Nov. 6, 1962 J. D. McCLUER 3,062,678

FLAME RETARDANT VAPOR BARRIER FABRIC AND METHOD FOR PRODUCING THE SAME

Filed June 26, 1959

Fig. 1.

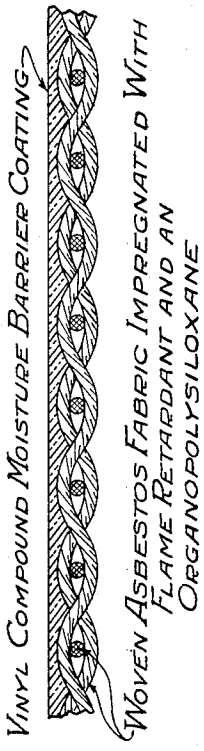
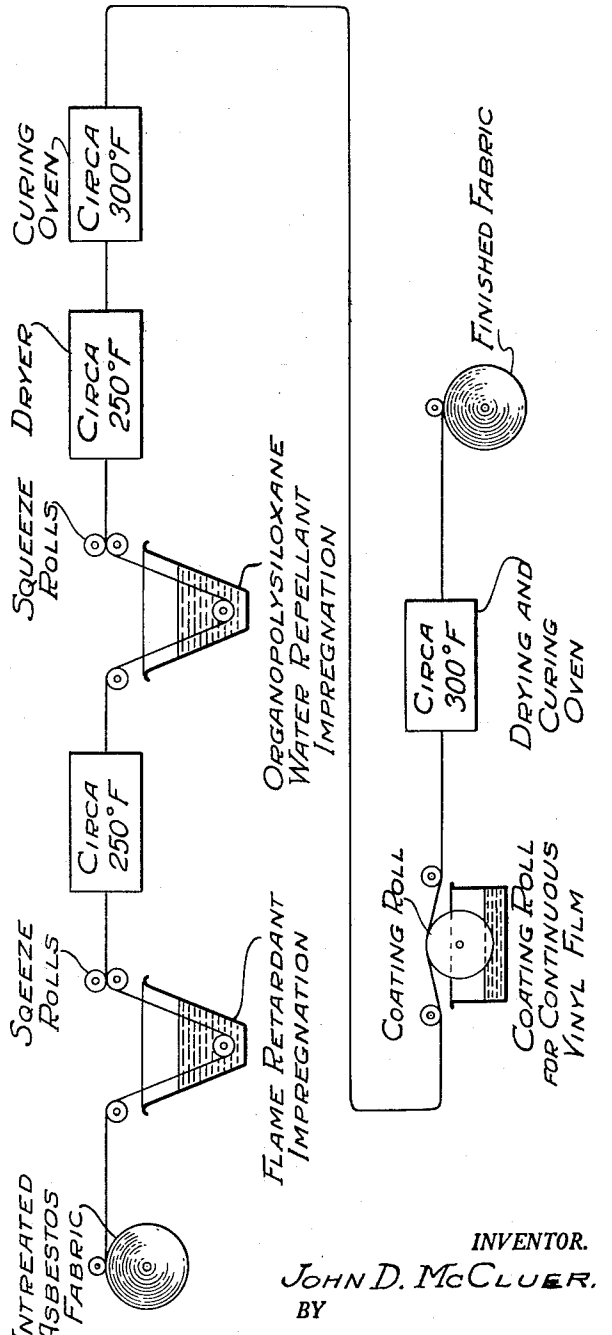


Fig. 2.



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FLAME RETARDANT VAPOR BARRIER FABRIC AND METHOD FOR PRODUCING THE SAME

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13 Claims. (Cl. 117—76)

This invention relates to a flame retardant fabric which is highly impervious to the passage of water vapor, as well as to such a fabric which is also flexible, resilient and water repellent. It also relates to a method for producing such flame retardant, vapor barrier fabrics.

This application is a continuation-in-part of my copending application Serial No. 673,162, filed July 22, 1957, now U.S. Patent No. 2,948,641, entitled "Flame Retarding Composition and Fabric Treated Therewith," which in turn is a continuation-in-part of my application Serial No. 449,521, filed August 12, 1954, entitled "Flame Resistant Fabrics," now U.S. Patent No. 2,884,343, dated April 28, 1959.

Existing vapor barrier materials while generally sufficient for the purpose intended, do have many limitations. For example, the product is often rigid or stiff and does not readily yield to being wrapped around odd-shaped objects which are to be protected from water vapor. Often these rigid or stiff products are also brittle and will deteriorate as by chipping or cracking when subjected to vibration or mechanical shock. Furthermore, such rigid materials are often bulky which is a serious drawback to their use wherever space is an important factor. As a further consideration it should be mentioned that most of the water vapor barrier materials currently available whether rigid or flexible are not flame-proof, and their vapor barrier properties are often seriously degraded when they are periodically submersed or brought into intermittent contact with materials such as hot water, oil, hydraulic fluids, sea water or bilge water. Still further, these materials often have poor abrasion resistance. Finally, most of the currently available barrier materials must be applied to the object to be protected on the job and cannot be saisfactorily prefabricated.

In the accompanying drawings:

FIG. 1 is a representation of an enlarged cross-section of a flame retardant, water repellent, moisture barrier woven asbestos-base fabric product in accordance with the present invention, and

FIG. 2 is a self-explanatory flow diagram of the process of the present invention.

The product of the present invention overcomes all of the above objections to presently available vapor barrier materials. It is water repellent, flame-proof, a superior water vapor barrier and may be flexible, resilient and also highly resistant to abrasion. Furthermore, the vapor barrier properties of the product are not substantially reduced even when the material is submerged for periods of several days in the aforementioned liquids. Furthermore, the product may be prefabricated and very simply applied at any time or place to the object sought to be moisture-proofed.

The product of the present invention comprises a fabric base having deposited thereon and intermediate the fibers thereof a flame retardant material and an organopolysiloxane. At least one surface of the fabric is coated with a vinyl polymer. The flame retardant, organopolysiloxane and vinyl polymer are essential materials which, respectively render the fabric flame-proof, water repellent and substantially impervious to water vapor, and these materials are always present in the product of the present invention. Preferably, however, the vinyl polymer surface is over-coated with a thin layer of an organopolysiloxane. In one embodiment of this invention a very finely divided, for example through 200 to 400 mesh screen, inorganic abrasion resistant material is dispersed throughout the vinyl polymer coating, and the coated surface of the product is thus made resistant to abrasion.

The fabric of the product of the present invention is preferably an "asbestos-base" fabric, which term as employed herein is intended to mean a fabric containing at least 50% by weight of asbestos fiber. For example, a preferred fabric base for the product of the present invention is one containing about 83% asbestos and the balance other fibers, for example, cotton.

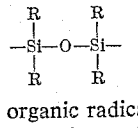
The flame retardant may be any of the well-known flame-proofing agents, typical examples of which are borax, ammonium borate, or one of the other borates, for example, fluoborate salt, zinc borate, boric acid, ammonium chloride, ammonium acetate, antimony oxide, monoammonium phosphate, diammonium phosphate, monosodium phosphate, ammonium sulfamate, urea phosphate, aluminum sulfate, chlorinated paraffin, Vinylite, etc., or various combinations of one or more of the above retardants, as for example, borax and boric acid or borax and ammonium chloride. However, the flame retardant is preferably a fluoborate salt, that is a compound containing the BF_4^- radical.

The fluoborate salts are preferred, as pointed out in my earlier copending application S.N. 673,162, because they are much more effective than borates or fluorides alone or in chemical combination, for example, and also more effective than any of the other flame retardants mentioned above. That is to say, substantially less fluoborate salt is required to obtain a given degree of flame retardancy.

The water soluble salts, for example, ammonium and the alkali metal fluoborates, are preferred. However, it is not necessary that the salt be completely or even partially water soluble, and the alkaline earth metal fluoborates or organic fluoborate salts, whether partly soluble or insoluble in water, may be employed. It is apparently the boron-fluoride radical which is the effective flame retardant, and organic compounds containing the boron-fluoride are satisfactory if they can be dissolved or dispersed in a treating liquid. Examples of suitable organic compounds are boron phenoldifluoride and boron p-tolyldifluoride.

In the preferred embodiment of the present invention, the fabric in addition to the flame retardant, also contains a plasticizer designed to retain in the fabric the softness and resiliency which ordinarily would in part be destroyed by introduction of the flame retardant, and a texture-imparting agent, preferably finely divided mica, which acts partly in the nature of a dry lubricant and serves to retain in the fabric the ability to slide over itself during folding and turning operations which would normally be inhibited by the presence of the flame retardant in the fabric. The preferred plasticizer is tricresyl phosphate, but other compounds, for example, propylene glycol or triphenyl phosphate may be substituted therefor.

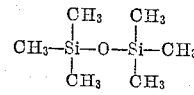
The product of the present invention also contains an organopolysiloxane dispersed in the fabric base to impart water repellency to the treated fabric. This material is introduced to the fabric following deposition of the flame retardant as an unpolymerized or only partly polymerized siloxane having the following linkage:



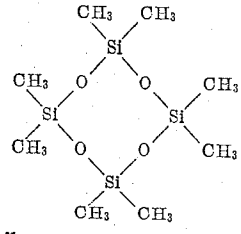
where R represents an organic radical, for example, either an aliphatic radical such as the methyl or ethyl group or

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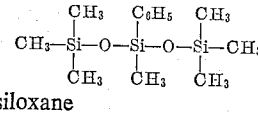
an aromatic radical such as the phenyl group. In addition, the organic radical may be from a series containing the epoxy group or it may be the vinyl group. It is not necessary that all of the R's be the same organic radical. One of the prefered siloxanes is hexymethyldisiloxane which contains six methyl groups and has the structural formula



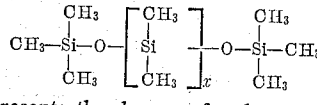
However, many other readily available compounds containing the siloxane linkage are applicable to the present invention, for example, dimethyl tetrasiloxane



methyl phenyl siloxane



and dimethyl siloxane



where x represents the degree of polymerization. While the siloxane is applied to the fabric as an unpolymerized or only partly polymerized material, substantially complete polymerization is effected in the preparation of the product of the present invention, as set forth hereinafter.

At least one surface of the present product bears a continuous film of a polymer containing the vinyl group as the vapor barrier material. In the coating polymer the vinyl group may be chemically bonded to chlorine or to one or more organic groups. The material may also be a vinyl co-polymer. While a wide variety of vinyl polymers may be employed as the vapor barrier coating, one of the following is preferred: 2-chloro-butadiene-1,3, better known as neoprene, polyvinyl chloride, or a copolymer of butadiene (bi-vinyl) with acrylonitrile preferably in the ratio of 55 parts butadiene to 45 parts acrylonitrile.

In a preferred embodiment of the present invention, the vapor barrier coating has a high resistance to abrasion or wear, and this is imparted to the product by dispersing very finely divided inorganic abrasion resistant material throughout the vinyl polymer before application of the polymer to the fabric. This very finely divided material is preferably mica or graphite or a metal, for example, aluminum, copper, zinc, tin, cadmium, lead and others or one of the oxides of these metals. While a wide variety of other metals, metal oxides or metal compounds may serve as the abrasion resistant material, I prefer aluminum or alumina. Mica and graphite are both good abrasion resistant materials and advantageous since their fine particle are flake or leaf shaped and tend to overlap, giving excellent coverage. The state of subdivision of the abrasion resistant material is desirably between through 200 to 400 mesh screen, preferably through 325 mesh.

The product of the present invention is composed as follows:

	Percent
Fabric	55–80
Flame retardant	3–15
Organo-polysiloxane	0.5–4
Vinyl polymer coating	10–25

and in the preferred embodiment the product also contains about 1–5% mica, about 1–3% plasticizer and about 0.3–3% of the finely divided abrasion resistant material. The lower figures for the flame retardant, mica, plasticizer, organopolysiloxane, vinyl polymer and finely divided abrasion resistant material constitute the minimums necessary. While practical upper limits are specified for each of these materials, it is to be understood that more of the respective materials may be present in or on the fabric without departing from the spirit of the invention.

Where the fluoborate salt is employed as the flame retardant, it will generally be present in amounts of between about 3 and 10% by weight of the product, since less fluoborate is required for a given degree of flame retardancy than with the other flame retardants mentioned.

The percentages mentioned just above and throughout the remainder of the specification and claims are percents by weight based upon the total weight of the flame retardant vapor varrier fabric, unless otherwise specified.

The novel fabric product is well adapted for lagging cold pipes aboard marine craft, particularly submarines. A great deal of condensation occurs on cold pipes carrying fluids ranging in temperature from —20° to 70° F. in a submarine where the ambient temperature is often as high as 110° F. This condensation is a serious problem since the vessel often remains submerged for long periods of time.

In current standardized practice an adhesive described in Military Specification MIL–3316, Type II, is applied to the pipe in question over the insulation, and then an untreated asbestos-base fabric is wrapped around the pipe and lapped and allowed to dry for about 24 hours. After drying a coat of a vapor seal compound, described in Military Specification MIL–876A is brushed on the outer surface and allowed to dry. The vapor barrier is thus fabricated on the job. With the product of the present invention, which is already substantially impervious to water vapor, it is unnecessary to construct such a build-up. Rather, the adhesive is applied to the insulated pipe and the flexible material of the present invention is wrapped thereabout. To insure moisture integrity some of the vinyl coating polymer is brushed onto any laps in the resulting wrapping. Since the present product is a vapor barrier in both directions, the vinyl polymer coated surface may be toward or away from the pipe.

By reason of the fact that the vinyl coated surface of the product may be abrasion resistant, pipes or other elements to be protected from moisture are preferably lagged with the vinyl coating outermost. This method of application is particularly important where the pipe, for example, has already been lagged with an insulating material which will deteriorate on repeated shock and abrasion. As so employed the product of the present invention serves not only as a vapor barrier but as an abrasion protective covering.

A series of tests were conducted on a typical product of the present invention and on the vapor barrier material currently specified as standard for the lagging of pipes on submarines in order to compare the vapor barrier properties of the two materials.

The government specification vapor barrier material consisting of AG 1.40 asbestos cloth (conforming to Government Specification SSC–446A, Type I, Grade A, Class 5) was painted on one side with MIL–3316, Type II, adhesive and one coat of MIL–876A vapor sealant was brushed onto the other side. The product of the present invention consisted of the same AG 1.40 asbestos cloth treated to produce the preferred product of the present invention. This material was painted on one side with one coat of adhesive MIL–3316, Type II. Tests were conducted in accordance with ASTM procedure E96–53T at temperatures of 75° F. and 110° F. One face of the test specimen was exposed to a zero percent relative

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humidity atmosphere. Exposure was for a period of 168 hours, and two tests were made with both the standard material and the product of the present invention. The respective materials were then immersed in bilge water comprising 91 parts 20% salt water, 2 parts hydraulic fluid, 2 parts grease, 2 parts lubricating oil and 3 parts diesel fuel for a period of 24 hours after which they were conditioned at 75° F. and 50% relative humidity, and then exposed as above at 75° and 110° F. The average results of these tests are reported in the following table wherein the figures indicate the grams of water vapor transmitted per 24 hours per square meter of material.

Material	75° F.	110° F.
Standard	21.7	45.2
Present Invention	17.8	21.3
AFTER 24 HOUR BILGE WATER IMMERSION		
Standard	29.9	55.8
Present Invention	23.8	20.9

The superiority of the product of the present invention is readily apparent.

The novel flame retardant vapor barrier material is prepared by first impregnating the fabric base with the flame retardant after which the fabric is dried and then treated with a solution or dispersion of the siloxane. It is then again dried and raised to a temperature sufficiently high to completely polymerize the siloxane. The resulting fabric is then coated on at least one side with a mixture of the vinyl polymer, after which it is dried and calendered. Where abrasion resistance of the coated surface of the product is desired, the very finely divided inorganic abrasion resistant material is incorporated with the vinyl polymer and applied to the surface of the fabric therewith.

The above steps represent the process of the present invention in its broadest aspect. However, where flexibility and resilience are an important consideration, mica and plasticizer are introduced into the fabric prior to application of the siloxane, preferably along with the flame retardant.

Referring now to the present process in detail, an asbestos-base fabric is treated with a fluid medium, containing the flame retardant, mica and the plasticizer. The treating medium is preferably aqueous and where the flame retardant is water soluble, the same is dissolved. The mica of course being insoluble is dispersed throughout the medium. A preferred impregnating or treating medium is one which contains:

	Parts by weight
Water	100.
Sodium fluoborate	6–12 (preferably 10).
Mica	1.5 to 7 (preferably 3).
Plasticizer	2–4 (preferably 2.5).
Asbestos fines	1–7 (preferably 2.5).

It will be observed that the above aqueous impregnating medium contains substantially more flame retardant than that employed in the typical impregnating composition described in my earlier application S.N. 673,162. In the present process a greater quantity is required since in addition to flameproofing the asbestos material, it is necessary also to compensate for the water repellent and the vinyl coating of the product and also for the adhesive material which may subsequently be applied thereto in order to hold the product in place.

The above typical impregnating composition employs the preferred fluoborate salt. If another flame retardant is used, the quantities thereof in the impregnating solution will constitute from at least 6 to about 25 parts per 100 parts of water.

The asbestos fines are employed as a filler material and are not essential to the process or the product of the present invention. They simply contribute to a smoother, more uniform material since the fines tend to fill the spaces between the individual fibers of the base fabric.

Impregnation with the flame retardant is conveniently effected by passing the fabric through a trough containing the impregnating composition after which the fabric is passed through squeeze rolls to remove excess liquid and then passed to an oven where it is dried at a temperature preferably between about 220 and 250° F. The dry fabric is then passed through a trough containing a solution or emulsion of the siloxane, a typical example of which is an aqueous emulsion containing between about 4 and 9 parts (preferably 6 parts) of a siloxane such as hexymethyldisiloxane per 100 parts of water.

It is not necessary that the siloxane waterproofing material be applied to the fabric as an aqueous emulsion. For example, it may be dispersed or dissolved in a non-aqueous solvent. In any event, it is essential that the medium from which the water repellent siloxane is imparted to the fabric not have any appreciable solvent action on the flame retardant. While it might be assumed that the aqueous emulsion of siloxane mentioned would readily remove the water-soluble fluoborate from the fabric, it has been found that the siloxanes have physical properties which inhibit the solvent action of the water in which they are dispersed. This action prevents the water from dissolving the flame retardant which it would normally dissolve were the siloxane not present.

Following incorporation of the siloxane with the fabric, the material is again dried in an oven at a normal temperature of about 220 to 250° F. and subsequently given a treatment at a temperature sufficiently high, for example, about 300° F. for a period of about 4 to 7 minutes, to polymerize the siloxane and make it more water repellent.

Preferably, however, before drying the fabric and while the same is still wet with the solixane dispersion as it comes from the impregnating trough, the fabric is passed through squeeze rolls to remove excess liquid and then scrubbed to smooth the surface. This scrubbing may be carried out by passing the fabric between two high-speed rotary brittle brushes, one brush scrubbing the top and the other the bottom of the fabric. The brushes are preferably slightly offset and backed with a smooth steel or plastic plate on the opposite side of the fabric. The scrubbing operation while the fabric is still wet has an unusual effect, causing all upstanding fiber ends to be forced against and into the interstices or openings between the individual fibers of the yarn of which the fabric is composed. Immediately after scrubbing, the fabric is dried and cured as aforesaid.

In the next step of the process the fabric is coated on at least one side with the vinyl polymer. Coating can be accomplished by employing an applicator roll which revolves partially in the coating compound contained in a trough and applies a coating to the underside of the fabric as the latter passes over the applicator roll. Coating can also be accomplished with a knife coater, in which case the fabric is continuously passed under a knife blade the width of the material and the coating compound is fed onto the fabric just ahead of the blade which smooths the polymer uniformly over the surface. In either case, coating is so effected that the wet coated side of the fabric does not touch any surface, and the fabric is then passed onto a horizontal conveyor belt with the coated side up and carried through a drying oven. After drying the coated fabric may be calendered.

As noted earlier, in a preferred embodiment, finely divided inorganic abrasion resistant material is incorporated with the vinyl compound prior to application to the surface of the fabric. In any event during preparation of the vinyl polymer coating composition it is generally necessary to employ a thickening agent to adjust the viscosity of the material for proper coating. The

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thickening agent may be a vinyl or acrylic copolymer, for example, a polymer of sodium acrylate, or a natural gum such as guar gum or gum karaya, sodium carboxymethyl cellulose, or any one of the well known thickening agents. The following are typical coating compositions which when dried, render the flame retardant and water repellent fabric substantially impervious to water vapor.

Example 1:	Parts by weight
Polyvinylchloride emulsion	100.
Sodium polyacrylate	9–17 (preferably 15).
Aluminum powder (through 325 mesh)	4–11 (preferably 7).
Example 2:	
Copolymer of butadiene-acrylonitrile (55:45) emulsion	100.
Sodium carboxymethyl cellulose	7–12 (preferably 10).
Aluminum powder (through 325 mesh)	5-13 (preferably 8).
Example 3:	
2-chlorobutadiene 1,3 emulsion	100.
Sodium polyacrylate	9–13 (preferably 11).
Aluminum powder (through 325 mesh)	3–9 (preferably 5).

Following the process steps outlined above, including the drying, curing and scrubbing operations mentioned, a typical resilient, flexible, flame retardant, water repellent asbestos base fabric was prepared by first impregnating the asbestos base material with an aqueous flame retarding composition containing:

	Parts by weight
Water	100
Sodium fluoborate	10
Mica	3
Plasticizer	2.5
Asbestos fines	2.5

In a second treatment an aqueous emulsion containing 100 parts water and 6 parts hexymethyldisiloxane were applied to the fabric, and in the third step the vinyl coating composition of Example 3 was applied to one surface of the fabric.

The material thus produced had the following analysis:

	Percent
Asbestos fabric	70
Sodium fluoborate	5.4
Mica	1.6
Plasticizer	1.4
Polyhexymethyldisiloxane	1.0
2-chlorobutadiene 1,3 polymer	16.2
Sodium polyacrylate	1.9
Aluminum powder	0.9
Asbestos fines	1.6

As noted earlier herein, a preferred product in accordance with this invention has a thin organopolysiloxane coating over the vinyl polymer. This polysiloxane outer coat imparts additional water repellency to the treated fabric, and removes all tackiness which may characterize the vinyl polymer surface for a short time after drying. Furthermore, the polysiloxane coating eliminates any possibility of the fabric sticking to itself when it is rolled or wound up following manufacture. This outer coating is preferably the same organopolysiloxane employed to impart water repellency to the fabric and is applied to the dried vinyl polymer surface as a thin coating of a solution or dispersion of the polysiloxane, as by spraying or mopping, followed by drying and curing at about 300° F. for a few minutes.

In addition to its aforementioned uses, the fabric of the present invention is useful as a safety garment of the type worn by a steel worker, for example. Surprisingly, molten metal at temperatures up to 3000° F. splashed onto the coated surface of the fabric slides off without sticking or burning the surface or underlying portion of the fabric, even when in contact with the surface for up to 8–10 minutes.

By way of example, the product of the present invention was tested by mounting a specimen at an angle of 15° with the vertical on a wire screen support. Under the back, or uncoated side of the fabric was placed a light fold of wool cloth, and immediately back of this cloth was placed a polyethylene film with a melting point between 80° and 100° C. The wool cloth simulated the lining of a coat and the polyethylene simulated a man's skin, it having a melting point at the same temperature that a man's skin would burn. When one pint of molten steel at 2750° F. was poured over a period of 6 seconds onto the coated side of the fabric no sticking or burning occurred. Upon examination of the back side, the wool showed no scorching nor the polyethylene any sign of fusion from the heat.

Where the present product is to be used for such a garment, the abrasive material which might normally be present in the vinyl coating is either completely absent or a non-oxidizable material is employed, for example, finely divided mica or one of the aforementioned metal oxides. The vinyl coating may be pigmented as desired without destroying any of its efficiency in shedding the molten metal. The vinyl coating is overcoated with a thin film of the organopolysiloxane as described above.

I claim:

1. A flexible, resilient, flame retardant, water repellent, vapor barrier thermal insulating material, which comprises an asbestos-base fabric, at least one face thereof presenting a smooth surface substantially free of upstanding fiber ends, a flame retardant deposited on said fabric and intermediate the fibers thereof, an organopolysiloxane deposited throughout the fabric in amount sufficient to render the fabric and the flame retardant thereon water repellent, and a continuous flexible water insoluble vinyl polymer water vapor barrier film adhered to and coextensive with the smooth face of the flame retardant, water repellent fabric.

2. A material as set forth in claim 1 wherein the flame retardant constitutes about 3 to 15% by weight thereof.

3. A material as set forth in claim 1 wherein the flame retardant is a fluoborate salt.

4. A flexible, resilient, flame retardant, water repellent, vapor barrier, thermal insulating material, which comprises an asbestos-base fabric, at least one face thereof presenting a smooth surface substantially free of upstanding fiber ends, a flame retardant deposited on said fabric and intermediate the fibers thereof in amount sufficient to impart flame retardant properties to the material product, about 0.5 to 4% by weight of an organopolysiloxane deposited throughout the fabric to render the fabric and the flame retardant thereon water repellent, and a continuous flexible water insoluble vinyl polymer water vapor barrier film adhered to and coextensive with the smooth face of the flame retardant, water repellent fabric, said vinyl polymer vapor barrier film constituting about 10 to 25% by weight of the material product.

5. A flexible, resilient, flame retardant, water repellent, vapor barrier, thermal insulating material, which comprises an asbestos-base fabric, at least one face thereof presenting a smooth surface substantially free of upstanding fiber ends, about 3 to 15% by weight of a flame retardant, about 1 to 5% mica, and about 1 to 3% plasticizer deposited on said fabric and intermediate the fibers thereof, about 0.5 to 4% of an organopolysiloxane deposited throughout the fabric to render the fabric and the flame retardant thereon water repellent, and a continuous flexible water insoluble vinyl polymer water vapor barrier film adhered to and coextensive with the smooth face of the flame retardant water repellent fabric, said vinyl polymer vapor barrier film constituting about 10 to 25% by weight of the material product.

6. A flexible resilient, flame retardant, water repellent, vapor barrier, thermal insulating material, which comprises an asbestos-base fabric, at least one face thereof presenting a smooth surface substantially free of upstanding fiber ends, about 3 to 10% by weight of a flame retardant fluoborate salt, about 1 to 5% by weight mica and about 1 to 3% by weight plasticizer deposited on said fabric and intermediate the fibers thereof, about 0.5 to 4% by weight of an organopolysiloxane deposited throughout the fabric to render the fabric and the flame retardant thereon water repellent, and a continuous flexible water insoluble vinyl polymer water vapor barrier film adhered to and coextensive with the smooth face of the flame retardant water repellent fabric, said vinyl polymer vapor barrier film constituting about 10 to 25% by weight of the material product, said film having dispersed therethrough about 0.3 to 3% by weight of the material product of finely divided particles of abrasion-resistant material.

7. A process for producing a flexible, resilient, flame retardant, water repellent, vapor barrier, thermal insulating material, which comprises impregnating an asbestos-base fabric with a flame retardant, subsequently impregnating the fabric with a siloxane, so wet-abrading at least one face of the fabric as to force upstanding fiber ends against the fabric surface and into interstices thereof thereby smoothing the surface of said fabric face, subjecting the fabric to temperatures sufficiently high to polymerize the siloxane thereon, and then so applying to said smooth face of the fabric a water insoluble vinyl polymer in a fluid coating composition as to produce a continuous, substantially uniform, non-porous, flexible vinyl polymer film thereon coextensive therewith and then drying the coated fabric.

8. A process for producing a flexible, resilient, flame retardant, water repellent, vapor barrier, thermal insulating material, which comprises impregnating an asbestos-base fabric with a flame retardant, subsequently impregnating the fabric with a siloxane disposed in a fluid medium, which medium containing the siloxane is without appreciable solvent action for the flame retardant on the fabric, so wet-abrading at least one face of the fabric as to force upstanding fiber ends against the fabric surface and into interstices, thereof thereby smoothing the surface of said fabric face, subjecting the fabric to temperatures sufficiently high to polymerize the siloxane thereon, and then so applying to said smooth face of the fabric a water insoluble vinyl polymer in a fluid coating composition as to produce a continuous, substantially uniform, non-porous, flexible vinyl polymer film thereon coextensive therewith and drying the coated fabric.

9. A process for producing a flexible, resilient, flame retardant, water repellent, vapor barrier, thermal insulating material, which comprises impregnating an asbestos-base fabric with an aqueous medium containing a flame retardant, drying the fabric, impregnating the dried fabric with an aqueous dispersion of a siloxane, while wet with said siloxane dispersion so abrading at least one face of the fabric as to force upstanding fiber ends against the fabric surface and into the interstices thereof thereby smoothing the surface of said fabric face, drying the thus treated fabric and polymerizing the siloxane thereon, and then so applying to said smooth face of the fabric a water insoluble vinyl polymer in a fluid coating composition as to produce a continuous, substantially uniform, non-porous, flexible vinyl polymer film thereon coextensive therewith and drying the coated fabric.

10. A process as set forth in claim 9 wherein the flame retardant is a fluoborate salt and the medium from which the same is applied to the fabric contains about 6 to about 12 parts of said salt per 100 parts water.

11. A process as set forth in claim 9 wherein the aqueous flame retardant medium also contains mica and a plasticizer.

12. A process as set forth in claim 9 wherein the aqueous dispersion of siloxane is an aqueous emulsion containing between about 4 and about 9 parts siloxane per 100 parts water.

13. A process as set forth in claim 9 wherein the vinyl polymer is selected from the group consisting of neoprene, polyvinylchloride and butadiene-acrylonitrile copolymers.

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