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Scott

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[54] **SYNTHETIC FUR**

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[21] Appl. No.: **173,885**

[52] **U.S. Cl.** **161/67,** 156/72, 156/93, 161/19, 161/63, 161/403

[51] **Int. Cl.** **D03d 27/00,** D04h 11/00

[58] **Field of Search** 161/48, 50, 52, 19, 161/62–67, 403; 156/72, 93, 68; 69/22; 112/412

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Primary Examiner—William A. Powell
Attorney—Arthur A. Jacobs

[57] **ABSTRACT**

A synthetic fur product and method of making such product which comprises coating synthetic hair fibers with a heat-settable composition containing a hardening and adhesive agent in aqueous media, either with or without the addition of separate water-proofing agents, flame-retardant agents, softening agents, and the like, and then applying heat to the coated hair to set the coated hair in the selected condition. Then the treated hair fibers are formed into long and short hair wefts, the two lengths and "belly" hair. The wefts are then stitched or otherwise adhered to a backer. In another form, only one length of hair fiber is used to form the wefts and these are stitched to a woven mat which has been treated similarly to the wefts.

6 Claims, 7 Drawing Figures

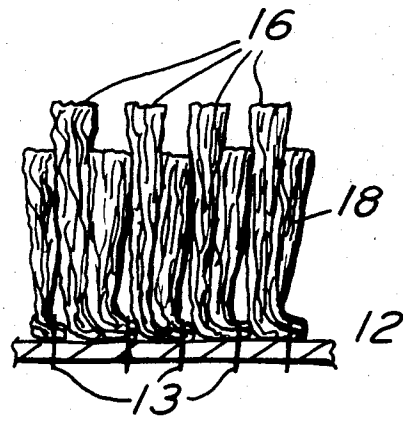


FIG. 1

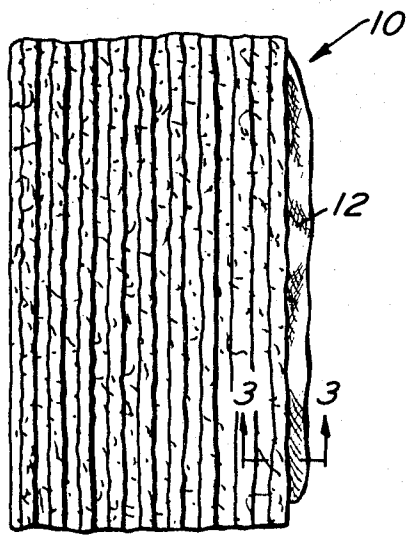


FIG. 2

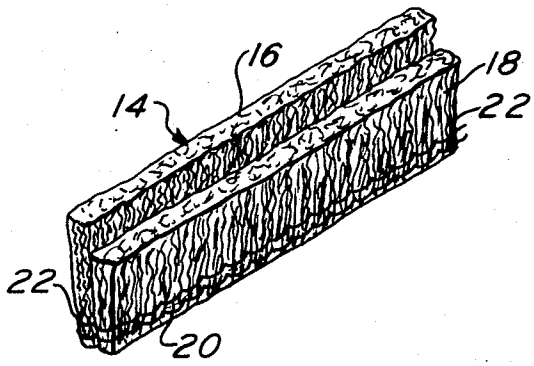


FIG. 3

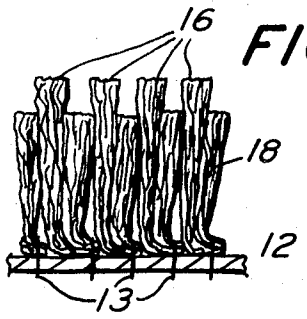


FIG. 4

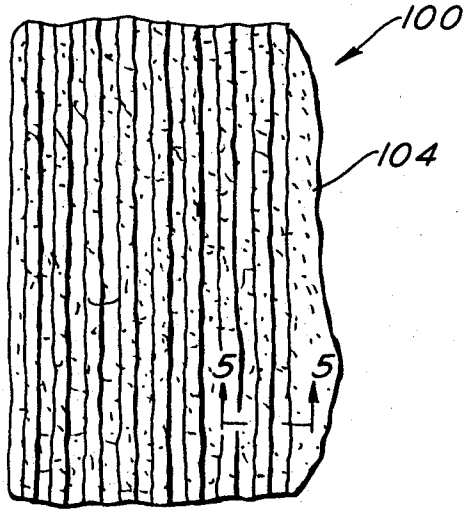
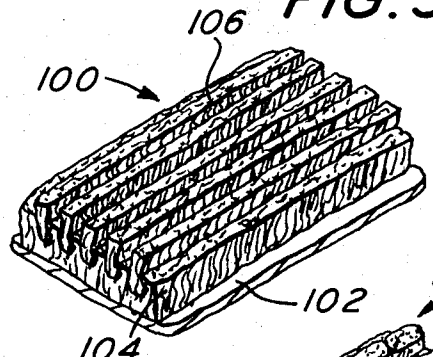


FIG. 5



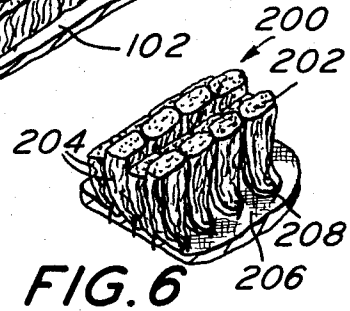


FIG. 6

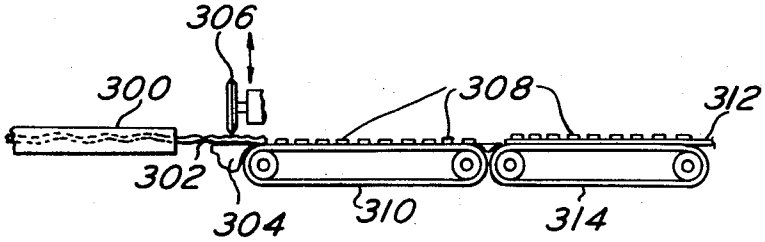


FIG. 7

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SYNTHETIC FUR

This invention relates to synthetic fur, and it particularly relates to a process for making synthetic fur from synthetic hair-like fibers.

Many processes have heretofore been used to make synthetic furs which resemble natural furs, such as mink and the like. However, these prior processes have all been unduly expensive and complex and the resulting products have rarely had a sufficiently close resemblance to the natural product. Furthermore, they have generally had a tendency to rapidly deteriorate under conditions of use, especially when exposed to moisture, and quickly became so shoddy in appearance that they could no longer be used.

It is one object of the present invention to overcome the above and other defects of prior-produced synthetic furs by providing a relatively simple and inexpensive process producing such synthetic furs, whereby the resultant furs are very natural in appearance and are adapted to retain such appearance under all normal conditions of use.

Another object of the present invention is to provide a process of the aforesaid type which utilizes relatively inexpensive raw materials.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following description when read in conjunction with the accompanying drawings wherein:

FIG. 1 is a fragmentary top plan view showing the construction of a fur embodying the present invention.

FIG. 2 is a fragmentary perspective view showing one fiber weft unit of the fur of FIG. 1.

FIG. 3 is a cross-sectional view taken on line 3—3 of FIG. 1.

FIG. 4 is a top plan view of another form of the present invention.

FIG. 5 is a fragmentary perspective view taken generally along the line 5—5 of FIG. 4.

FIG. 6 is a fragmentary perspective view showing individual stitching of the fiber wefts.

FIG. 7 is a schematic view of a mechanism for forming the fiber wefts used in this invention.

Referring now in greater detail to the various figures of the invention wherein similar reference characters refer to similar parts, there is shown in FIGS. 1, 2 and 3 a fur pelt, generally designated 10, comprising a backer sheet 12, made of fabric or the like (see FIG. 3), to which is stitched a series of fiber hair weft units 14 (see FIG. 2). Each weft unit 14 consists of a long weft 16 and a short weft 18 sewn together as at 20.

The wefts 16 and 18 are constructed of a plurality of synthetic hair fibers made of a synthetic polymer such as nylon or the like, the fibers being stitched together at 22. The fibers in each weft 16 and 18 are of curled and chemically-treated construction as will hereinafter be more fully described.

After each weft unit 14 is constructed, they are each stitched, as at 13, to the backer 12 in closely adjacent relationship (as seen in FIG. 3). In the resultant pelt, the short wefts 16 constitute the so-called "belly hair" while the long wefts 18 constitute the surface hair which gives the fur its surface appearance.

It is to be understood, in this respect, that the widths of the long and short wefts are somewhat exaggerated in the drawings for greater clarity, while, in actuality, they are each of the thickness of several hair strands, so that, when assembled, there are so many wefts to each inch that the overall appearance of the surface formed by the long weft hairs is similar to that of natural fur such as mink.

In FIGS. 4 and 5 there is shown an alternative construction of the fur pelt wherein the pelt, generally designated 100, comprises a backer 102 upon which is sewn, glued or otherwise adhered a woven mat 104 constructed of synthetic fibers. The mat 104 is similar in appearance and construction to the so-called pebble-weave type of carpeting. This mat 104 is treated in the same manner as the wefts 16 and described above, as will be hereinafer more fully described.

Sewn to the mat 104 are a series of closely spaced synthetic fiber hair wefts 106 similar to the wefts 16 described above. In this form of the invention, the mat 104 constitutes the "belly hair" while the wefts 106 constitute the surface hair.

In the form of the invention shown in FIGS. 1, 2 and 3, the wefts 14 and 16 are sewn together first to form weft units and these units are then sewn to the backer. In FIG. 6, an alternative construction, generally designated 200, is shown, wherein small individual wefts, indicated at 202 and 204, are individually stitched to the backer 206 by hand stitches 208.

As indicated above, it is important to provide the hair fibers with a wavy or curled appearance to simulate the hair fibers of natural fur. This may be accomplished in any manner desired. One manner of accomplishing this is by means of the apparatus shown in FIG. 7.

The apparatus of FIG. 7 comprises a heated tube 300 having a wave-like hollow interior. The heat may be applied electrically or in any other desired manner. Hanks of the fiber, which have been first chemically treated in the manner hereinafter described, are forced, under pressure, through the tube 100 and, when extruded therefrom, have a curled or wavy set, as indicated at 302.

As the curled hanks are extruded onto a platform 304 they are cut into predetermined size by a rotary knife 306. Although not shown, the knife 306 is reciprocated toward and away from the platform 304 in timed intervals corresponding to the length of the hanks desired. The mechanism for operating the knife in such timed relation is not shown since any standard mechanism may be used and the specific mechanism, by itself, forms no part of the present invention.

The severed hanks 308 are then moved by an endless belt conveyor 310 onto a mat 312 carried on an endless belt conveyor 314 which conveys the mat 312 and the hanks 308 to a stitching or other treating station.

The apparatus illustrated in FIG. 7 is used primarily for the construction of furs such as shown in FIGS. 4 and 5, the mat 314 corresponding to the mat 102 and the hanks 308 corresponding to the tufts 104. However, it is also possible to use a modified form of such apparatus for the fur shown in FIGS. 1, 2 and 3. In such modified apparatus (not shown), the mat 312 would correspond to the backer 12 and two mold tubes 300, two knives 306 and two conveyors 310 would be used, one set of mechanisms for each size tuft. The two conveyors 310 would then be timed to deposit their tufts alternately on the mat or backer 308 on conveyor 314.

If desired, only the mold tube 300 may be used to curl or wave the hair fibers and these fibers may then be cut and assembled by hand or by any other feasible mechanism.

In order to provide satisfactory body for the hair fibers as well as permanent curl or wave, certain types of hardening agents are used. Such hardening agents comprise:(1) p,p'-methyl-enedianiline; (2) a copolymer obtained by polymerizing a mixture of (a) about 0.5–25 percent by weight of itaconic acid, (b) 3–4 percent by weight of at least one polymerizable compound selected from the group consisting of acrylonitrile, alkyl esters of acrylic and methacrylic acids having from 1 to 18 carbon atoms in the alkyl group, phenyl methacrylate, cyclohexyl methacrylate, p-cyclohexylphenyl methacrylate, methacrylonitrile, methyl vinyl ketone and vinyl chloride, and (c) 35–96.5 percent by weight of vinylidene chloride, the proportions being selected to total 100 percent; (3) water-insoluble copolymers obtained by the emulsion copolymerization of about 0.5–6 percent by weight of either N-methylolacrylamide, N-methylolmethacrylamide, or mixtures thereof with about 0.5–25 percent by weight of either acrylamide or methacrylamide, and having a molecular weight of 100,000 to 10,000,000; (4) copolymers of acrylonitrile and styrene produced by Pennsylvania Industrial Chemical Corp., under the trade name "Piccoflex" and (5) "Arolon **363**" (Archer Daniels Midland Co.), a solution of a water-soluble, oxidizing resin containing about 50 percent by weight solids, having a viscosity of SX (Gardner Holdt at 25° C.) and a pH of between 6.9 and 7.3 at 25° C.

Another effective hardening and adhesive agent, which may also serve as a flame retardant, is one or more of the "Geons" produced by the B.F. Goodrich Co. These include "Geon **652,**" a vinyl chloride-vinylidene chloride copolymer; "Geon **575 × 43**" and "Geon **577,**" which are vinyl chloride polymers plasticized with alkyl aryl phosphate plasticizers at levels of 25 and 35 parts per hundred polymer respectively; "Geon **576,**" a vinyl chloride polymer plasticized with 35 parts dioctyl phthalate per 100 parts polymer; "Geon **151,**" "Geon **354,**" "Geon **352**" and "Geon **351,**" the first of these being an unplasticized vinyl chloride homopolymer and the last three being unplasticized vinyl chloride copolymers: "Geon 450 × 167," "Geon 450 × 20," "Geon 450 × 3," "Geon 450 × 23," "Geon 460 × 1," all of which are vinyl chloride-acrylic latexes; and "Geon **552,**" a vinyl chloride/butadiene-acrylonitrile polyblend latex.

The hardening agent is utilized in a proportion of about 10–80 percent by volume of the total composition, said composition including water as at least one of the other ingredients.

It is also desirable to provide an adequate degree of flame-retardancy to the fur. A highly effective flame-retardant agent is sodium bicarbonate, and is used in a proportion of about 1–20 percent by volume, preferably about 1–6 percent by volume, of the total composition.

Other effective flame-retardant agents (which are also effective adhesive agents) are tris(**2,3**-dibromopropyl) phosphate, hexabromobenzene and hexabromobiphenyl. Each of these compounds is used in a 10–25 percent by weight concentration, preferably about 15 percent, in an appropriate solvent. The solvents comprise most aromatics, and some chlorinated straight chain hydrocarbons.

Among the preferable solvents are perchloroethylene, carbon tetrachloride and polyvinyl chloride. These compounds may, furthermore, be used by themselves or in admixture with either one or both of the others. In any event, they are preferably used (either as a single component or as a mixture) in a proportion of about 10–25 percent by volume of the total composition.

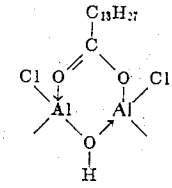
It is preferable to apply the composition, including the hardening agent and the flame-retardant agent, to the hair fibers as by spraying, dipping, rubbing, or the like, and then to immediately dry the treated fibers at a temperature of about 120°–250° F.

As indicated above, the hardening and adhesive agent may be used by itself in aqueous media or it may be used together with the flame-retardant agent in said aqueous media (in the aforesaid range of proportions). The composition, in either case, is prepared by simple admixture, preferably under agitation, at room temperature and pressure.

Although, as stated above, the hardening and adhesive agent may be used by itself to obtain a satisfactory coating composition, it has been found that the addition of a very small amount of a softening agent materially enhances the appearance and quality of the finished product. This softening agent is generally utilized in a proportion of about 0.1–0.5 percent by volume of the total composition.

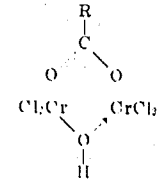
Among the softening agents preferably used is an aqueous dispersion of N-methylol stearamide, wherein the compound is present in the dispersion in a concentration of about 20–45 percent by weight, preferably about 25–30 percent by weight.

Another softening agent, which has a water-repellent function as well, is an aluminum complex (commercially available as DuPont's "Aluminum Complex **101**"), which is a coordination of complex aluminum and myristic acid and which has the following structure:



In this complex, the aluminum groups anchor to the treated surfaces while the myristic group orients outward.

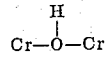
Yet another softening agent is a Werner type chromium complex having the structure:



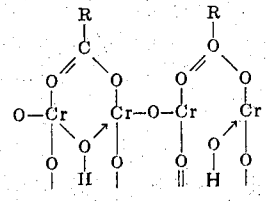
R is either $C_{17}H_{35}$ or $C_{13}H_{27}$.

This product is commerically available as DuPont's "Quilon S" or "Quilon M," the first being the stearic acid complex and the second being the myristic acid complex.

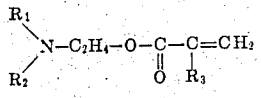
Another commercially available chrome complex that may be used as the softening agent is that identified as DuPont's "Quilon C." This is a Werner chromium complex, usually in isopropanol solution, that differs from "Quilon S" and "Quilon M" through partial polymerization. The chromium atoms polymerize through "olation" bridges to form



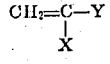
groups. On drying, hydrolysis and condensation occur to the point where the polymer is condensed through -O- bridges with the surface as follows:



If a separate water-repellent agent is used, it is preferably one which is preferably used in a proportion of about 1–50 percent by volume, consists of (a) a wax-polymer emulsion wherein the ratio of wax to polymer is about 3:1, the polymer being a copolymer which consists of (1) about 15–90 percent by weight of an amino group containing comonomer having the structure:



where R_1 and R_2 are selected from the group consisting of lower alkyl and cycloalkyl that include R_1, R_2, and R_3 is selected from the group consisting of H and CH_3, and (2) 10–85 percent by weight of a comonomer having the structure:



where X is a member of the group selected from H and CH_3 and Y is a member selected from the polar group consisting of nitrile, aliphatic acyloxy having from 1–18 carbon atoms and alkoxy-carbonyl having from 1–18 carbon atoms, said copolymer having an intrinsic viscosity in benzene at 30° C. of from 0.04–0.5.

Other products that may be used as the water-proofing or water-repellent agent are such commerically available products as "Zonyl RP" (DuPont), which is an anionic fluoro compound having a density at 77° F. of 8.85 lb/gal., a viscosity at 77° F. of 8.85 lb/gal., a viscosity at 77° F. of 10 centipoises, a pH of 7.0 complete solubility in water. Also "Nalan RF" and "Nalan RD" (DuPont), "Zelcon SL" (DuPont), "Zepel" (DuPont) and other similar water-dispersible products, as, for example, "Scotchgard" (Minnesota Mining & Manufacturing Co.).

The slipping agent, utilized in a proportion of about 0.1–10 percent by volume may be any one of a number of fluoro resins. Among these resins is a product produced by Dupont under the name of "Teflon P-TFE." This product, as used herein, is a polytetrafluoroethylene having a molecular weight of between about 1,000,000 to 10,000,000, and a viscosity greater than 10^{10} poises at 380° C. Also utilizable is a vinylidene fluoride resin having a molecular weight of between about **300,000** and **600,000** and having the structure:

$$-CH_2-CF_2-CH_2-CF_2-CH_2-CF_2-$$

The emollient, which may be used in a proportion of from 0 to about 50.00 percent by volume, may be lanolin or any equivalent substance.

All of the compositions embodying the present invention may be prepared by mixing together the desired proportions of all the components at room temperature and pressure until a homogenous, viscous, grease-like cream is obtained.

In the operation of the present process, the hair strands are coated with the composition, either by spraying, dipping, rubbing, etc, and the coated hair is passed through the heated tube **300** to effect a curing and simultaneous curling, thereby forming a relatively permanent set. The heat required for this purpose is between 120°–250° F. depending on the type of hair or fiber being processed and on the type of composition used.

When a mat, such as shown at **104** is used to form the "belly hair," the mat **104** is merely coated with the above-described composition and then cured at the above-described temperature prior to attachment of the treated fibers forming the surface hair.

The following examples illustrate the invention, without, however, limiting it except as claimed:

EXAMPLE 1

75 percent by volume of p,p' -methylenedianiline was mixed, at room temperature and pressure, with 3.5 percent by volume of sodium bicarbonate and with 21,5 percent water, the mixture taking place under agitation until a monogeneous cream-like substance was produced.

EXAMPLE 2

47.5 parts by weight of ethyl acrylate, 3 parts by weight of a non-ionic dispersing agent (a 70 percent aqueous solution of a tertoctylphenoxylpolyethoxyethanol containing an average of about 35 oxyethylene units in the molecule) and 100 parts by weight of water were cooled to 15° C. and then agitated. Then 0.085 parts by weight of ammonium persulfate and 0.08 parts by weight of sodium hydrosulfite were added. As soon as the temperature began to rise, 2.5 parts by weight of itaconic acid, dissolved in 44 parts by weight of water, was added over a period of 8 minutes. As polymerization proceeded, the temperature rose in 17 minutes to a maximum of 56° C. The dispersion was stirred until it reached room temperature.

50 percent by volume of the above dispersion was mixed, under agitation, at room temperature and pressure, with 0.3 percent by volume "Aluminum Complex **101**," 2 percent by volume sodium bicarbonate, 4 percent by volume of the wax-polymer emulsion described above, 1 percent by volume of "Teflon P-TFE," and 16.7 percent by volume water. Agitation was continued until a heavy grease-like cream was obtained.

EXAMPLE 3

The same ingredients, proportions and procedures

were used as in Example 2, except that a 25 percent by weight aqueous dispersion of N-methylol stearamide was substituted for the "Aluminum Complex 101."

EXAMPLE 4

To a solution of 300 parts of 2-diethylaminoethyl methacrylate and 700 parts of octadecyl methacrylate in 1,000 parts of molten paraffin wax, maintained at 75° C., in a suitable vessel equipped with an agitator, are added 10 parts of 2,2¹-azodiisobutyronitrile in small increments over a period of 6 to 10 hours. After the last addition of the polymerization initiator, the reaction mass is held at 75° C. for 2 hours, and the temperature is then raised to 100° C. and held at that temperature for about ½ hour. The charge is then diluted with 2,000 parts by weight of molten paraffix wax, to give a wax:-copolymer ratio of 3:1. All parts herein are by weight.

Into 100 parts by weight of the above-wax-copolymer composition, melted by heating to between 65° and 70° C., 4 parts by weight of glacial acetic acid are stirred. The wax-copolymer mass is then slowly added to 294 parts by weight of water kept under vigorous agitation with a high shear mixer, and maintained at 65° to 70° C. Agitation is then continued for a sufficient time to complete the emulsification. The resulting product is then cooled to room temperature. The product has a molecular weight of between about 20,000 and 80,000 and a viscosity of about 16 centipoises at 80° F. (Brookfield).

12 percent by volume of the above emulsion was mixed with 67.5 percent by volume of p,p'-methylenedianiline, 0.5 percent by volume "Teflon P-TFE" having a molecular weight of about 1,500,000, and 20 percent by volume lanolin. The mixture was thoroughly agitated at room temperature and pressure until a homogeneous, grease-like cream was produced.

The products of each of the above examples were applied to a hank of nylon fiber, by brushing them onto the fibers and then each hank was cured and curled at a temperature of 150° F. The resulting hanks were then cut into "short" and "long" wefts. Individual long wefts were stitched to individual long wefts to form weft units. A series of such weft units were stitched, in close parallelism, to a woven backer sheet to form a "fur" pelt.

The invention claimed is:

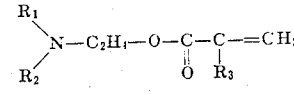
1. A synthetic fur product comprising a backer sheet, a first layer of synthetic fibrous material attached to said backer sheet, and a second layer of synthetic fibrous material attached to said first layer, at least said second layer comprising a series of curled fiber wefts arranged in generally parallel relationship, the fibers of each layer being coated with a treating composition which has been cured in situ, said treating composition comprising a hardening and adhesive agent in aqueous media, the hardening and adhesive agent being in a concentration of about 10–80 percent by volume, and being selected from the group consisting of (1) p,p'-methylenedianiline; (2) a copolymer obtained by polymerizing a mixture of (a) about 0.5–25 percent by weight of itaconic acid, (b) 3–4 percent by weight of at least one polymerizable compound selected from the group consisting of acrylonitrile, alkyl esters of acrylic and methacrylic acids having from 1 to 18 carbon atoms in the alkyl group, phenyl methacrylate, cyclohexyl methacrylate, p-cyclohexyl phenyl methacrylate, methacrylonitrile, methyl vinyl ketone and vinyl chloride, and (c) 35–96.5 percent by weight of vinylidene chloride, the proportions being selected to total 100 percent; (3) water-insoluble copolymers obtained by the emulsion copolymerization of about 0.5–6 percent by weight of either N-methylolacrylamide, N-methylolmethacrylamide, or mixtures thereof with about 0.5–25 percent by weight of either acrylamide or methacrylamide, and having a molecular weight of 100,000 to 10,000,000; (4) copolymers of acrylonitrile and styrene; (5) a solution of a water-soluble, oxidizing resin containing about 50 percent by weight solids, having a viscosity of SX (Gardner Holdt at 25° C.) and a pH of between 6.9 and 7.3 at 25° C. and (6) vinyl chloride polymer latexes.

2. The product of claim 1 and including a flame-retardant agent, said fire-retardant agent being present in a proportion of about 1–25 percent by volume and being selected from the group consisting of sodium bicarbonate, tris(2,3-dibromopropyl) phosphate, hexabromobenzene, and hexabromobiphenyl.

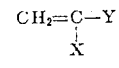
3. The product of claim 1 and including a softening agent, said softening agent being present in a proportion of about 0.1–0.5 percent by volume and being selected from the group consisting of N-methylol stearamide, a complex of aluminum and a higher alkyl acid having from 13 to 17 carbon atoms, and polymers of said complex.

4. The product of claim 1 and including a softening agent, said softening agent being present in a proportion of about 0.1–0.5 percent by volume and being selected from the group consisting of N-methylol stearamide, a complex of aluminum and a higher alkyl acid having from 13 to 17 carbon atoms, and polymers of said complex.

5. The product of claim 1 and including about 1–50 percent by volume of a wax-polymer emulsion wherein the ratio of wax to polymer is about 3:1, the polymer being a copolymer which consists of (1) about 15–90 percent by weight of an amino group containing comonomer having the structure:



where R_1 and R_2 are selected from the group consisting of lower alkyl and cycloalkyl that include R_1, and R_2, and R_3 is selected from the group consisting of H and CH_3, and (2) 10–85 percent by weight of a comonomer having the structure:



where X is a member of the group selected from H and CH_3 and Y is a member selected from the polar group consisting of nitrile, aliphatic acyloxy having from 1-18 carbon atoms and alkoxycarbonyl having from 1–18 carbon atoms, said copolymer having an intrinisic viscosity in benzene at 30° C. of from 0.04–0.5.

6. The product of claim 1 and including about 0.1–10 percent by volume of a polytetrafluoroethylene having a molecular weight of between about 1,000,000 to 10,000,000 and a viscosity greater than 10^{10} poises at 380° C. also utilizable is a vinylidene fluoride resin having a molecular weight of between about 300,000 and 600,000 and having the structure:

$$—CH_2—CF_2—CH_2—CF_2—CH_2—CF_2.$$

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