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(54) **Self service dry cleaning using siloxane solvent and machine powered by single phase electricity**

(57) The invention provides a method of self service dry cleaning using a dry cleaning composition comprising siloxane solvent(s) and a machine powered by single phase electricity.

EP 1 420 107 A1

Description

FIELD OF THE INVENTION

5 **[0001]** This invention is directed to a method of self service dry cleaning (e.g., in the home or self operated in a laundromat or other area) using a dry cleaning composition comprising a siloxane solvent(s) and a machine powered by single phase electricity.

BACKGROUND OF THE INVENTION

10 **[0002]** In many cleaning applications, it is desirable to remove contaminants (e.g., stains) from substrates, like metal, ceramic, polymeric, composite, glass and textile comprising substrates. Particularly, it is highly desirable to remove contaminants from clothing whereby such contaminants include dirt, salts, food stains, oils, greases and the like.

15 **[0003]** Typically, dry cleaning systems use organic solvents, like chlorofluorocarbons, perchloroethylene and branched hydrocarbons to remove contaminants from substrates. In response to environmental concerns, other dry cleaning systems have been developed that use inorganic solvents such as densified carbon dioxide, to remove contaminants from substrates. The systems that use organic or inorganic solvents to remove contaminants from substrates generally employ a surfactant and a polar co-solvent so that a reverse micelle may be formed to trap the contaminant targeted for removal.

20 **[0004]** The use of organic solvents, however, is no longer favored since preferred organic solvents, like halogenated hydrocarbons, often lead to environmental hazards and health risks. Also, densified carbon dioxide is not always a desired solvent since machines that use such a solvent can be dangerous since they operate at very high pressures.

[0005] An alternative solvent group which has been used are the siloxane solvents (e.g., both linear and cyclic solvents).

25 **[0006]** Commercial/industrial dry cleaning machines are used outside the home. Typically, these machines are powered by 3-phase electricity which has higher voltage than one phase electricity. Three phase motors are smaller than one phase motors and, therefore, are generally cheaper to make.

30 **[0007]** There are fabric cleaning machines which use non-aqueous solvents, including silicone (see, for example, WO 01/94682, assigned to Procter & Gamble). It is not clear whether these types of machines are powered by one phase or three phase electricity. Further, previous machines using non-aqueous fluids have also used 3-phase electricity. Thus, machines for dry cleaning (using non-aqueous siloxane solvents) powered by single phase electricity are simply not clearly disclosed or suggested by the art.

35 **[0008]** The impetus to creating the dry cleaning machines using siloxane solvent and single phase electricity of the subject invention was two-fold. First, since the machines of the invention is intended for in home or self service commercial use, the lower voltage single phase electricity is safer for homes. Also, there is less worry about ensuring wiring is absolutely correctly done as would be the case for three phase electricity wiring. The second reason has to do with use of siloxane solvent. Specifically, while siloxane solvents have many advantages over other solvents, for reasons noted above, their flashpoint may make them susceptible to flammability problems. Thus, to ensure the preferred siloxane solvents can be used, especially for in-home environment, it has been found that use of lower voltage single phase electricity is highly desirable.

40 **[0009]** Thus, the present invention is directed to a method of dry cleaning articles in home or in self operated environment, which method comprises using dry cleaning machine systems comprising siloxane solvent and wherein the system is powered by single phase electricity.

BACKGROUND MATERIAL

45 **[0010]** U.S. Patent No. 6,258,130 to Murphy discloses a dry cleaning system using linear silicone oligomer and optionally functionalized surfactants and polar molecules.

[0011] U.S. Patent No. 5,942,007 to Berndt et al. discloses dry cleaning with cyclic siloxane.

50 **[0012]** EP 1,043,443 (assigned to GE) discloses a method for cleaning and preventing redeposition on clothes using linear or branched siloxane solvent and one or more surfactants.

[0013] None of the references disclose use of siloxane in machines powered by single phase electricity.

SUMMARY OF THE INVENTION

55 **[0014]** The present invention is directed to a method of dry cleaning articles in a machine for self service dry cleaning (e.g., in the home or self operated in laundromat or elsewhere), wherein machines are powered by a particular power source and use a particular solvent. More particularly, the invention is concerned with a method of self service dry

cleaning using dry cleaning solvent comprising linear or cyclic siloxane in a machine powered by single phase electricity.

[0015] Specifically, the present invention comprises a method for dry cleaning laundry fabrics (e.g., articles of clothing, linen, drapery etc.) comprising contacting a fabric or fabrics with a dry cleaning composition comprising a linear, branched or cyclic siloxane, wherein the machine in which the fabric article is cleaned is powered by single phase electricity.

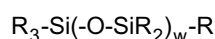
DETAILED DESCRIPTION OF THE INVENTION

[0016] The invention is directed to dry cleaning process combining dry cleaning in a dry cleaning composition comprising linear or cyclic siloxane and using a machine powered by single phase electricity. (It should be clear that, although we are using the term "dry cleaning", cleaning applies to all articles of laundry (e.g., clothes), including those traditionally cleaned in water and which, according to the subject invention, are cleaned in non-aqueous solvent). Because these machines may be used in the home and because of slightly potentially greater problems associated with flammability of siloxane solvents (notwithstanding their other multiple benefits in other regards), it has been found advantageous to use machines comprising siloxane solvent (for their advantages) powered by single phase electricity power source (which not only allows safe use of siloxane solvents in in-house machines, but further allows less concern about wiring).

[0017] The laundry article or fabric (e.g., soiled laundry articles) which may be dry cleaned in the invention includes men's and women's suits, coats, rugs, slacks, curtains, linen, upholstery, drapery, shirts, clothing accessories etc. although these examples are not intended to be limiting in any way. As noted above, the intention is to cover even articles traditionally cleaned in water.

[0018] There is generally no limitation with respect to the solvent comprising linear or cyclic substance other than that the solvent may be employed to clean the laundry article or substrate.

[0019] The siloxane solvent of the invention may be linear, branched or cyclic or some combination thereof of these. Linear and cyclic oligo dimethylsiloxanes are a preferred group. Also preferred is an alkylsiloxane represented by the formula:



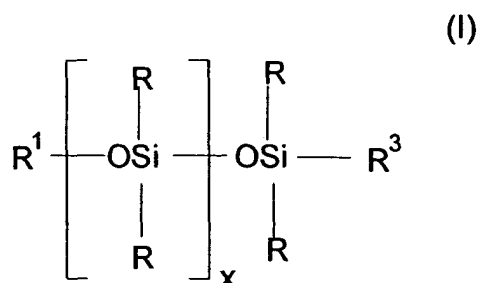
where each R is independently chosen from an alkyl group having from 1 to 10 carbon atoms and w is an integer from 1 to 30. Preferably, R is methyl and w is 1-4, even more preferably w is 2 or 3.

[0020] Of the cyclic siloxanes, octamethyl cyclotetrasiloxane and decamethyl cyclopentasiloxane are particularly effective.

[0021] Very useful siloxanes are selected from the group consisting of hexamethyldisiloxane, octamethyltrisiloxane, decamethyltetrasiloxane and mixtures thereof.

[0022] A typical commercially available cyclic siloxane based solvent is available from Green Earth Cleaning, LLC. The cyclic siloxane based solvent generally has flash point over 65°C, with octamethyl-cyclotetrasiloxane and decamethyl-cyclopentasiloxane being preferred. A detailed description of such commercially available siloxane comprising solvent may be found in U.S. Patent No. 5,942,007 to Murphy, the disclosure of which is hereby incorporated by reference into the subject application.

[0023] Preferred linear silicone polymers will have the following formula.



wherein each R is independently a substituted or unsubstituted linear, branched or cyclic C₁₋₁₀ alkyl, C₁₋₁₀ alkoxy, substituted or unsubstituted aryl, aryloxy, trihaloalkyl, cyanoalkyl or vinyl group, and R¹ is a hydrogen or a siloxy group having the formula:



and each R^2 is independently a linear, branched or cyclic C_{1-10} substituted or unsubstituted alkyl, C_{1-10} alkoxy, aryloxy, substituted or unsubstituted aryl, trihaloalkyl, cyanoalkyl, vinyl group, amino, amido, ureido or oximo group, and R^3 is an unsubstituted or substituted linear, branched or cyclic C_{1-10} alkyl, or hydroxy, or $\text{OSi}(\text{R}^2)_3$ whereby R^2 is as previously defined, and x is an integer from about 0 to about 20.

[0024] A particularly preferred such linear solvent is one wherein each R is methyl, R^1 is $\text{Si}(\text{R}^2)_3$, R^2 is methyl and R^3 is methyl. Preferably, x is an integer from about 0 to about 10, and most preferably, is an integer from about 2 to about 5, including all ranges subsumed therein.

[0025] Such solvents are made commercially by General Electric and Dow Corning under the name Dow Corning 200® fluid. A description of the solvents may be found in U.S. Patent Nos. 3,931,047 and 5,410,007, the disclosures of which are incorporated herein by reference.

[0026] The solvent comprising the linear silicon comprising oligomer that may be used is often made by equilibration of the appropriate proportions of end capped and monomer units according to the reaction: $\text{MM} + x\text{D} \rightarrow \text{MD}_x\text{M}$. Such a reaction is generally known as an equilibration reaction, and is catalyzed by an acid or a base. Similar reactions are depicted in *Silicone Surfactants*, as edited by Randall Hill, Marcel Dekker (Vol.96) 1999, the disclosure of which is incorporated herein by reference. Other similar descriptions of the synthesis of similar oligomers may be found in U.S. Patent No. 3,931,047 and 5,410,007, the disclosures of which are incorporated herein by reference. Also, the solvents are often made commercially available by Dow Corning (e.g., Dow Corning 200 (R) fluids) and The General Electric Company.

[0027] It is noted that while the solvent comprising the linear silicon comprising oligomer may comprise of linear silicon comprising oligomer, it is also within the scope of the invention for the solvent to consist essentially of or consist of the same. Moreover, as used herein, oligomer is defined to mean a compound represented by Formula I wherein x is an integer from about 0 to about 20.

[0028] When dry cleaning clothing or garments, for example, with the cleaning solvent comprising the linear, branched or cyclic comprising oligomer described in this invention, the type of machine that may be used for the dry cleaning process is the same or substantially the same as the commonly used dry cleaning machines used for dry cleaning with perchloroethylene. Such machines typically comprise a solvent tank or feed, a cleaning tank, distillation tanks, a filter and solvent exit. These commonly used machines are described, for example, in U.S. Patent No. 4,712,392, the disclosure of which is incorporated herein by reference.

[0029] Once the garment is placed in the machine and the solvent of this invention is fed into the machine, the normal cleaning cycle is run (typically between ten (10) minutes and one (1) hour) and the garment is cleaned. Thus, in order to demonstrate cleaning, it is not required to add anything to the cleaning machine other than the garment and the linear solvent of this invention.

[0030] In a preferred embodiment, however, the cleaning solvent of this invention further comprises from about 0.001% to about 5.0%, and preferably, from about 0.01% to about 1.0%, and most preferably, from about 0.1 % to about 0.3% by weight of a silicone oil, based on total weight of cleaning solvent and silicone oil, including all ranges subsumed therein. The silicone oil often preferred in this invention is an alkoxyated polydimethylsiloxane with a molecular weight from about 600 to about 20,000. The silicone oil preferably has ethoxy and/or propoxy pendants, with ethoxylated pendants being especially preferred. It is also noted that such an alkoxyated polydimethylsiloxane may also have alkoxyated end functionalization; however, a silicone oil with less than 50% of all sites on the silicone oil backbone capable of being functionalized ethoxy groups is especially preferred. Illustrative examples of such silicone oils are Silwet® 7622, 7602, 7605, 7600, 7230 and 7200, all of which are commercially available from Witco.

[0031] In addition to silicone oil, it is especially preferred to add from about 0.01% to about 10.0%, preferably about 0.03 to about 3.0% and more preferably, from about 0.05 to about 1.0%, and most preferably, from about 0.1 to about 0.5% by weight of a polar additive (e.g., C_{1-10} alcohol and preferably water), based on total weight of cleaning solvent, silicone oil and polar additive, including all ranges subsumed therein. Such an addition (silicone oil and water) to the cleaning solvent is often desired so that cleaning may be enhanced, for example, by the formation of reverse micelles.

[0032] In another preferred embodiment, it is within the scope of this invention to employ (with or without silicone oil and/or water) 0.001% to about 10%, and preferably, from about 0.05% to about 0.25%, and most preferably, from about 0.1 to about 0.20 by weight of at least one member selected from the group consisting of an unfunctionalized siloxane and a functionalized siloxane (based on total weight of cleaning solvent and unfunctionalized or functionalized siloxane), including all ranges subsumed therein.

[0033] The unfunctionalized siloxane is similar to the cleaning solvent represented by Formula I, except that X is greater than 20, and the functionalized siloxane is one having a molecular weight ranging from about 300 to about 20,000. The former is commercially available from The General Electric Company and the latter is commercially avail-

able from Goldschmidt, Inc. The preferred functionalized siloxane is an amine functionalized siloxane wherein the functionalization is pendent and/or end functionalization, with less than about 50% of all sights on the siloxane backbone capable of being functionalized having amine functionalization. Such functionalized and unfunctionalized siloxanes are typically desired in this invention to act as softeners when clothing is being cleaned.

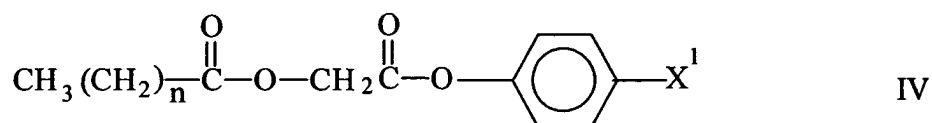
[0034] When cleaning fabrics, the pressure and temperature of the dry cleaning system (e.g., the system comprising the fabric targeted for cleaning, the continuous phase solvent and the surfactant described in this invention) within the machine is limited only to the extent that the temperature and pressure allow for the fabric to be cleaned. The pressure is often from about 1 to about 10,000 psi, and preferably, from about 200 to about 5,000 psi, and most preferably, from about 250 to about 3,000 psi, including all ranges subsumed therein. The temperature is often from about -30.0 to about 100°C, and preferably, from about -5.0 to about 70.0°C, and most preferably, from about 0.0 to about 45°C, including all ranges subsumed therein.

[0035] Adjunct materials can vary widely and can be used at widely ranging levels. For example, deterative enzymes such as proteases, amylases, cellulases, lipases and the like as well as bleach catalysts including the macrocyclic types having manganese or similar transition metals all useful in laundry and cleaning products can be used herein at very low, or less commonly, higher levels. Adjunct materials that are catalytic, for example enzymes, can be used in "forward" or "reverse" modes, a discovery independently useful from the specific appliances of the present invention. For example, a lipolase or other hydrolase may be used, optionally in the presence of alcohols as adjuncts, to convert fatty acids to esters, thereby increasing their solubility in the non-aqueous fluid. This is a "reverse" operation, in contrast with the normal use of this hydrolase in water to convert a less water-soluble fatty ester to a more water-soluble material. In any event, any adjunct ingredient must be suitable for use in combination with the non-aqueous fluid.

[0036] The compositions may comprise emulsifiers. Emulsifiers are well known in the chemical art. Essentially, an emulsifier acts to bring two or more insoluble or semi-soluble phases together to create a stable or semi-stable emulsion. It is preferred in the claimed invention that the emulsifier serves a dual purpose wherein it is capable of acting not only as an emulsifier, but also as a treatment performance booster. For example, the emulsifier may also act as a surfactant thereby boosting cleaning performance. Both ordinary emulsifiers and emulsifier/surfactants are commercially available.

[0037] Some suitable cleaning additives include, but are not limited to, builders, surfactants, enzymes, bleach activators, bleach catalysts, bleach boosters, bleaches, alkalinity sources, antibacterial agents, colorants, perfumes, pro-perfumes, finishing aids, lime soap dispersants, composition malodor control agents, odor neutralizers, polymeric dye transfer inhibiting agents, crystal growth inhibitors, photo bleaches, heavy metal ion sequestrants, anti-tarnishing agents, anti-microbial agents, antioxidants, anti-redeposition agents, soil release polymers, electrolytes, pH modifiers, thickeners, abrasives, divalent or trivalent ions, metal ion salts, enzyme stabilizers, corrosion inhibitors, diamines or polyamines and/or their alkoxylates, suds stabilizing polymers, solvents, process aids, fabric softening agents, optical brighteners, hydrotropes, suds or foam suppressors, suds or foam boosters, fabric softeners, antistatic agents, dye fixatives, dye abrasion inhibitors, anti-croaking agents, wrinkle reduction agents, wrinkle resistance agents, soil release polymers, soil repellency agents, sunscreen agents, anti-fade agents, and mixtures thereof.

[0038] Examples of optional additives include an oxidizing agent, like hydrogen peroxide, and an organic bleach activator such as those represented by the formula:



wherein n is an integer from about 0 to about 20 and X¹ is hydrogen or SO₃M and M is hydrogen, an alkaline metal or an immodium cation. A more detailed description of such additives may be found in U.S. Patent No. 5,431,843, the disclosure of which is incorporated herein by reference.

[0039] Examples of anti-static agents include C₈-C₁₂ alcohol ethoxylates, C₈-C₁₂ alkaline glycols and glycol esters. The deodorizing agent may include fragrances such as those described in U.S. Patent No. 5,784,905, the disclosure of which is incorporated herein by reference.

[0040] Examples of hydrotropes include propylene glycol and sodium xylene sulphonate.

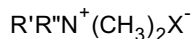
[0041] The term "surfactant" conventionally refers to materials that are surface-active either in the water, the non-aqueous fluid, or the mixture of the two. Some illustrative surfactants include nonionic, cationic and silicone surfactants as used in conventional aqueous detergent systems. Suitable nonionic surfactants include, but are not limited to:

(a) polyethylene oxide condensates of nonyl phenol and myristyl alcohol, such as in U.S. Patent No. 4,685,930

Kasprzak; and

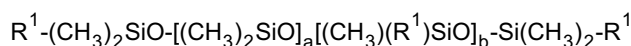
(b) fatty alcohol ethoxylates, $R-(OCH_2CH_2)_aOH$ $a = 1$ to 100, typically 12-40, R = hydrocarbon residue 8 to 20 C atoms, typically linear alkyl. Examples polyoxyethylene lauryl ether, with 4 or 23 oxyethylene groups; polyoxyethylene cetyl ether with 2, 10 or 20 oxyethylene groups; polyoxyethylene stearyl ether, with 2, 10, 20 21 or 100 oxyethylene groups; polyoxyethylene (2), (10) oleyl ether, with 2 or 10 oxyethylene groups. Commercially available examples include, but are not limited to: ALFONIC®, BRIJ®, GENAPOL®, NEODOL®, SURFONIC®, TRYCOL®. See also U.S. Patent No. 6,013,683 Hill et al.

[0042] Suitable cationic surfactants include, but are not limited to dialkyldimethylammonium salts having the formula:

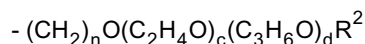


where each $R'R''$ is independently selected from the group consisting of 12-30 C atoms or derived from tallow, coconut oil or soy, $X=Cl$ or Br , Examples include: didodecyldimethylammonium bromide (DDAB), dihexadecyldimethyl ammonium chloride, dihexadecyldimethyl ammonium bromide, dioctadecyldimethyl ammonium chloride, dieicosyldimethyl ammonium chloride, didocosyldimethyl ammonium chloride, dicoconutdimethyl ammonium chloride, ditallowdimethyl ammonium bromide (DTAB). Commercially available examples include, but are not limited to: ADOGEBN, ARQUAD, TOMAH, VARIQUAT. See also U.S. Patent No. 6,013,683 to Hill et al.

[0043] Suitable silicone surfactants include, but are not limited to the polyalkyleneoxide polysiloxanes having a dimethyl polysiloxane hydrophobic moiety and one or more hydrophilic polyalkylene side chains and have the general formula:



wherein $a + b$ are from about 1 to about 50, preferably from about 3 to about 30, more preferably from about 10 to about 25, and each R^1 is the same or different and is selected from the group consisting of methyl and a poly(ethyleneoxide/propyleneoxide) copolymer group having the general formula:



with at least one R^1 being a poly(ethyleneoxide/propyleneoxide) copolymer group, and wherein n is 3 or 4, preferably 3; total c (for all polyalkyleneoxy side groups) has a value of from 1 to about 100, preferably from about 6 to about 100; total is from 0 to about 14, preferably from 0 to about 3; and more preferably d is 0; total $c + d$ has a value of from about 5 to about 150, preferably from about 9 to about 100 and each R^2 is the same or different and is selected from the group consisting of hydrogen, an alkyl having 1 to 4 carbon atoms, and an acetyl group, preferably hydrogen and methyl group. Examples of these surfactants may be found in U.S. Patent No. 5,705,562 to Hill and U.S. Patent No. 5,707,613 to Hill, both of which are incorporated herein by reference.

[0044] Examples of this type of surfactants are the Silwet® surfactants which are available CK Witco, Osi Division, Danbury, Conn. Representative Silwet surfactants are as follows:

Name	Average MW	Average $a + b$	Average total c
L-7608	600	1	9
L-7607	1,000	2	17
L-77	600	1	9
L-7605	6,000	20	99
L-7604	4,000	21	53
L-7600	4,000	11	68
L-7657	5,000	20	76
L-7602	3,000	20	29

[0045] The molecular weight of the polyalkyleneoxy group (R^1) is less than or equal to about 10,000. Preferably, the molecular weight of the polyalkyleneoxy group is less than or equal to about 8,000, and most preferably ranges from about 300 to about 5,000. Thus, the values of c and d can be those numbers which provide molecular weights within these ranges. However, the number of ethyleneoxy units ($-C_2H_4O$) in the polyether chain (R^1) must be sufficient to render the polyalkyleneoxide polysiloxane water dispersible or water soluble. If propyleneoxy groups are present in the polyalkyleneoxy chain, they can be distributed randomly in the chain or exist as blocks. Preferred Silwet surfactants are L-7600, L-7602, L-7604, L-7605, L-7657, and mixtures thereof. Besides surface activity, polyalkyleneoxide polysiloxane surfactants can also provide other benefits, such as antistatic benefits, and softness to fabrics.

[0046] The preparation of polyalkyleneoxide polysiloxanes is well known in the art. Polyalkyleneoxide polysiloxanes of the present invention can be prepared according to the procedure set forth in U.S. Patent No. 3,299,112, incorporated herein by reference.

[0047] Another suitable silicone surfactant is SF-1488, which is available from GE silicone fluids.

[0048] These and other surfactants (e.g., including anionic and zwitterionic surfactant suitable for use in combination with the non-aqueous fluid as adjuncts are well known in the art, being described in more detail in Kirk Other's Encyclopedia of Chemical Technology, 3rd Ed., Vol. 22, pp.360-379, "Surfactants and Detergent Systems", incorporated by reference herein. Further suitable nonionic detergent surfactants are generally disclosed in U.S. Patent No. 3,929,678 to Laughlin et al., issued December 30, 1975, at column 13, line 14 through column 16, line 6, incorporated herein by reference.

[0049] As to the amount of optional additives used with the surfactants of the present invention, such an amount is limited only to the extent that the additive does not interfere with the cleaning process.

[0050] A second key component of the invention (besides use of composition comprising linear branched or cyclic siloxane) is that the power source used to power the dry cleaning machine be a single phase electricity power source.

[0051] By using such single phase power source instead of a typical 3-phase source used in conventional dry cleaning machines, it is possible to more safely use the machine safely in self operated manner (e.g., in home or laundromat). That is, the single phase allows for the self use of a siloxane solvent dry cleaning machine in the home (i.e., without concern that the higher voltage three phase machine typically used in commercial establishments) and further allow less concern about the wiring.

[0052] Generally speaking, there are two types of electricity used for power applications, direct current (DC) and alternating current (AC). Direct current power sources include batteries and direct current generators. Electrons in a conductor (i.e., material through which electrons flow such as, for example, copper, aluminum or silver, all of which are considered good conductors; or glass and plastic, which are considered poor conductors, or insulators) flow continuously in one direction, as long as the circuit is complete, in a direct current. The most common source of direct current is a battery.

[0053] In an alternating current, electrons change directions regularly and frequently. Alternating current is produced by an alternating current generator. The method by which electricity is produced by the generator causes the electrons to change direction. Alternating current is the more common electricity as permanent supply to commercial and industrial buildings and the domestic premises.

[0054] Alternating current may be represented typically by a so-called sine wave wherein a vertical axis (y axis) represents the direction and magnitude of the current and the horizontal axis (x axis) represents time. When the wave form is above the x axis ($y > 0$), current is flowing in a positive (+) direction and, when the wave form is below the x axis ($y < 0$), current is flowing in the negative (-) direction. In a given period (period 1), current starts at zero magnitude, increases to a maximum magnitude and goes back to zero. In a second period, the current flow reverses direction and increases in base negative direction. When it reaches maximum negative magnitude, it diminishes until it reaches zero again.

[0055] The pattern of alternating current flowing first in the positive direction (period 1) and then in the negative direction (period 2) is called one cycle (periods 1 and 2).

[0056] Normal alternating current goes through many cycles each second. The number of cycles per second is measured in Hertz (Hz). In Europe and many countries, alternating current is generated at 50 Hz or 50 cycles per second and, in the U.S. current is typically generated at 60 Hz.

[0057] There are two types of alternating current, single phase and three phase. In a single phase current, there is one current form (also only one voltage form, where voltage, measured in volts, is defined by Ohm's law as current measured in amperes, times resistance, measured in Ohms). Single phase AC power is produced either by a generator which produces only a single phase (single phase generator) or by using only one phase of a three phase supply.

[0058] Three phase AC power is a series of overlapping single phase AC cycles. Each phase is offset by one third of a cycle.

[0059] According to the subject invention, the dry cleaning machine uses a single phase (whether because it is a single phase generator or only one phase is used from a three phase supply). Using a single phase, it is possible to readily use the dry cleaning machine in a self operated manner because there is no complicated wiring for the consumer

to have to deal with. Usually, single phase electricity utilizes lower voltage than three phase and therefore also affords a safety advantage to the consumer and their home - this is especially true for preferred siloxane solvent and its flash point. Preferably, the voltage in the single phase machine should be less than about 260 voltage (especially for, for example, European homes where voltage is about 220 volts) and preferably, for countries like United States where home voltage is about 110 volts, below about 150 volts.

[0060] Except in the operating and comparative examples, or where otherwise explicitly indicated, all numbers in this description indicating amounts or ratios of materials or conditions or reaction, physical properties of materials and/or use are to be understood as modified by the word "about".

[0061] Where used in the specification, the term "comprising" is intended to include the presence of stated features, integers, steps, components, but not to preclude the presence or addition of one or more features, integers, steps, components or groups thereof.

[0062] The following examples are intended to further illustrate the invention and are not intended to limit the invention in any way.

[0063] Unless indicated otherwise, all percentages are intended to be percentages by weight.

EXAMPLES

EXAMPLE 1

[0064] A consumer dry cleaning machine powered by single phase, 115V electricity is purchased and plugged into a standard wall outlet in a home. Said machine is charged with a load of soiled mixed cotton, rayon and silk fabric articles, and activated by the control panel. When this occurs, it fills with a cleaning composition of the following formula:

Ingredient	%
Decamethyl cyclopentasiloxane	99
Water	0.5
Sodium bis 2-ethylhexylsulfosuccinate	0.25
Silicone polyether (such as Silwet L-7602, ex OSI Specialty Chemicals)	

[0065] The fabric articles are tumbled in this composition for a period of 10 minutes, rinsed with neat solvent and allowed to dry via a condenser drying system. The use of these systems, in conjunction with single phase, 115V electricity significantly reduces the electrocution and fire hazards the consumer is exposed to during the washing/drying cycles. Said clean and refreshed clothes are then removed from the machine and hung for storage.

EXAMPLE 2

[0066] A consumer dry cleaning machine outfitted with a coin box, powered by single phase, 115V electricity is purchased and plugged into a standard wall outlet in a self-service laundromat. Said machine is charged with a load of soiled mixed wool, acetate and silk fabric article, and activated by the control panel. When this occurs, it fills with a cleaning composition of the following formula:

Ingredient	%
Hexamethyldisiloxane	2-95
Octamethyltrisiloxane	2-95
Decamethyltetrasiloxane	2-95
Water	1.0
Sodium bis 2-ethylhexyl sulfosuccinate	2.0
Silicone Polyether (such as Silwet L-7602, ex OSI Specialty Chemicals)	2.0

[0067] The fabric articles are tumbled in this composition for a period of 10 minutes, rinsed with neat solvent and allowed to dry via a condenser drying system. The use of these systems, in conjunction with single-phase, 115V electricity significantly reduces the electrocution and fire hazards the consumer is exposed to during the washing/drying cycles. Said clean and refreshed clothes are then removed from the machine and hung for transportation to the con-

sumer's residence.

Claims

1. A method for dry cleaning a laundry article comprising:

contacting said laundry article with dry cleaning composition comprising a linear, branched or cyclic siloxane or mixtures thereof.

wherein a machine in which the laundry article is cleaned is powered by single phase electricity.

2. A method according to claim 1, wherein said method is used in the home.

3. A method according to claim 1, wherein said machine is self-operated.

4. A method according to claim 1, wherein said machine is powered by electricity with an average voltage lower than 260 volts.

5. A method according to claim 4, wherein said machine is powered by electricity with an average voltage lower than 150 volts.

6. A method for dry cleaning a laundry article comprising:

contacting said laundry article with a dry cleaning composition comprising a linear, branched or cyclic siloxane or mixtures thereof,

wherein a machine in which the laundry article is cleaned is powered by electricity with an average voltage of less than about 260.

7. A method according to claim 6, wherein voltage is less than about 150.

8. A method according to claim 6, wherein said method is used in the home.

9. A method according to claim 1, wherein said machine is self-operated.



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 19 February 2004	Examiner Fiocco, M
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