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(71) Applicant: **Alberto-Culver Company**
2525 Armitage Avenue
Melrose Park Illinois 60610(US)

(72) Inventor: **Pallone, Thomas J.**
35 Watergate Road
South Barrington, IL 60010(US)
Inventor: **Alania, Larry J.**
1014 Whirlaway Avenue
Naperville, IL 60540(US)
Inventor: **Weber, William C., Jr.**
845 Manassas Court
Naperville, IL 60540(US)
Inventor: **Farmer, Robert F.**
21954 North Green Forest Road
Barrington, IL 60010(US)

(74) Representative: **Patentanwälte Grünecker, Kinkeldey, Stockmair & Partner**
Maximilianstrasse 58
W-8000 München 22(DE)

(54) **Aerosol preparations for removing particulate matter from fabric.**

(57) A method and aerosol preparations are provided for removing lint, hair, and other particulate matter from fabric articles such as clothing, upholstery, or draperies. A specially formulated sprayable aerosol adhesive composition is applied to flexible sheet material, such as a paper towel, so as to splatter the surface of the sheet with tacky adherent globules of a tackified or plasticized resin without forming a continuous coating on the surface. The sprayed surface of the sheet is ready within 30 seconds for contacting with the fabric from which the particulate matter is to be removed.

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METHOD AND AEROSOL PREPARATIONS FOR REMOVING PARTICULATE MATTER FROM FABRIC

FIELD OF INVENTION

The field of this invention is the removal of particulate matter such as lint or hair from fabric other than by washing or dry cleaning. Methods and devices within the field of the invention include those which can be employed for quick removal of particulate matter from the surface of a garment while the garment is being worn or immediately prior thereto.

BACKGROUND OF INVENTION

It is known to impregnate or coat cloth, paper, or other sheet material with a tacky adhesive, and to applying the impregnated or coated sheet material to a garment from which it is desired to remove lint or hair. Illustrative United States patents include 1,468,380, 3,682,690, 4,557,011, 4,575,890, and 4,713,274. As described in patent 3,682,690, a roller may be coated with a tacky elastomer which is water-washable, thereby permitting the particulate matter collected by the roller to be removed by washing. Patents 4,557,011 and 4,575,890 utilize a series of separately detachable adhesive sheets which are supported on a roller for applying to the garment. After the outer sheet on the roll has picked up the lint or hair, it then must be removed, exposing a fresh sheet.

Patent 4,713,274 describes a pad having a plurality of removable sheets which are coated with an adhesive material for use in collecting particulate matter. Patent 4,820,558 describes an envelope formed from plastic sheets having the outer surfaces of the sheets coated with an adhesive material suitable for collecting particulate matter. A hand may be inserted within the pocket formed by the sheets for applying the device.

As far as is known, no one has heretofore proposed the use of an aerosol adhesive spray for removing particulate matter. Patent 2,759,860 describes a lint removing process in which a liquid composition is applied to the bristles of a brush or whisk broom. The brush or whisk broom after coating with the composition is brushed cver the surface of the garment.

Aerosol adhesive formulations are known. In general, they consist of a film-forming resin, a tackifier or plasticizer therefor, and an aerosol propellant in which the resin is soluble or readily dispersible. On application to sheet material, such as the backs of photographs, the spray forms a tacky, adherent coating. Such formulations include acrylic polymers such as the methacrylate polymers employed with volatile aerosol propellants as disclosed in U.S. patent 3,305,510. As there described, the alkyl acrylate polymer may be modified so that it is water-washable to facilitate removal of misapplied spray. The patent indicates that dimethyl ether can function both as a propellant and solvent for acrylate polymers. Patent 3,340,095 describes an aerosol-packaged spray adhesive formulated from an elastomeric polymer together with a tackifier resin. The spray composition is intended to form a tacky coating.

SUMMARY OF INVENTION

In the development of this invention, it was found that a tacky aerosol adhesive spray can be employed for removing lint, hair, or other particulate matter from garments or other fabric surfaces providing the spray is formulated in accordance with certain criteria and is used in a defined manner. In formulating the sprayable adhesive composition, the film-forming resin together with a tackifier or plasticizer therefor should be dissolved or dispersed in a volatile aerosol propellant. More specifically, the propellant should be sufficiently volatile so that it evaporates very rapidly from the sprayed droplets, either in transit or immediately after the droplets are deposited. Furthermore, the spraying of the composition should be carried out so as to splatter the surface of the substrate with tacky adherent globules of the tackified or plasticized resin without forming a continuous coating on the surface.

Since film-forming resins readily produce coatings and have typically been employed for this purpose, a very brief spraying time is required to produce the desired relatively discrete adherent globules. Spray times of as little as 1 to 5 seconds have been found to be advantageous. In fact, the most effective spray

time for producing a globular-type surface coating is in the range of 2 to 4 seconds.

The rough, globular-type coating produced by the method of this invention has been found to be especially suitable for removal of lint and hair from garments or other fabric articles, such as upholstery or draperies. The globules can be deposited in less than five seconds and are ready for use in less than 30 seconds. The deposited tacky globules are adherent to the substrate to which they are applied, and are sufficiently free of solvent that they can be contacted with a cloth garment without transfer to the garment. The relatively rough tacky surface is especially effective in picking up lint or hair.

An advantage of the method and aerosol preparations of this invention is that they can be employed with readily available substrates such as paper towels. Although a paper towel is highly absorbent, because of the limited amount of spray applied and the deposit of the spray in the form of droplets or globules, the deposited adhesive material remains on the surface of the towel paper and thereby functions effectively for removal of hair or lint. Other absorbent sheet material can be used, such as cloth. Sheet material subject to shedding, such as face or toilet tissue is not desirable. Both absorbent and non-absorbent substrates can be employed, including polyethylene bags, waxed paper, aluminum foil cloth, paper towel, etc.

In the event of misapplication of the sprayed composition, such as on the hands, or unintentional application to a garment, it is desirable to have the tackified or plasticized resin readily water-washable. To accomplish this, the resin can be modified to provide water-solubility. Alternatively, and preferably, a surfactant is incorporated in the formulation to promote water-removability.

Preferred formulations for the purpose of this invention utilize acrylic polymers as the film-forming resin, with tackifiers therefor, such as rosin-type tackifiers. In one preferred embodiment, the sole propellant is dimethyl ether. In other embodiments, the propellant system comprises a mixture of dimethyl ether and a hydrocarbon propellant of suitable volatility such as n-butane, isobutane, propane, or mixtures thereof.

DETAILED DESCRIPTION

In carrying out the method of this invention, a sprayable adhesive composition is prepared in a valve-equipped aerosol container. The composition comprises an adhesive film-forming resin in admixture with a tackifier or plasticizer therefor, and a volatile aerosol propellant in which the tackified or plasticized resin and or rosin is soluble or readily dispersible. The packaged composition is sprayed from the container onto flexible sheet material providing an essentially non-shedding surface for receiving the spray. Importantly, the spraying is carried out so as to splatter the surface with tacky adherent globules of the tackified or plasticized resin without forming a continuous coating on the surface. As soon as the globules are essentially free of the propellant, preferably in less than 30 to 60 seconds after application, the surface of the sheet material is contacted with the fabric from which the particulate matter is to be removed. This method has particular application to clothing, upholstery, drapes and other fabric articles which have collected lint, hair, or other detachable particulate matter.

Film-forming resins of the kind which have heretofore been employed for aerosol adhesive compositions can be used. Such resins include acrylic polymers and copolymers. For example, alkyl acrylate or alkyl methacrylate polymers can be used. Elastomeric resins can also be used, such as polyvinylpyrrolidone, vinyl acetate/crotonic acid/vinyl neodeconate copolymers, butyl esters of poly(methylvinyl ether/maleic acid), etc. Such resin polymers are available commercially from a number of sources, as indicates subsequently. Acrylic polymers are preferred and may be used either as an aqueous latex emulsion or as an organic solvent solution. Organic solvent solutions of acrylic polymers in essentially anhydrous compositions are preferred.

For purpose of the present invention, it will usually be desirable to employ a tackifier or plasticizer in combination with the film-forming resin. The sprayed globules should have tacky adhesive character. Rosin-type tackifiers are useful for this purpose, such as rosin polyol esters, modified tall oil rosins, glycerol esters of resin, etc. In certain embodiments, the tackifier may itself be a modified film-forming resin, such as modified acrylics which function as tackifiers. In addition to a modified acrylic having tackifier properties, a plasticizer may also be used.

The propellant or propellant systems should be selected to provide rapid evaporation on spraying of the composition. The individual propellant or the components of a mixture should each have a volatility producing a vapor pressure of 10 psig or higher at 70° F. Preferred solvents are dimethyl ether, or a mixture of dimethyl ether with a hydrocarbon propellant such as propane, n-butane, isobutane, or mixtures thereof. For example, the mixed propellant may contain from 30 to 75 parts by weight of a butane propellant (preferably n-butane) together with 70 to 25 parts of dimethyl ether. Such combinations may

produce a lower cost propellant, but for some optimized embodiments it is preferred to employ dimethyl ether as the sole propellant, especially with acrylic latex emulsions. Anhydrous systems using organic solvent solutions of acrylic polymers as copolymers (e.g., acrylic vinyl copolymers) can be used more effectively with combinations of dimethyl ether and hydrocarbon propellants. When permitted by applicable governmental regulations, chlorofluoroalkanes can be employed as full or partial substitutes for dimethyl ether. Such propellants include chlorodifluoromethane and dichlorofluoromethane. The propellant system should also act as an effective solvent for the other ingredients, especially the resin and tackifier. However, a single phase system is not essential if the phases are readily redispersible on shaking the container. It is desired to dispense an essentially homogeneous composition.

To promote water-washability of the applied composition (free from propellant/solvent), a surfactant is preferably incorporated in the aerosol formulation. Suitable surfactants include sorbitan monolaurate, alkylbenzene sulfonate, octylphenoxy polyethoxyethanol, and similar surfactants.

A general formulation of the aerosol compositions for use in this invention can be represented as follows:

General Formulation	
Ingredients	Parts by Wt.
Film-forming resin	1.00 to 12.00 (100% solids)
Tackifier/Plasticizer	1.00 to 7.00
Propellant/Solvent	78.00 to 99.00
Surfactant	0.30 to 3.00

Preferably, the formulation includes at least 4 to 5 parts by weight of the film-forming resin which may be an acrylic polymer or copolymer. Illustrative compositions based on acrylic polymers are set out below, Composition A using an acrylic polymer latex, and Composition B being an anhydrous formulation.

Composition A	
Ingredients	Parts by Wt.
Acrylic Polymer Latex (50% aqueous)	4.00 to 10.00
Rosin and/or Modified Acrylic Tackifier	1.23 to 2.33 (100% solids)
Dimethyl Ether	30.00 to 87.00
n-Butane	0.00 to 55.00
Surfactant	0.77 to 2.00
Composition B	
Ingredients	Parts by Wt.
Acrylic Vinyl Copolymer (Organic Solvent Solution)	5.00 to 15.00
Elastomeric Tackifier (e.g., Polybutene)	1.0 to 5.00
Dimethyl Ether	25.00 to 94.00
n-Butane	0.00 to 60.00
Surfactant	0.50 to 2.00

To avoid the possibility of corrosion, it is usually not desirable to employ tinplate aerosol containers with formulations like Composition A which con are less expensive than aluminum containers. This can provide a cost advantage for formulations like Composition B.

The method of this invention can be practiced with a variety of flexible sheet materials which can provide essentially non-shedding surfaces for receiving the spray. Towel paper is a preferred substrate because of its ready availability and because the absorbent character of the paper does not interfere with the production of the desired globular-type coating if carried out in accordance with the method steps of this invention. Other readily available substrates include polyethylene bags, such as sandwich or food storage bags, as well as other non-absorbent sheet material like waxed paper, aluminum foil, etc. Alternatively, cloth formed from cotton, wool, or synthetic fibers can be used as a substrate.

In applying the aerosol composition to the substrate, a short spray time should be used in order to promote an uneven, globular, discontinuous surface deposit. For example, at spray distances of from 8 to 12 inches, spraying times of 1 to 5 seconds are employed for up to each square foot of sprayed area. For example, a paper towel sheet having a surface area of up to about one square foot can be used. More specifically, at a normal spray distance of 8 to 10 inches, a spray time of 2 to 4 seconds produces the surface deposition desired for use in removing lint or hair from fabric.

Because of the volatility of the propellant/solvent, it largely dissipates in transit. Residual solvent substantially evaporates in 30 to 60 seconds following deposition. In preferred embodiments, the substrate is ready for use in less than 30 seconds following the deposition.

If the length of the spraying time is increased beyond 5 seconds, there is a greater tendency for the deposited film-forming composition to produce a continuous coating. Such coatings may contain residual solvent which will tend to promote absorption of the coating by absorbent substrates such as towel paper. Further, when applied to non-absorbent surfaces such as polyethylene bags, there is a greater tendency for the deposited material to transfer to the garment being treated. It is desirable to avoid spray applications which produce continuous coatings as the spray is deposited.

If on use of a deposit-bearing substrate it is found to be insufficiently tacky or to have an insufficient amount of deposited globules for effective removal of lint or hair, the substrate can be resprayed providing the spraying limitations above are followed.

Formulations for use in practicing the method of this invention are further illustrated by the following examples. Commercial sources of the ingredients are keyed by reference letters to a later presented table. Examples 1 and 2 are latex emulsion formulations, and Examples 3 and 4 are anhydrous formulations.

EXAMPLE 1	
Ingredients	% w/w
Concentrate	
Ucar 175 (Acrylic Polymer Latex) (50% Aqueous)[a]	8.940
Duro-Tak 80-1211 (Modified Acrylic (Solution) (44% Solids)[b]	5.078
Unitac R40 (Rosin Polyol Ester)[c]	0.080
Triton X100 (Octylphenoxy Polyethoxy-ethanol)[d].	0.894
Isopropanol	0.008
Propellant/Solvent:	
Dimethyl Ether[e]	85.000
	100.000

Manufacturing Procedure

Charge manufacturing tank with Duro-Tak. Begin mixing. Add Unitac/IPA blend. Add Triton. Increase mixer speed. Slowly add Ucar 175. Adjust to pH = 7.00 with TEA.

Charge a 53 mm x 184 mm aluminum aerosol container with 31.8 grams of above blended concentrate. Add 180.2 grams Dimethyl Ether propellant to a pressure of 63-80 psig.

EXAMPLE 2	
Ingredients	% w/w
Concentrate:	
Ucar 175 (Acrylic Polymer Latex) (50% Aqueous)[a]	10.000
Duro-Tak 80-1211 (Modified Acrylic Solution)[b]	2.840
Triton X100 (Octylphenoxy Polyethoxy-ethanol)[d]	2.000
Propellant/Solvent:	
Dimethyl Ether[e]	85.160
	100.000

Manufacturing Procedure

Charge manufacturing tank with Duro-Tak. Begin mixing. Add Triton. Increase mixer speed. Slowly add Ucar 175.

Charge a 38 mm x 107 mm aluminum aerosol container with 11.9 grams of above blended concentrate. Add 68.1 grams Dimethyl Ether propellant to a pressure of 63-80 psig.

EXAMPLE 3	
Ingredients	% w/w
Concentrate:	
Trichloroethane	4.167
Cascorez E-5317 (Resin Emulsion) (55% Aqueous Solution)[g]	8.333
Unitac R100 (Pentaerythritol Rosin Ester)[c]	4.167
Triton X100 (Octylphenoxy Polyethoxy-ethanol)[d]	1.961
Propellant/Solvent:	
Dimethyl Ether[e]	81.372
	100.000

Manufacturing Procedure

Dissolve Unitac R-100 in Trichloroethane. Add above solution to Cascorez with mixing. Add Triton X-100.

Charge a 59 mm x 218 mm aluminum aerosol container with 57.2 grams of above blended concentrate. Add 249.8 grams Dimethyl Ether propellant to a pressure of 63-80 psig.

EXAMPLE 4	
Ingredients	% w/w
Concentrate:	
Ucar 175 (50%) (Acrylic Polymer Latex) (50% Aqueous)[a]	8.900
Duro-Tak 80-1211 (44%) (Modified Acrylic Solution)[6]	5.000
Unitac R40 (90% in Isopropanol) (Rosin Polyol Ester)	0.100
Triton X-100 (Octylphenoxy Polyethoxy-ethanol)[d]	0.800
Triethanolamine	0.200
Propellant/Solvent:	
Dimethyl Ether[e]/n-Butane[g] (80/20 wt./wt.)	85.000
	100.000

Manufacturing Procedure

Charge manufacturing tank with Duro-Tak. Begin mixing. Add Unitac R40. Add Triton X-100. Increase mixer speed. Slowly add Ucar 175. Adjust to pH = 7.00 with Triethanolamine.

Charge a 53 mm x 184 mm aluminum aerosol container with 31.8 grams of above blended concentrate. Add 180.2 grams of the preblended propellant mixture to a pressure of 60-80 psig.

Commercial Sources

a. Union Carbide Corporation (Danbury, Connecticut, U.S.A.)
b. National Starch and Chemical Corporation (Bridgewater, New Jersey)
c. Union Camp Corporation (Wayne, New Jersey, U.S.A.)
d. Rohm and Haas (Philadelphia, Pennsylvania, U.S.A.)
e. E.I. DuPont de NeMours & Company (Wilmington, Delaware, U.S.A.)
f. Borden Chemical (Columbus, Ohio, U.S.A.)
g. Aeropres Corporation (Sibley, Louisiana, U.S.A.)

Use of Aerosol Formulations

Use of the foregoing aerosol formulations can be illustrated in relation to the spraying of a paper towel, which is a preferred, readily available substrate. One hand may be covered with a sheet of clean, dry paper towel, and the aerosol container held upright at about 8 to 10 inches from the towel sheet. Spraying may be carried out with a circular motion, the spraying being for about 2 to 4 seconds. Following spraying, the towel sheet is held for about 10 to 20 seconds before use, such as about 15 seconds. The sprayed side of the sheet is then used by patting it against the garment or other fabric item to lift hair, lint, etc. It is desirable to avoid wiping the fabric with the sprayed sheet. If needed, the same towel surface can be resprayed to accomplish additional or more complete removal of particulate material, providing the same spray procedure is used and the spraying is not continued or repeated until a continuous coating is formed on the sheet.

Claims

1. The method of removing lint, hair, and other particulate matter from fabric, comprising:
(a) preparing a sprayable adhesive composition in a valve-equipped aerosol container, said composition comprising an adhesive film-forming resin in admixture with a tackifier or plasticizer and an aerosol propellant in which said resin is soluble or dispersible, said propellant having a vapor pressure of 10 psig

or higher at 70° F;

(b) spraying said composition from said container onto flexible sheet material which has an essentially non-shedding surface for receiving the spray, said spraying being carried out so as to splatter said surface with tacky adherent globules of the tackified or plasticized resin without forming a continuous coating on said surface; and

(c) as soon as said globules are substantially free of said propellant contacting the sprayed surface of the sheet material to the fabric from which the particulate matter is to be removed.

2. The method of claim 1 in which said resin is an acrylic polymer or copolymer.

3. The method of claim 1 or claim 2 in which said propellant is dimethyl ether.

4. The method of claim 1 or claim 2 in which said propellant is a mixture of dimethyl ether and a hydrocarbon propellant.

5. The method of claim 1 or claim 2 in which said propellant is a mixture of dimethyl ether and n-butane.

6. The method of claim 1 in which said spraying is carried out in about 1 to 5 seconds for up to each square foot of sprayed area, and in which said sheet material is contacted with said garment in less than 30 seconds after said globules are formed thereon.

7. The method of claims 1 or 3 to 6 in which said composition is essentially anhydrous, said resin is an acrylic polymer, said tackifier or plasticizer is a modified acrylic resin, and said propellant is dimethyl ether.

8. A packaged aerosol preparation for use in applying to sheet materials for removing lint, hair and other particulate matter from fabrics, comprising a valve-equipped aerosol container having a sprayable liquid composition therein, said composition containing an acrylic polymer or copolymer resin, a tackifier or plasticizer, a surfactant, and a liquefied propellant selected from the group consisting of dimethyl ether and mixtures of dimethyl ether with a hydrocarbon propellant, said propellant having a vapor pressure at 70° F of at least 10 psig, and said preparation being sprayable onto sheet material to produce a deposition of tacky, adherent, water-washable globules.

9. The aerosol preparation of claim 8 in which said composition is essentially anhydrous, said propellant is dimethyl ether, said resin is an acrylic polymer and said composition also includes a plasticizer and/or an acrylic resin having tackifier properties.

10. The aerosol preparation of claim 8 in which said resin is an aqueous acrylic polymer emulsion.