broken down in advance to a Mooney of 15) and 25 parts of Butyl (GR–I 25) and the solvent used was an aliphatic hydrocarbon solvent known in the trade as "Cupersol Solvent" instead of gasoline. The coated fabric was 0.017" thick, had a breathability of 45 seconds, a moisture vapor permeability of 21 grams/hour/square meter and a Suter value of 71 centimeters.

The term "Butyl rubber" is used herein in its ordinary sense to denote a sulfur-vulcanizable copolymer of a major proportion (typically 90 to 99.5%) of isobutylene and a minor proportion (typically 10 to 0.5%) of an aliphatic conjugated diolefin hydrocarbon, typically butadiene or isoprene, the copolymer typically having a Staudinger molecular weight of from 30,000 to 80,000.

Having thus described our invention, what we claim and desire to protect by Letters Patent is:

1. The method of making a breathable and water vapor-permeable but waterproof coated fabric which consists essentially of taking neoprene which when broken down to a Mooney viscosity of 15 and dissolved in toluene to 20% solids forms a solution having a viscosity less than 650 centipoises, breaking down this neoprene by mastication to a Mooney viscosity of not over 30, commingling the broken down neoprene with a volatile organic solvent therefor, curing ingredients for the neoprene, a substantially non-volatile oil which is a softener for the neoprene, the amount of said oil being equal to from 15 to 40 parts per 100 parts of said neoprene, and water-repellent material for the hereinafter-described flock composed of wax and silicone fluid, commingling the resulting mixture with purified wood cellulose flock 40% of which has an average particle size of about 35 microns, 97% of this portion passing a 100 mesh screen and 78% passing a 200 mesh screen, and 60% of which has an average particle size of about 90 microns, 65% of this portion passing a 100 mesh screen and 40% passing a 200 mesh screen, to form a putty-like mixture, the amount of said flock being equal to from 1.0 to 2.0 times the weight of said neoprene, effecting incorporation of said flock in such a way that substantial penetration of neoprene into the flock is prevented, the amount of said solvent being equal to from 10 to 20% by weight of said putty-like mixture, the amount of said wax being equal to from 2 to 5% by weight of said flock, the amount of said silicone fluid being equal to from 1 to 3% of said flock, applying a single coating of said putty-like mixture to a fabric by even-speed calendering while avoiding substantial compression of the mixture and keeping the temperature of the mixture from rising above 100° F., the thickness of said coating ranging from 0.005 to 0.025 inch, drying the thus-coated fabric, and curing the resulting coating.

2. The method of claim 1 wherein said softener is a mixture of an oily hydrocarbon product of a condensation reaction between formaldehyde and an aromatic petroleum fraction and a light-colored naphthenic hydrocarbon rubber softening oil in a ratio of 8 to 10.

3. The method of claim 1 wherein said curing step is carried out at from 200 to 250° F.

4. Coated fabric which is breathable and water vapor-permeable but waterproof and which is made by the method of claim 1.

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