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HAIR TREATING COMPOSITIONS CONTAINING A SATURATED HYDROCARBON AS A MOISTURE-BARRIER MATERIAL

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ABSTRACT OF THE DISCLOSURE

Prepares a hair setting composition which contains a water-soluble resin, e.g., P.V.P., a water-insoluble hydrocarbon moisture-barrier material, e.g., perhydrosqualene, and a volatile solvent; when aerol form of invention is employed, suitable propellants are added.

This invention relates to hair-setting compositions and to methods for employing the same. More particularly, it relates to hair setting compositions adapted to be applied in the form of a spray.

Many compositions have been suggested in the prior art for use in setting hair on the human head. These are designed to maintain in place a particular hairstyle into which the hair has been combed or shaped. For the most part, the compositions have taken the form om solutions of a resin in a solvent in which said solvent is volatile at ambient temperature. In use the solution is sprayed or applied to the styled hair in any suitable manner. On evaporation of the solvent, a coating of resin remains behind on the hair which serves to maintain the form of the styled hair.

A variety of resins have been proposed for use in the compositions of the type described above. One which has gained wide acceptance is polyvinylpyrrolidone, hereinafter referred to as PVP. However, the deposit of PVP or other resin left behind on the hair after evaporation of the solvent leaves the hair in a very undesirable state. Hair under these conditions is stiff, rough, dry, and scaly. Although some protection of the hair against penetration by atmospheric moisture is afforded by the resin, this effect is short-lived.

In an effort to avoid these disadvantages, plasticizers which were compatible with the resins were incorporated in the prior art hair setting compositions. Typical examples of such plasticizers are the diesters of phthalic acid, e.g. diethylphthalate, dioctylphthalate, etc. The compatible plasticizers have the effect of improving the flexibility of the resin. However, the vulnerability to moisture of hair set with a compatible plasticizer containing composition represents no improvement over the unplasticized composition.

It has now been found that the incorporation into a resin containing hair setting solution of a moisture-barrier material which is incompatible with said resin component avoids the disadvantages of the prior art compositions described above. Hair set with compositions of the present invention has a soft and silky feel without being greasy, as well as a high gloss. Furthermore, it is particularly resistant to atmospheric moisture penetration which would tend to destroy the hair set.

It is accordingly an object of the present invention to provide a relatively long acting hair setting composition capable of giving to the hair a high gloss of soft and silky feel without being greasy.

It is a further object of this invention to provide a hair setting composition capable of providing a double-moisture barrier between the hair and the atmosphere.

It is another object of the present invention to provide a method for setting hair with a composition capable of giving to the hair a long lasting effective set and a soft and silky feel with a high gloss without being greasy and at the same time, to provide an effective double-moisture barrier between the hair and the atmosphere.

Other and more detailed objects of this invention will be apparent from the following description and claims.

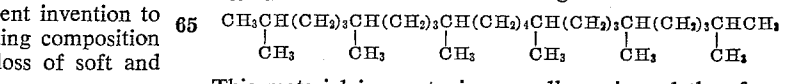
As noted above, a feature of the present invention resides in incorporating in a hair setting composition comprising a resin, such as PVP, and a solvent, a moisture-barrier material which is incompatible with said resin. The moisture-barrier material is dispersible (i.e., dissolvable or suspendable) in the solvent system and preferably, has lesser affinity for the hair than does the resin employed.

When a composition of this character is applied to the hair, e.g. by spraying, and the solvent permitted to evaporate, the hair becomes coated with a double layer of materials which serve as a double-moisture barrier. Since the resin, preferably, has greater affinity for the hair than does the moisture-barrier material, the layer closer to the hair is comprised of the resin, whereas the layer adjacent to the atmosphere is the resin-incompatible, moisture-barrier material. Desirable grooming characteristics can be built into the hair setting composition through the selection of the appropriate resin-incompatible, moisture-barrier material as described in more detail below.

It has been found in accordance with the present invention that a particular class of resin-incompatible moisture-barrier materials give especially good results. In addition to the characteristics set out above, this preferred group of moisture-barrier materials is characterized by good spreadability characteristics. This property is measured by the so-called spreading coefficient (see "Cosmetics, Science and Technology," Sagarin, 1957, pp. 1012–1013), and the moiture-barier materials of interest here have a greater spreading coefficient than mineral oil. One big advantage which flows from employing these materials of higher spreadability is the fact that they can be used in relatively low concentrations without sacrificing the moisture-barrier activity. Since moisture-barrier materials tend to be oily in character and in general, impart greasiness to the hair, the ability to use the moisture-barrier materials employed in this invention in low concentrations makes possible a product which does not leave a greasy deposit.

The moisture-barrier materials forming part of the present invention are further characterized as good gloss imparting and lubricating agents. The former improves the appearance and the latter improves the feel of the hair. This is also accomplished without the need of making a greasy product. Furthermore, said moisture-barrier materials are preferably water insoluble but readily washed out of the hair by ordinary soap or shampoo solutions.

A variety of materials can be used as moisture-barrier materials in accordance with the present invention. In general, however, they will be branched chain, saturated aliphatic hydrocarbons having from 15 to 45 carbon atoms and a boiling point of at least about 200° C. A material which is particularly suitable for use in perhydrosqualene (also known as Squalane). This has an empirical formula $C_{30}H_{62}$. The structural formula is given as follows:



This material is non-toxic, non-allergenic and therefore, completely compatible with the human epidermis. It imparts a higher degree of *gloss* and combability to the hair than equal amounts of phenyl silicone oils, mineral oil or ethoxylated lanolin derivatives.

A variety of film forming resins are known in the prior art which are suitable for employment in an aerosol hair spray composition designed for use as a hair setting agent. These include polyvinylpyrrolidone as well as copolymers thereof, as for example set forth in column 2 of U.S. Patent 3,073,794. Moreover, encompassed in this group are the alkyl-substituted PVP compounds (U.S. Patent 2,948,656) 5,5'-dialkylhydantoin-formaldehyde resins (U. S. Patent 2,956,927) and polyvinyl imidazole polymers (U.S. Patent 2,953,498). Any of the resins mentioned above, which are preferably water soluble, and which are soluble in the solvent system utilized in the instant composition may be used in accordance with the present invention. The water-soluble characteristics of the resin facilitates its removal in washing. However, the preferred resin is PVP. This is available, commercially, in several degrees of polymerization. Typical PVP resins which can be used have a molecular weight in the range of about 10,000 to 360,000. In this group the preferred material is known in the art as PVP K–30 which has an average molecular weight of about 40,000.

The solvent system employed in this invention can be any system in which the resin and moisture-barrier materials are dispersible, i.e., dissolvable or suspendable. Since these products are designed particularly with the view of employing them as a spray, the solvents are preferably readily volatile at ambient temperatures. Furthermore, since the product is intended to be used in connection with propellants which will serve to convey the composition out of the container, it is desirable that the solvent also be miscible with the propellant. Of particular utility in this regard are the lower aliphatic alcohol solvents, and especially the alkyl alcohol solvents, e.g., methyl, ethyl, propyl, iso-propyl alcohols.

Although anhydrous solvent systems have been found to be suitable for the present invention, it is beneficial to incorporate a small quantity of water in the composition. This has been discovered to have a marked effect in making the resin deposited on the hair feel softer. The quantity of water can vary, but best results were obtained with a composition to which was added about .5% water by weight based on the total weight of the composition.

In preparing a product of the present invention for use in an aerosol container, any of the well-known propellants may be used. It is advantageous to employ a propellant and solvent system that are miscible with each other. It is preferred to employ fluorinated hydrocarbon propellants, of the kind available under the proprietary designation "Freon" from E. I. du Pont de Nemours & Co. (Inc.), Wilmington, Del.; or under the proprietary designation "Genetron" from Allied Chemical & Dye Corporation, New York, N.Y.; or under the proprietary designation "Isotron" from Pennsalt Chemicals Corporation, Philadelphia, Pa. Useful propellants are those made by compounding mixtures of various "Freon" individuals, e.g., "Freon" 11 (trichloromonofluoromethane), "Freon" 12 (dichlorodifluoromethane) and "Freon" 114 (symmetrical dichlorotetrafluoroethane). Especially useful are mixtures of "Freon" 11 and "Freon" 12 in the proportions recommended by the manufacturers for pressure ranges of 12–60 p.s.i.g. It is also advantageous to use a stabilizer, such as nitromethane, with the Freons and particularly, with "Freon" 11 and 12.

In addition to the ingredients outlined above, other ingredients may also be added to the composition. Thus, a plasticizer which is compatible with the resin may be added to impart flexibility to the resin film deposited on the hair. The phthalic acid esters and particularly, the diesters of phthalic acid, e.g., diethyl phthalate, and dioctyl phthalate are especially suitable for this purpose. Moreover, suitable perfumes may be added to make a more elegant product.

The relative quantities of the several materials that may be incorporated in the compositions of the present invention may vary according to the use to which the compositions are to be put or the particular character of the hair setting composition which is to be emphasized. Thus, in compositions which are intended for use on hard to hold hair, larger quantities of resin and moisture-barrier material are utilized. Furthermore, if a softer feel is desired or required this can be accomplished by increasing the water content. If a smoother feel is necessary, this can be obtained by increasing the quantity of moisture-barrier material. Moreover, to get a crisper effect a larger amount of resin is incorporated in the composition.

The relative quantities of solvent and propellant, when used, may also vary widely depending on the choice of aerosol-valve buttons. This does not affect the final outcome on the hair.

In general, it may be stated that the constituents of this composition can be employed in the ranges set forth in Table I below. The percentages and ratios in Table I and those expressed elsewhere herein are on a weight basis unless otherwise specified.

TABLE I

Ingredient	General Range, Percent of Total	Preferred Range, Percent of Total
Resin (e.g. PVP K-30)	.5 to 4.5	.7 to 4.2
Compatible Plasticizer (e.g. Diethylphthalate)	.05 to .45	.07 to .42
Moisture-Barrier Material (e.g. Perhydrosqualene)	.01 to .7	.01 to .3
Water	0 to .5	.5

The balance of the compositions of Table I are made up with a mixture of solvent (e.g., ethanol), a propellant (e.g., mixture of Freon 11 and Freon 12) and a small quantity of perfume if desired.

Within the values given in Table I the resin, compatible plasticizer and moisture-barrier material are advantageously employed in the following ratio based on the resin component:

	Resin (PVP K-30)	Compatible Plasticizer	Moisture-Barrier Material (Perhydrosqualene)
General Ratio	1	.05 to .2	.02 to .4
Preferred Ratio	1	.1	.136

The relative quantities of propellant and solvent may also vary considerably without materially effecting the functioning of the composition. In general they will fall in the range of from 50 parts of propellant to 50 parts of solvent, up to 80 parts of propellant to 20 parts of solvent. A very suitable ratio is about 70 parts of propellant to 30 parts of solvent.

Worthy of special mention are compositions containing 1.25% by weight based on resin, and particularly PVP K–30 and from .025% to .2% of moisture-barrier material, e.g., perhydrosqualene. Hair treated with such compositions had a good feel without any objectionable oiliness.

The compositions of the present invention are prepared by mixing the ingredients together. Where an aerosol product is made, the procedures well-known to those skilled in the art can be employed. (See Examples III and IV of U.S. Patent 2,953,498.)

The following examples are further illustrative of the present invention. It should be understood, however, that the invention is not limited thereto.

In Example 1 below two typical compositions embodied in the present invention are given. One is for hard to set hair and the other is for regular hair.

EXAMPLE 1

	Typical Hard to Hold	Typical Regular
Percent PVP K-30 (A.M.W. 40,000)	3.00	1.60
Percent Diethylphthalate	0.30	0.16
Percent Perhydrosqualene	0.40	0.25
Percent Perfume	0.07	0.07
Percent Water	0.60	0.40
Percent Ethanol	20.63	37.52
Percent Freon 11 (trichloromonofluoromethane)	50.00	36.00
Percent Freon 12 (Dichlorodifluoromethane)	25.00	24.00

The following examples further illustrate a variety of compositions which fall within the scope of the present invention.

Ingredients in weight percent	Example No. 2	3	4	5	6
PVP K-30 [1]	0.700	0.700	0.700	0.700	1.400
Diethylphthalate	0.070	0.070	0.070	0.070	0.140
Perhydrosqualene	0.014	0.014	0.112	0.112	0.028
Perfume	0.070	0.070	0.070	0.070	0.070
Water	0.000	0.500	0.000	0.500	0.000
Ethanolanhydrous	44.146	43.646	44.048	43.548	33.362
Freon 11 [2]	33.000	33.000	33.000	33.000	33.000
Freon 12 [3]	22.000	22.000	22.000	22.000	22.000

Ingredients in weight percent	Example No. 7	8	9	10	11
PVP K-30 [1]	1.400	1.400	1.400	4.200	4.200
Diethylphthalate	0.140	0.140	0.140	0.420	0.420
Perhydrosqualene	0.028	0.224	0.224	0.056	0.056
Perfume	0.070	0.070	0.070	0.070	0.070
Water	0.500	0.000	0.500	0.000	0.500
Ethanolanhydrous	32.862	33.166	32.666	40.354	39.854
Freon 11 [2]	33.000	33.000	33.000	33.000	33.000
Freon 12 [3]	22.000	22.000	22.000	22.000	22.000

Ingredients in weight percent	Example No. 12	13	14	15	16
PVP K-30 [1]	4.200	4.200	0.700	0.700	0.700
Diethylphthalate	0.420	0.420	0.070	0.070	0.070
Perhydrosqualene	0.672	0.672	0.014	0.014	0.112
Perfume	0.070	0.070	0.070	0.070	0.070
Water	0.000	0.500	0.000	0.500	0.000
Ethanol	39.638	39.138	24.146	23.646	24.048
Freon 11 [2]	33.000	33.000	53	53	53
Freon 12 [3]	22.000	22.000	22	22	22

Ingredients in weight percent	Example No. 17	18	19	20	21
PVP K-30 [1]	0.700	1.400	1.400	1.400	1.400
Diethylphthalate	0.070	0.140	0.140	0.140	0.140
Perhydrosqualene	0.112	0.028	0.028	0.224	0.224
Perfume	0.070	0.070	0.070	0.070	0.070
Water	0.500	0.000	0.500	0.000	0.500
Ethanol	23.548	23.362	22.862	23.166	22.666
Freon 11 [2]	53	53	53	53	53
Freon 12 [3]	22	22	22	22	22

Ingredients in weight percent	Example No. 22	23	24	25
PVP K-30 [1]	4.200	4.200	4.200	4.200
Diethylphthalate	0.420	0.420	0.420	0.420
Perhydrosqualene	0.056	0.056	0.672	0.672
Perfume	0.070	0.070	0.070	0.070
Water	0.000	0.500	0.000	0.500
Ethanol	20.354	19.854	19.638	19.138
Freon 11 [2]	53	53	53	53
Freon 12 [3]	22	22	22	22

Ingredients in wieght percent	Example No. 26	27
PVP K-30	1.25	1.25
Diethylphthalate	.125	.125
Perhydrosqualene	.2	.025
H_2O	.5	.500
Perfume	.07	.070
Freon 11	33	53.000
Freon 12	22	22.000
Ethanol	42.855	23.030

[1] A.M.W.—40,000.
[2] Trichloromonofluoromethane.
[3] Dichlorodifluoromethane.

The moisture-barrier materials employed in the present invention and particularly, perhydrosqualene are superior to mineral oil in impeding the passage of water vapor and are, therefore, capable of forming with the resin a more effective double-moisture barrier. The following experiment illustrates this improved moisture-barrier property:

Experiment 1

To each of three 3-inch petri dishes was added 10 grams of water. One was used as a control, 0.1 gram of perhydrosqualene was added to the second and 0.1 gram of mineral oil was added to the third. The samples were allowed to evaporate at room temperature for 24 hours, and the loss in weight was determined. Results are given below:

Percent loss in weight: Control, 65; Mineral oil, 57; Perhydrosqualene, 52.

Observation of the above samples showed that the perhydrosqualene spreads over a much larger area than the mineral oil. This spreadability accounts for the better resistance to moisture vapor and also for the fact that lower concentrations of perhydrosqualene are more effective than higher concentrations of mineral oil in imparting a good feel and gloss.

As mentioned above, a feature of the present invention is the formation of a double-moisture barrier on the hair because of the high degree of incompatibility between the moisture-barrier material and the resin. The following experiment supports this position. In it the incompatibility of perhydrosqualene with two common hair spray resins, PVP K-30 and Resyn 28-1310 (polyvinyl acetate copolymer), was verified by phase contrast microscopy. Comparisons are made with DC 555 (Silicone oil) and dibtuylphthalate.

Experiment 2

Samples were made up as hair sprays with varying quantities of plasticizers and sprayed on glass slides. After evaporation of solvent, the resin particles were observed by phase contrast microscopy for insoluble oil droplets. The concentrations below which the oil droplets were no longer visible are given:

	DC 555	Dibutyl Phthalate	Perhydrosqualene	Ratio of Perhydrosqualene: PVP
4.35% PVP	0.2	0.1	0.006	1:725
1.25% PVP	(1)	(1)	0.0025	1:500
2.4% Resyn 28-1310	0.01	0.1	0.004	1:600

[1] Not run.

It is evident that since separate oil droplets disappear only at much lower concentration with perhydrosqualene as compared with DC 555 and dibutylphthalate that this material is much more incompatible with the resins and more capable of forming two layers.

Although the invention has been described with reference to specific forms thereof, it will be understood that many changes and modifications may be made without departing from the spirit of this invention.

What is claimed is:

1. A hair setting composition comprising:

	Percent by weight
Polyvinylpyrrolidone average molecular weight 40,000	.5 to 4.5
Diethylphthalate	.05 to .45
Perhydrosqualene	.01 to .7
Water	0 to .5

dissolved in a solvent system comprising ethanol and a propellant comprising a mixture of dichlorodifluoromethane and trichloromonofluoromethane, the ratio of polyvinylpyrrolidone:diethylphthalate:perhydrosqualene, being 1:.05 to .2:.02 to .4, and the ratio of propellant to ethanol being in the range of about 50 parts of propellant to 50 parts by weight of ethanol to 80 parts of propellant to 20 parts of ethanol by weight.

2. A hair setting composition comprising:

	Percent by weight
Polyvinylpyrrolidone average molecular weight 40,000	.7 to 4.2
Diethylphthalate	.07 to .42
Perhydrosqualene	.01 to .3
Water	0 to .5

dissolved in a solvent system comprising ethanol and a propellant comprising a mixture of dichlorodifluoromethane and trichloromonofluoromethane, the ratio of polyvinylpyrrolidone:diethylphthalate:perhydrosqualene being 1:.1:.136 and the ratio of propellant to ethanol being about 70 parts by weight of propellant to 30 parts by weight of ethanol.

3. A hair setting composition capable of imparting to said hair protection against moisture, said composition comprising a volatile lower alkyl alcohol containing therein from .5% to 4.5% by weight of polyvinylpyrrolidone and from .01 to .7% by weight of a saturated aliphatic hydrocarbon moisture-barrier material having from 14 to 45 carbon atoms, said moisture-barrier material also having a boiling point of at least 200° C. and a spreading coefficient greater than mineral oil.

4. A composition according to claim 3 wherein said moisture-barrier material is perhydrosqualene.

5. A composition according to claim 4 also including from .05% to .45% by weight of a diester of phthalic acid as a plasticizer.

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