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METHOD OF AND LIQUID COMPOSITION FOR CLEANING ELECTRICALLY INSULATED ARTICLES

Robert T. K'Burg, Niagara Falls, N. Y., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del., a corporation of Delaware

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This invention relates to liquid cleaning compositions and particularly to liquid compositions for use in the cold cleaning of electrically insulated articles such as electric motor windings and the like.

There is a large demand for a relatively inexpensive composition of the organic type for use as a cold cleaner for removing oils, grease, dirt and the like from electrically insulated parts and articles. Gasolene has been used for that purpose and effects good cleaning, but its use is extremely hazardous because of its high flammability. Gasolene-carbon tetrachloride mixtures have been suggested and used. However, such mixtures are far from satisfactory due in large measure to the high toxicity of carbon tetrachloride. Furthermore, even when containing as much as 50% by volume of carbon tetrachloride such mixtures have flash points as low as about 5° F. and burn at ordinary temperatures so that their use involves a serious fire hazard. These and other disadvantages attending the use of said mixtures have been widely recognized as being so serious as to result in the prohibition of the use of such mixtures in many industrial establishments while other concerns have prohibited their use except under very restricted conditions.

It is an object of the present invention to provide an improved solvent mixture for the cold cleaning of electrically insulated solid articles and an improved method of cleaning such articles to remove oils, grease and the like efficiently therefrom without damaging the electric insulation. These and still further objects will be apparent from the following description of the invention.

The above objects are accomplished in accordance with the invention by the preparation and/or use for the cold cleaning of electrically insulated articles and parts, of a solvent mixture containing 36 to 63% by weight of a petroleum naphtha, the remainder of the composition comprising methylene chloride and perchloroethylene. I have discovered that such mixtures are well suited for the use indicated and are outstandingly superior to solvents or solvent mixtures known and used heretofore.

The term "cold cleaning" is used herein to mean cleaning by means of the solvent mixture in liquid form at a temperature not exceeding about 95° F., e. g., at 60° to 85° F. Cleaning at such temperatures is preferably accomplished by spraying the article to be cleaned with the liquid mixture. Alternatively, the mixture may be applied to article by means of a brush or a cloth previously dipped in the liquid. In such methods

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the mechanical action on the dirt particles of, for example, the jets of spray or the brushing, aids in the cleaning. If desired, cleaning may be accomplished by dipping or immersing the article in the liquid. In all such instances the cleaning mixture is employed as a liquid, generally at ordinary temperatures and liquid retained on the article is permitted to evaporate therefrom after the cleaning operation. Evaporation should generally be carried out in vented spaces or in relatively large well ventilated areas provided for that purpose. The cleaning operation, including drying, usually involves only a minute or so, e. g., up to 2 or 5 minutes. Contact of the article with the liquid for more than 5 minutes is seldom if ever required, although most commonly used insulation materials of the present type may remain in contact with the liquid mixtures for as long as 10 minutes without substantial damage.

The petroleum naphtha constituent of the mixture should have a distillation range within the range 300 to 410° F. and a flash point not lower than 100° F., e. g., 100 to 150° F. as determined by method described in Cross' "Handbook of Petroleum, Asphalt and Natural Gas," published as Bulletin No. 25 by the Kansas City Testing Laboratory, pages 650–651 and 660. The naphtha should be free of aromatic hydrocarbons such as benzene, toluene and the like and of unsaturated hydrocarbons. The well-known Stoddard Solvent, which is a petroleum naphtha having a distillation range as indicated above and a flash point of not lower than 100° F., is particularly well suited for use in practicing the invention. For many uses naphthas having a distillation range within the above range and a flash point of 100 to 140° C. is preferred while for certain applications a petroleum naphtha having a higher flash point, e. g., around 140 to 150° F., and a distillation range of 350 to 410° C. may be preferred.

The amount of petroleum naphtha in the solvent mixture should not exceed 63% nor be less than 36% by weight. The preferred range is 46 to 57%. If substantially more than 63% is present the mixture becomes flammable. Mixtures containing less than 36%, i. e., more than 64% by weight methylene chloride and perchloroethylene, may cause substantial damage to the insulation. The balance of the mixture will comprise methylene chloride and perchloroethylene in a weight ratio of 2 to 5 and preferably 2.5 to 4.5 parts of the former per 1 part of the latter.

I have discovered that electrical insulation materials which may be successfully cold cleaned with the above liquid compositions without harm-

ful effects resulting are those non-thermoplastic resinous materials which are adapted for use in insulating motor windings and the like. Specific examples of such materials are shellac and synthetic resins of the phenol-aldehyde, alkyd, superpolyamide and amine-aldehyde (including aniline-aldehyde, casein-aldehyde and urea-aldehyde) and silicone types, as contrasted with the thermoplastic rubber type insulating materials. The insulation may comprise a combination of such resinous material with, for example, a fibrous material, or it may contain only the resinous material, which may be applied to the article to be insulated in the form of a varnish or a lacquer.

I have found that petroleum naphtha alone is not at all suitable for the present purpose in that it is flammable and leaves on the cleaned parts an oily film which facilitates accumulation of dust and dirt thereafter. Methylene chloride or perchloroethylene alone, or mixtures of the two, is also not suitable for use in that substantial damage to electrical insulation of the types frequently used for motor windings results therefrom and in some instances the damage is such as to render the insulation worthless. The present invention is based upon the discovery that mixtures containing all three of the above ingredients in the proportions indicated accomplish excellent cleaning without leaving objectionable oily films thereon and without detectable or measurable damage to the insulation. The fact that such mixtures are relatively non-toxic and are non-flammable are added important advantages. The present compositions have no flash point up to their boiling points as determined by standard open and closed cup methods (described on pages 659 and 660 of the above mentioned Handbook of Petroleum, Asphalt and Natural Gas), although their vapors will burn with supported combustion. By the latter it is meant that if the vapors are added to a flame they will burn in the flame rather than extinguish it, but they will cease burning as soon as the flame is withdrawn.

Generally, it is desirable that compositions for cold cleaning purposes have a density not substantially greater than that of water and preferably lower. The reason for this is that if the density is substantially greater than that of water the mixture will be pocketed under water in sumps, pits, and other low places which would be objectionable for obvious reasons. The present compositions, particularly the preferred compositions, all have densities which are substantially equal to or lower than the density of water and no difficulty is experienced when using such compositions in their being pocketed under water as noted above.

The present mixtures are much less toxic than, for example, gasolene-carbon tetrachloride mixtures, and may be used much more widely and with less danger of harmful physiological effects. As far as is known, vapors of the present compositions exert no cumulative or permanent physiological effects upon the human system and in this respect as vastly superior to mixtures containing carbon tetrachloride. However, as is the case with all organic vapors and gases, undue exposure of workers to vapors from the mixtures should be avoided and best practice involves using the mixtures in well ventilated areas.

Specific examples of the present cold cleaning compositions are shown in the following examples in which concentrations of the components are expressed in weight percent.

Example 1

	Percent
Petroleum naptha, distillation range 302 to 392° F., flash point 105° F	57.0
Methylene chloride	34.5
Perchloroethylene	8.5
	100.0

The above composition was used to remove oily and greasy dirt from a 350 H. P. 2200 volt synchronous motor winding at room temperature by the spraying method. The cleaning action was rapid and efficient and no obnoxious odor was noted by the workmen. The composition had a density of

$$0.945 \frac{20°}{4° C.}$$

and, hence, did not pocket under water in low places. Solvent which adhered to the motor winding evaporated rapidly after the spraying to leave the part in a dry clean condition within a total elapsed time of about 3 minutes. No visible damage to the alkyd resin type insulation could be detected and dielectric strength tests showed no loss whatsoever in its insulating value.

Example 2

	Percent
Petroleum naphtha, distillation range 302 to to 392° F., flash point 105° F	46.0
Methylene chloride	38.5
Perchloroethylene	15.5
	100.0

Example 3

	Percent
Petroleum naphtha, distillation range 350 to 410° F., flash point 145° F	57.0
Methylene chloride	34.5
Perchloroethylene	8.5
	100.0

Example 4

	Percent
Petroleum naphtha, distillation range 350 to to 410° F., flash point 145° F	46.0
Methylene chloride	38.5
Perchloroethylene	15.5
	100.0

Compositions 2, 3 and 4 may be used as described in Example 1 to give substantially the same results. Parts insulated with any of the non-thermoplastic resinous materials specifically set forth hereinabove may be successfully cleaned in a similar manner.

In addition to being relatively non-toxic and non-flammable as compared with gasolene-carbon tetrachloride compositions used heretofore for similar purposes, the present compositions have the further distinct advantage of being non-corrosive. Carbon tetrachloride and compositions containing the same are notoriously corrosive to various industrial metals, particularly in the presence of moisture, in view of which corrosion of containers and of delicate electric parts by carbon tetrachloride mixtures has been recognized as a serious disadvantage attending their use. In contrast, no corrosion problems are presented in either the storage or use of the present compositions even under moist conditions.

I claim:

1. A liquid cleaning composition for the cold cleaning of solid electrically insulated articles and parts to remove therefrom oils, greases and dirt, comprising 36 to 63% by weight of a petroleum naphtha having a distillation range of 300 to 410° F. and a flash point not lower than 100° F., the remainder of the composition comprising methylene chloride and perchloroethylene in a weight ratio of 2 to 5 parts of the former to 1 part of the latter.

2. A composition according to claim 1 wherein the weight ratio of methylene chloride to perchloroethylene is 2.5 to 4.5 parts of the former to 1 part of the latter.

3. A composition according to claim 1 wherein the naphtha content is 46 to 57% by weight.

4. The composition according to claim 3 wherein the weight ratio of methylene chloride to perchloroethylene is 2.5 to 4.5 parts to 1 part of the latter.

5. A method of removing oils, greases and dirt from solid electrically insulated articles, comprising subjecting such articles at a temperature not greater than 95° F. to the action of a liquid composition comprising 36 to 63% by weight of a petroleum naphtha having a distillation range of 300 to 410° F. and a flash point not lower than 100° F., the remainder of said composition comprising methylene chloride and perchloroethylene in a weight ratio of 2 to 5 parts of the former to 1 part of the latter, and limiting contact of said articles with said liquid composition to not more than 10 minutes' duration.

6. A method of removing oils, greases and dirt from electrically insulated articles, comprising subjecting said articles at a temperature not greater than 95° F. to the action of a liquid composition comprising 46 to 57% by weight of a petroleum naphtha having a distillation range of 300 to 410° F. and a flash point not lower than 100° F., the remainder of said composition comprising methylene chloride and perchloroethylene in a weight ratio of 2.5 to 4.5 parts of the former to 1 part of the latter, and limiting contact of said articles with said liquid composition to not more than 5 minutes' duration.

ROBERT T. K'BURG.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,759,155	Farrington	May 20, 1930
1,944,859	Born	Jan. 23, 1934
1,989,478	Grebe et al.	Jan. 29, 1935
2,462,982	MacClean	Mar. 1, 1949

FOREIGN PATENTS

Number	Country	Date
584,515	Germany	Sept. 22, 1933