

Light stabilisation of two-layer uni-lacquer coatings

The present invention relates to the stabilisation, by the addition of polyalkylpiperidine derivatives, of two-layer baked uni-lacquer coatings based on acrylic, alkyd and polyester resins, against the action of light, and also to the lacquers stabilised in this way.

It is already known from the two Japanese Patent Applications Sho 52-132050 and Sho 53-60942 that two-layer uni-lacquer coatings can be stabilised with conventional UV-absorbers. However, if good stabilisation is to be ensured, these stabilisers must be used in relatively high concentrations and, moreover, in most cases they do not possess the desired lack of colour which, because of the frequently varying layer thicknesses of the clear lacquers, is of extremely great importance in practice.

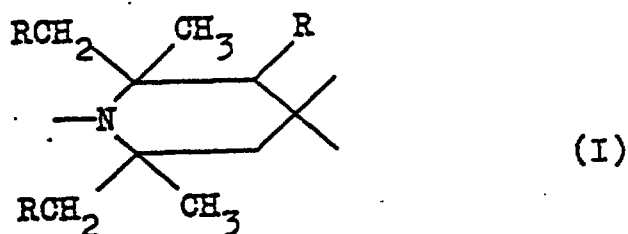
Typical degradation phenomena in two-layer baked lacquer coatings, especially crazing, blistering and delamination should, according to experience, best be prevented by UV-absorbers. However, it has now been found, suprisingly, that when light stabilisers based on polyalkylpiperidine derivatives are used excellent stabilisation is achieved, even in considerably smaller concentrations, despite the lack of absorption in the near-UV range. Moreover, the requisite lack of colour is ensured by the polyalkylpiperidine derivatives.

It has already been proposed (JP-A 52-51421 and 52-22029), for the stabilisation of physically drying lacquers based on binders containing nitrocellulose and

an acrylic resin, to add to these lacquers a mixture of an acrylonitrile derivative and a sterically hindered piperidine derivative. This prevents or reduces yellowing in UV light, which is mainly caused by the nitrocellulose. This does not allow a conclusion as to an analogous effect in the case of baked coatings used for two-layer lacquers, which are free of nitrocellulose.

The present invention therefore relates to the use of 2,2,6,6-tetraalkylpiperidine compounds or their acid addition salts or complexes with metal compounds, if desired together with further stabilisers, for stabilising two-layer uni-lacquer coatings based on acrylic, alkyd or polyester resins, which, if desired, can be crosslinked with melamine/formaldehyde resins, epoxide resins or polyisocyanates, against the action of light.

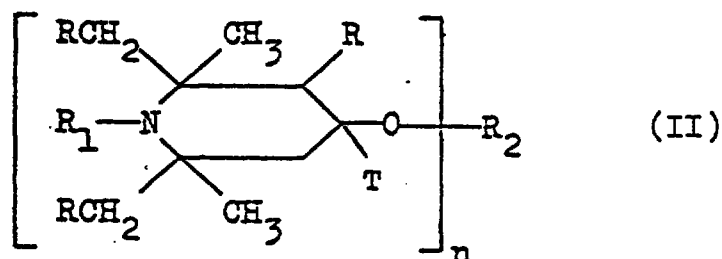
The 2,2,6,6-tetraalkylpiperidine compounds to be used according to the invention are generally known and are already employed against light degradation. They are preferably compounds which contain a group of the formula (I)



in which R is hydrogen or methyl.

The light stabilisers to be used according to the invention include, in particular, the following compound categories:

a) Light stabilisers of the formula (II)



in which n is the numbers 1 - 4 and preferably 1 or 2,

T is hydrogen or $-\text{CONH}_2$, R is as defined under formula (I), R_1 is hydrogen, oxyl, C_1-C_{18} alkyl, C_3-C_8 alkenyl, C_3-C_8 alkynyl, C_7-C_{12} aralkyl, C_1-C_8 alkanoyl, C_3-C_5 alkenoyl, glycidyl or a group $-\text{CH}_2\text{CH}(\text{OH})-\text{Z}$, in which Z is hydrogen, methyl, ethyl or phenyl, and R_1 is preferably hydrogen, C_1-C_{12} alkyl, allyl, benzyl, acetyl or acryloyl and R_2 , if $n=1$, is hydrogen, C_1-C_{18} alkyl, which can be interrupted by one or more oxygen atoms, cyanoethyl, benzyl, glycidyl, a monovalent radical of an aliphatic, cycloaliphatic, araliphatic, aromatic or heterocyclic carboxylic acid, carbamic acid or phosphorus-containing acid or a monovalent silyl radical, preferably a radical of an aliphatic carboxylic acid having 2 - 18 C atoms, of a cycloaliphatic carboxylic acid having 5 - 12 C atoms or of an aromatic carboxylic acid having 7 - 15 C atoms, if $n = 2$ is C_1-C_{12} alkylene, C_4-C_{12} alkenylene, xylylene, a divalent radical of an aliphatic, cycloaliphatic, araliphatic, aromatic or heterocyclic dicarboxylic acid, dicarbamic acid or phosphorus-containing acid or a divalent silyl radical, preferably a radical of an aliphatic dicarboxylic acid having 2 - 36 C atoms, of a cycloaliphatic or aromatic dicarboxylic acid having 8 - 14 C atoms or of an aliphatic, cycloaliphatic or aromatic dicarbamic acid having 8 - 14 C atoms, if $n = 3$ is a trivalent radical of an aliphatic, cycloaliphatic, aromatic or heterocyclic tricarboxylic acid, of an aromatic tricarbamic acid or of a phosphorus-containing acid or a trivalent silyl radical and if $n = 4$, is a tetravalent radical of an aliphatic, cycloaliphatic or aromatic tetracarboxylic acid.

Any C_1-C_{12} alkyl substituents are, for example, methyl, ethyl, n-propyl, n-butyl, sec.-butyl, tert.-butyl, n-hexyl, n-octyl, 2-ethyl-hexyl, n-nonyl, n-decyl, n-undecyl or n-dodecyl.

C_1-C_{18} Alkyl R_1 or R_2 can be, for example, the groups listed above and, in addition, also, for example, n-tridecyl, n-tetradecyl, n-hexadecyl or n-octadecyl.

C_3-C_8 Alkenyl R_1 can be, for example, 1-propenyl, allyl, methallyl, 2-butenyl, 2-pentenyl, 2-hexenyl, 2-octenyl or 4-tert.-butyl-2-butenyl.

C_3-C_8 Alkynyl R_1 is preferably propargyl.

C_7-C_{12} Aralkyl R_1 is especially phenethyl or in particular benzyl.

C_1-C_8 Alkanoyl R_1 is, for example, formyl, propionyl, butyryl or octanoyl, but preferably acetyl, and C_3-C_5 alkenoyl R_1 is especially acryloyl.

As a monovalent radical of a carboxylic acid, R_2 is, for example, a radical of acetic acid, stearic acid, salicylic acid, methacrylic acid, maleic acid, benzoic acid or β -(3,5-di-tert.-butyl-4-hydroxyphenyl)-propionic acid.

As a divalent radical of a dicarboxylic acid, R_2 is, for example, a radical of adipic acid, suberic acid, sebacic acid, phthalic acid, dibutylmalonic acid, dibenzylmalonic acid, butyl-(3,5-di-tert.-butyl-4-hydroxybenzyl)-malonic acid or bicycloheptenedicarboxylic acid.

As a trivalent radical of a tricarboxylic acid, R_2 is, for example, a radical of trimellitic acid or of nitrilotriacetic acid.

R_2 can also be radicals of di- and tri-carboxylic acids such as are prepared industrially by oligomerisation of higher unsaturated fatty acids or by a Diels-Alder addition of acrylic acid onto linoleic acid. R_2 can also be radicals which are formed by reacting mono-, di- and polyepoxides, for example bisphenol A diglycidyl ether, butanediol diglycidyl ether, tris-glycidyl isocyanurate or 1,3-diglycidyl-4,4-dimethyl-hydantoin, with 4-hydroxy-1,2,2,6,6-pentamethylpiperidine.

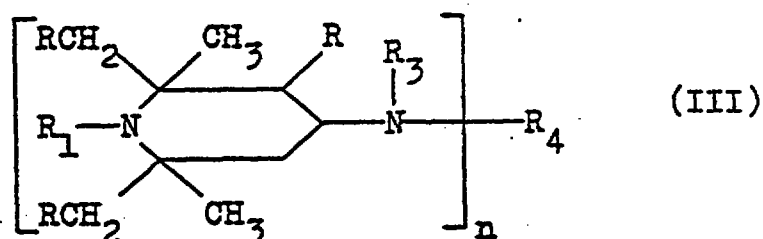
As a tetravalent radical of a tetracarboxylic acid, R_2 is, for example, a pyromellitic acid radical.

As a divalent radical of a dicarbamic acid, R_2 is, for example, a radical of hexamethylenedicarbamic acid or of 2,4-toluylene-dicarbamic acid.

Examples of 2,2,6,6-tetraalkylpiperidine light stabilisers of this category are the following compounds:

- 1) 4-Hydroxy-2,2,6,6-tetramethylpiperidine
- 2) 1-Allyl-4-hydroxy-2,2,6,6-tetramethylpiperidine
- 3) 1-Benzyl-4-hydroxy-2,2,6,6-tetramethylpiperidine
- 4) 1-(4-tert.-Butyl-2-butenyl)-4-hydroxy-2,2,6,6-tetramethylpiperidine
- 5) 4-Stearoyloxy-2,2,6,6-tetramethylpiperidine
- 6) 1-Ethyl-4-salicyloyloxy-2,2,6,6-tetramethylpiperidine
- 7) 4-Methacryloyloxy-1,2,2,6,6-pentamethylpiperidine
- 8) 1,2,2,6,6-Pentamethylpiperidin-4-yl β -(3,5-di-tert.-butyl-4-hydroxyphenyl)-propionate
- 9) 1-Benzyl-2,2,6,6-tetramethyl-4-piperidinyl maleate
- 10) (Di-2,2,6,6-tetramethylpiperidin-4-yl) adipate
- 11) (Di-2,2,6,6-tetramethylpiperidin-4-yl) sebacate
- 12) (Di-1,2,3,6-tetramethyl-2,6-diethyl-piperidin-4-yl) sebacate
- 13) (Di-1-allyl-2,2,6,6-tetramethyl-piperidin-4-yl) phthalate
- 14) 1-Propargyl-4- β -cyanoethyloxy-2,2,6,6-tetramethyl-piperidine
- 15) 1-Acetyl-2,2,6,6-tetramethylpiperidin-4-yl acetate
- 16) Tri-(2,2,6,6-tetramethylpiperidin-4-yl) trimellitate
- 17) 1-Acryloyl-4-benzyloxy-2,2,6,6-tetramethylpiperidine
- 18) Di-(1,2,2,6,6-pentamethylpiperidin-4-yl) dibutyl-malonate
- 19) Di-(1,2,2,6,6-pentamethylpiperidin-4-yl) butyl-(3,5-di-tert.-butyl-4-hydroxybenzyl)-malonate
- 20) Di-(1,2,2,6,6-pentamethylpiperidin-4-yl) dibenzyl-malonate
- 21) Di-(1,2,3,6-tetramethyl-2,6-diethyl-piperidin-4-yl) dibenzyl-malonate
- 22) Hexane-1',6'-bis-(4-carbamoyloxy-1-n-butyl-2,2,6,6-tetramethylpiperidine)
- 23) Toluene-2',4'-bis-(4-carbamoyloxy-1-n-propyl-2,2,6,6-tetramethylpiperidine)
- 24) Dimethyl-bis-(2,2,6,6-tetramethylpiperidin-4-oxy) silane
- 25) Phenyl-tris-(2,2,6,6-tetramethylpiperidin-4-oxy) silane
- 26) Tris-(1-propyl-2,2,6,6-tetramethylpiperidin-4-yl) phosphite

- 27) Tris-(1-propyl-2,2,6,6-tetramethylpiperidin-4-yl) phosphate
 28) Bis-(1,2,2,6,6-pentamethylpiperidin-4-yl) phenyl-phosphonate
 29) (Di-1,2,2,6,6-pentamethylpiperidin-4-yl) sebacate
 30) (Di-1-benzyl-2,2,6,6-tetramethylpiperidin-4-yl) sebacate
 31) (Di-1-allyl-2,2,6,6-tetramethylpiperidin-4-yl) sebacate
 31a) 2,2,6,6-Tetramethyl-4-hydroxy-4-carbamoyl-piperidine.
 b) Light stabilisers of the formula (III)



in which n is the number 1 or 2, R is as defined under formula I, R_1 is as defined under a), R_3 is hydrogen, C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, C_7 - C_8 aralkyl, C_2 - C_{18} alkanoyl, C_3 - C_5 alkenoyl or benzoyl and R_4 , if $n = 1$, is hydrogen, C_1 - C_{18} alkyl, C_5 - C_7 cycloalkyl, C_2 - C_8 alkenyl, which is unsubstituted or substituted by a cyano, carbonyl or carbamide group, glycidyl or a group of the formula $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}''$ or of the formula $-\text{CONH}-\text{Z}''$, in which Z'' is hydrogen, methyl or phenyl; and if $n=2$ is C_2 - C_{12} alkylene, C_6 - C_{12} arylene, xylylene, a $-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2$ group or a group $-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2-\text{O}-\text{X}-\text{O}-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2-$, in which X is C_2 - C_{10} alkylene, C_6 - C_{15} arylene or C_6 - C_{12} cycloalkylene, or, with the proviso that R_3 is not alkanoyl, alkenoyl or benzoyl, R_4 can also be a divalent radical of an aliphatic, cycloaliphatic or aromatic dicarboxylic acid or dicarbamic acid or the group $-\text{CO}-$, or R_3 and R_4 together, if $n = 1$, can be the imide radical of an aliphatic, cycloaliphatic or aromatic 1,2- or 1,3-dicarboxylic acid.

Any C_1 - C_{18} alkyl substituents are as already

defined under a).

Any C₅-C₇ cycloalkyl substituents are especially cyclohexyl.

C₇-C₈ Aralkyl R₃ is especially phenethyl or in particular benzyl.

C₂-C₁₈ Alkanoyl R₃ is, for example, propionyl, butyryl, octanoyl, dodecanoyl, hexadecanoyl or octadecanoyl, but preferably acetyl, and C₃-C₅ alkenoyl R₃ is especially acryloyl.

As C₂-C₈ alkenyl which is unsubstituted or substituted by a cyano, carbonyl or carbamide group, R₄ is, for example, 1-propenyl, allyl, methallyl, 2-butenyl, 2-pentenyl, 2-hexenyl, 2-octenyl, 2,2-dicyanovinyl, 1-methyl-2-cyano-2-methoxycarbonyl-vinyl or 2,2-diacetylaminovinyl.

Any C₂-C₁₂ alkylene substituents are, for example, ethylene, propylene, 2,2-dimethylpropylene, tetramethylene, hexamethylene, octamethylene, decamethylene or dodecamethylene.

Any C₆-C₁₅ arylene substituents are, for example, o-, m- or p-phenylene, 1,4-naphthylene or 4,4'-diphenylene.

C₆-C₁₂ Cycloalkylene X is especially cyclohexylene.

Examples of 2,2,6,6-tetraalkylpiperidine light stabilisers of this category are the following compounds:

32) N,N'-Bis-(2,2,6,6-tetramethylpiperidin-4-yl)-hexamethylene-1,6-diamine

33) N,N'-Bis-(2,2,6,6-tetramethylpiperidin-4-yl)-hexamethylene-1,6-diacetamide

34) 1-Acetyl-4-(N-cyclohexylacetamido)-2,2,6,6-tetramethylpiperidine

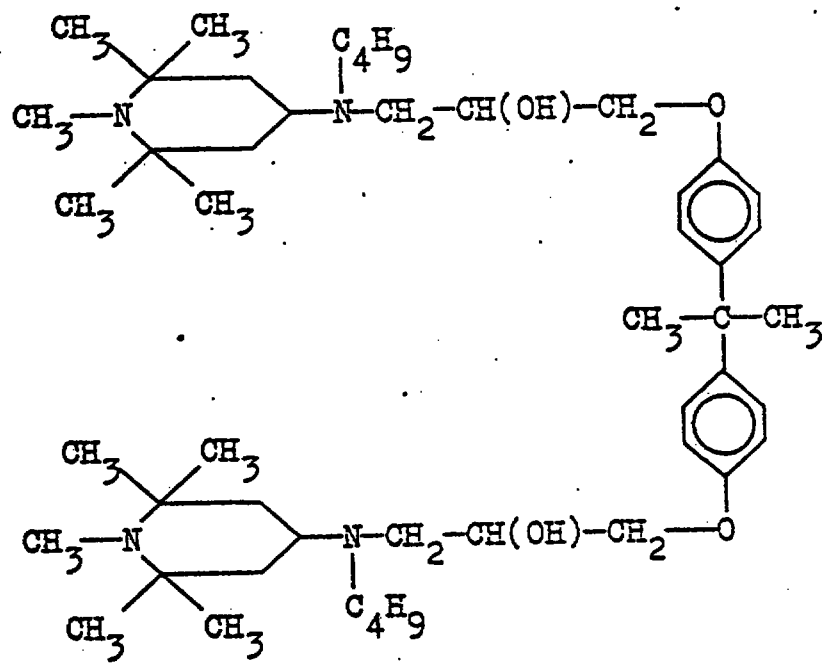
35) 4-Benzylamino-2,2,6,6-tetramethylpiperidine

36) N,N'-Bis-(2,2,6,6-tetramethylpiperidin-4-yl)-N,N'-dibutyl-adipamide

37) N,N'-Bis-(2,2,6,6-tetramethylpiperidin-4-yl)-N,N'-dicyclohexyl-(2-hydroxypropylene)

38) N,N'-Bis-(2,2,6,6-tetramethylpiperidin-4-yl)-p-xylylene-diamine

39) The compound of the formula



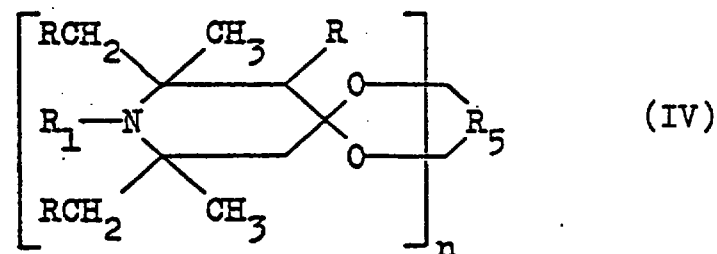
.....(sic)

41) 4-(3-Methyl-4-hydroxy-5-tert.-butyl-benzoic acid amido)-2,2,6,6-tetramethylpiperidine

42) 4-Methacrylamido-1,2,2,6,6-pentamethylpiperidine

43) Methyl α -cyano- β -methyl- β -[N-(2,2,6,6-tetramethylpiperidin-4-yl)]-amino-acrylate.

c) Light stabilisers of the formula (IV)



in which n is the number 1 or 2, R is as defined under formula (I), R₁ is as defined under a) and R₅, if n = 1, is C₂-C₈ alkylene or hydroxyalkylene or C₄-C₂₂ acyloxyalkylene and, if n = 2, is the group (-CH₂)₂C(CH₂-)₂.

C₂-C₈ Alkylene or hydroxyalkylene R₅ is, for

example, ethylene, 1-methyl-ethylene, propylene, 2-ethyl-propylene or 2-ethyl-2-hydroxymethylpropylene.

C_4-C_{22} Acyloxyalkylene R_5 is, for example, 2-ethyl-2-acetoxymethyl-propylene.

Examples of 2,2,6,6-tetraalkylpiperidine light stabilisers of this category are the following compounds:

44) 9-Aza-8,8,10,10-tetramethyl-1,5-dioxaspiro[5.5]undecane

45) 9-Aza-8,8,10,10-tetramethyl-3-ethyl-1,5-dioxaspiro[5.5]decane

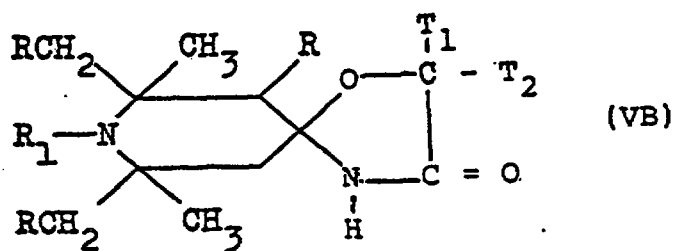
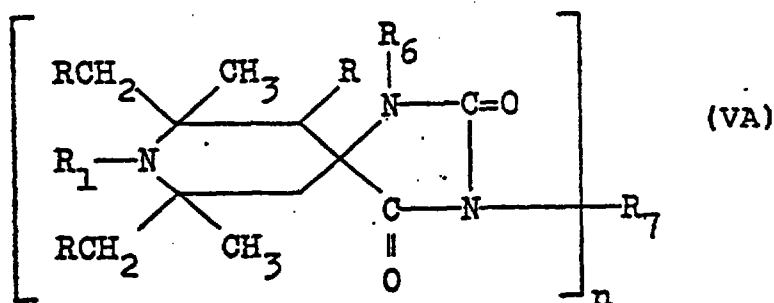
46) 8-Aza-2,7,7,8,9,9-hexamethyl-1,4-dioxaspiro[4.5]-decane

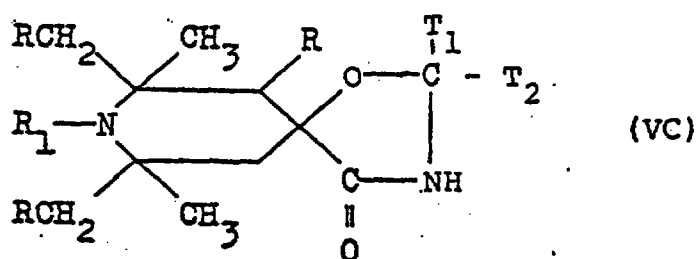
47) 9-Aza-3-hydroxymethyl-3-ethyl-8,8,9,10,10-pentamethyl-1,5-dioxaspiro[5.5]undecane

48) 9-Aza-3-ethyl-3-acetoxymethyl-9-acetyl-8,8,10,10-tetramethyl-1,5-dioxaspiro[5.5]undecane

49) 2,2,6,6-Tetramethylpiperidine-4-spiro-2'-(1',3'-dioxan)-5'-spiro-5''-(1'',3''-dioxan)-2''-spiro-4'''-(2''', 2''', 6''', 6'''-tetramethylpiperidine).

d) Light stabilisers of the formulae (VA), (VB) and (VC)





in which n is the number 1 or 2, R is as defined under formula (I), R_1 is as defined under a), R_6 is hydrogen, C_1-C_{12} alkyl, allyl, benzyl, glycidyl or C_2-C_6 alkoxyalkyl and R_7 , if $n=1$, is hydrogen, C_1-C_{12} alkyl, C_3-C_5 alkenyl, C_7-C_9 aralkyl, C_5-C_7 cycloalkyl, C_2-C_4 hydroxyalkyl, C_2-C_6 alkoxyalkyl, C_6-C_{10} aryl, glycidyl or a group of the formula $-(CH_2)_m-COO-Q$ or of the formula $-(CH_2)_m-O-CO-Q$, in which m is 1 or 2 and Q is C_1-C_{18} alkyl or phenyl, and if $n = 2$ is C_2-C_{12} alkylene, C_6-C_{12} arylene, C_4-C_{12} alkenylene, a group $-CH_2-CH(OH)-CH_2-O-X-O-CH_2-CH(OH)-CH_2-$, in which X is C_2-C_{10} alkylene, C_6-C_{15} arylene or C_6-C_{12} cycloalkylene, or a group $-CH_2CH(OZ')CH_2-(OCH_2-CH(OZ')CH_2)_2-$, in which Z' is hydrogen, C_1-C_{18} alkyl, allyl, benzyl, C_2-C_{12} alkanoyl or benzoyl, and T_1 and T_2 independently of one another are hydrogen, C_1-C_{18} alkyl or C_6-C_{10} aryl which is unsubstituted or substituted by halogen or C_1-C_4 alkyl, or C_7-C_9 aralkyl, or T_1 and T_2 together with the C atom which bonds them form C_5-C_7 cycloalkyl, pyrrolidinyl or piperidinyl, which are unsubstituted or substituted by C_1-C_4 alkyl.

Any C_1-C_{12} alkyl substituents are, for example, methyl, ethyl, n-propyl, n-butyl, sec.-butyl, tert.-butyl, n-hexyl, n-octyl, 2-ethyl-hexyl, n-nonyl, n-decyl, n-undecyl or n-dodecyl.

Any C_1-C_{18} alkyl substituents can be, for example, the groups listed above and, in addition, also, for example, n-tridecyl, n-tetradecyl, n-hexadecyl or n-octadecyl.

Any C_2-C_6 alkoxyalkyl substituents are, for example, methoxymethyl, ethoxymethyl, propoxymethyl,

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tert.-butoxymethyl, ethoxyethyl, ethoxypropyl, n-butoxyethyl, tert.-butoxyethyl, isopropoxyethyl or propoxypropyl.

C₃-C₅ Alkenyl R₇ is, for example, 1-propenyl, allyl, methallyl, 2-butenyl or 2-pentenyl.

C₇-C₉ Aralkyl R₇, T₁ and T₂ are especially phenethyl or in particular benzyl, and C₅-C₇ cycloalkyl R₇, T₁ and T₂ (T₁ and T₂ together with the C atom which bonds them) are in particular cyclohexyl.

C₂-C₄ Hydroxyalkyl R₇ is, for example, 2-hydroxyethyl, 2-hydroxypropyl, 2-hydroxybutyl or 4-hydroxybutyl.

C₆-C₁₀ Aryl R₇, T₁ and T₂ are especially phenyl or α- or β-naphthyl, which are unsubstituted or substituted by halogen or C₁-C₄ alkyl.

C₂-C₁₂ Alkylene R₇ is, for example, ethylene, propylene, 2,2-dimethylpropylene, tetramethylene, hexamethylene, octamethylene, decamethylene or dodecamethylene.

C₄-C₁₂ Alkenylene R₇ is especially 2-butenylene, 2-pentenylene or 3-hexenylene.

C₆-C₁₂ Arylene R₇ is, for example, o-, m- or p-phenylene, 1,4-naphthylene or 4,4'-diphenylene.

C₂-C₁₂ Alkanoyl Z' is, for example, propionyl, butyryl, octanoyl or dodecanoyl but preferably acetyl.

C₂-C₁₀ Alkylene, C₆-C₁₅ arylene or C₆-C₁₂ cycloalkylene X is as defined under b).

Examples of 2,2,6,6-tetraalkylpiperidine light stabilisers of this category are the following compounds:

50) 3-Benzyl-1,3,8-triaza-7,7,9,9-tetramethylspiro[4.5]-decane-2,4-dione

51) 3-n-Octyl-1,3,8-triaza-7,7,9,9-tetramethylspiro[4.5]-decane-2,4-dione

52) 3-Allyl-1,3,8-triaza-1,7,7,9,9-pentamethylspiro[4.5]-decane-2,4-dione

53) 3-Glycidyl-1,3,8-triaza-7,7,8,9,9-pentamethylspiro[4.5]decane-2,4-dione

53a) 2-iso-Propyl-7,7,9,9-tetramethyl-1-oxa-3,8-diaza-4-oxo-spiro[4.5]decane

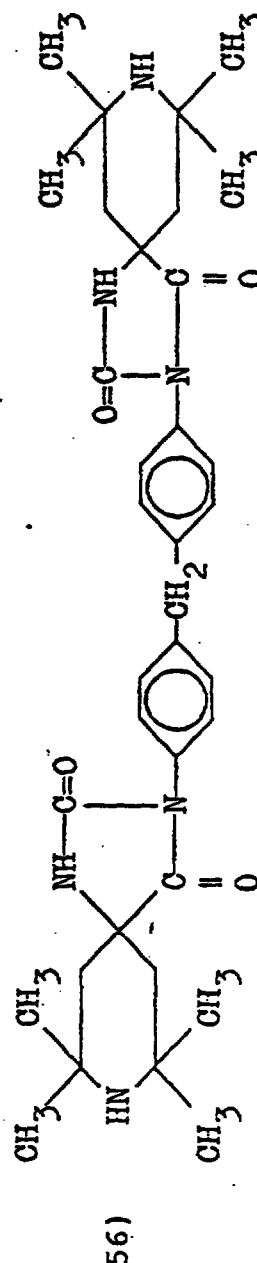
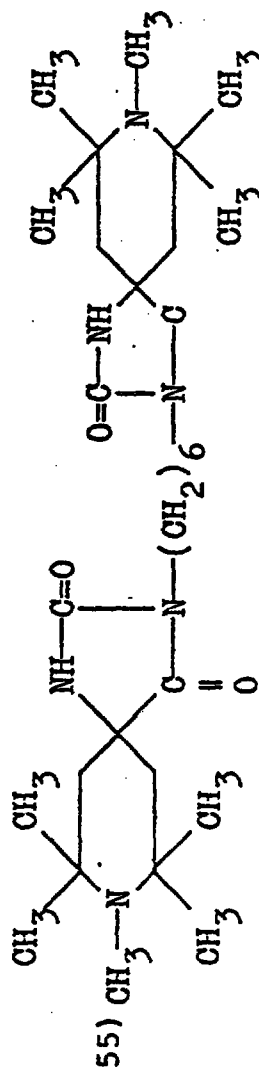
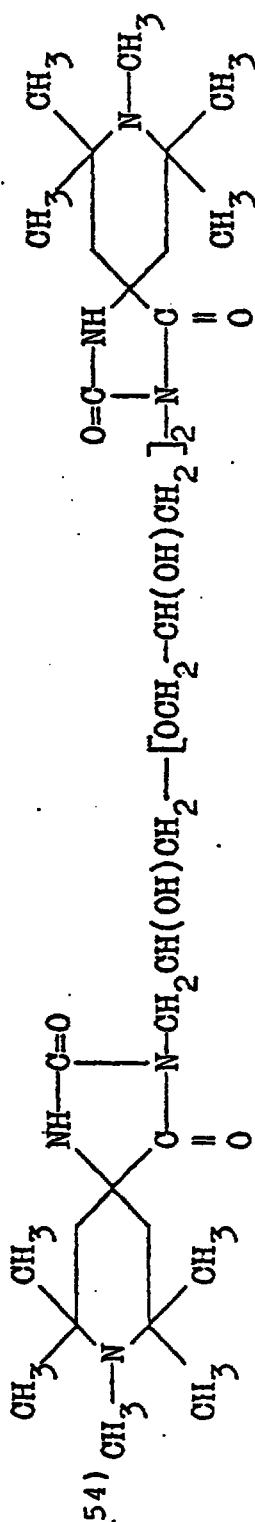
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53b) 2-Butyl-7,7,9,9-tetramethyl-1-oxa-3,8-diaza-4-oxo-spiro[4.5]decane

53c) 2-Isopropyl-7,7,9,9-tetramethyl-1-oxa-4,8-diaza-3-oxo-spiro[4.5]decane

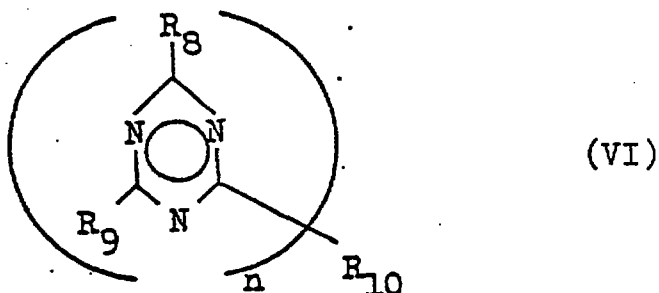
53d) 2-Butyl-7,7,9,9-tetramethyl-1-oxa-4,8-diaza-3-oxo-spiro[4.5]decane

or the compounds of the following of the following (sic) formulae:

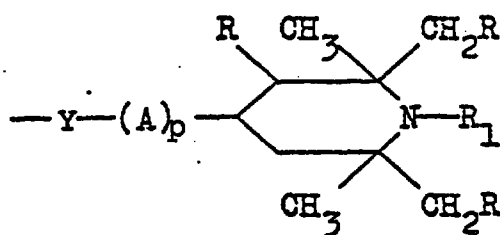


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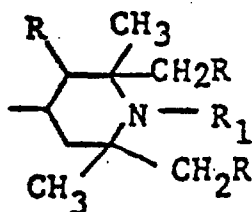
e) Light stabilisers of the formula (VI)



in which n is the number 1 or 2 and R_8 is a group of the formula

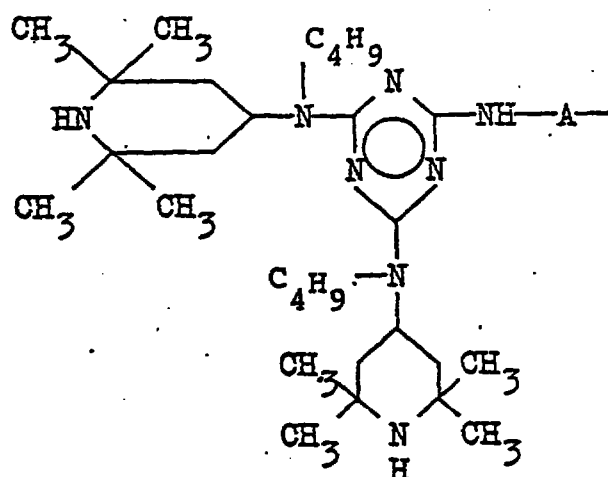


in which R is as defined under formula (I), R_1 is as defined under a), Y is $-O-$ or $-NR_{11}-$, A is C_2-C_6 alkylene or $-(CH_2)_3-O-$ and P is the numbers 0 or 1, R_9 is the groups R_8 , $NR_{11}R_{12}$, $-OR_{13}$, $-NHCH_2OR_{13}$ or $-N(CH_2OR_{13})_2$, and R_{10} , if $n = 1$, is the groups R_8 or R_9 , and if $n = 2$, is the group $-Y-B-Y-$, in which B is C_2-C_6 alkylene which can be interrupted by $-N(R_{14})-$, and R_{11} is C_1-C_{12} alkyl, cyclohexyl, benzyl or C_1-C_4 hydroxyalkyl or a group of the formula



R_{12} is C_1-C_{12} alkyl, cyclohexyl, benzyl or C_1-C_4 hydroxyalkyl, R_{13} is hydrogen, C_1-C_{12} alkyl or phenyl and R_{14} is hydrogen, C_1-C_{12} alkyl, cyclohexyl, benzyl or phenyl, or R_{11} and R_{12} together are C_4-C_5 alkylene or oxaalkylene, or R_{11} and R_{12} are each a group of the formula

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Any C_1 - C_{12} alkyl substituents are, for example, methyl, ethyl, n-propyl, n-butyl, sec.-butyl, tert.-butyl, n-hexyl, n-octyl, 2-ethylhexyl, n-nonyl, n-decyl, n-undecyl or n-dodecyl.

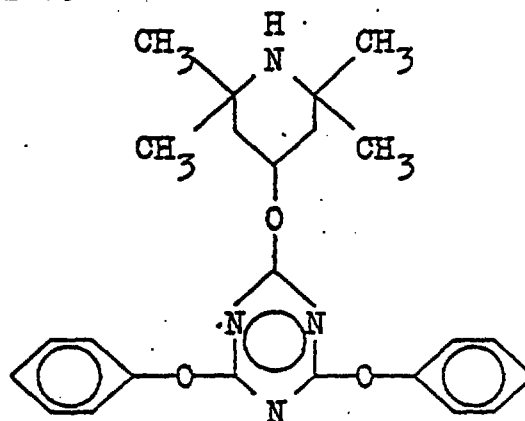
Any C_1 - C_4 hydroxyalkyl substituents are, for example, 2-hydroxyethyl, 2-hydroxypropyl, 3-hydroxypropyl, 2-hydroxybutyl or 4-hydroxybutyl.

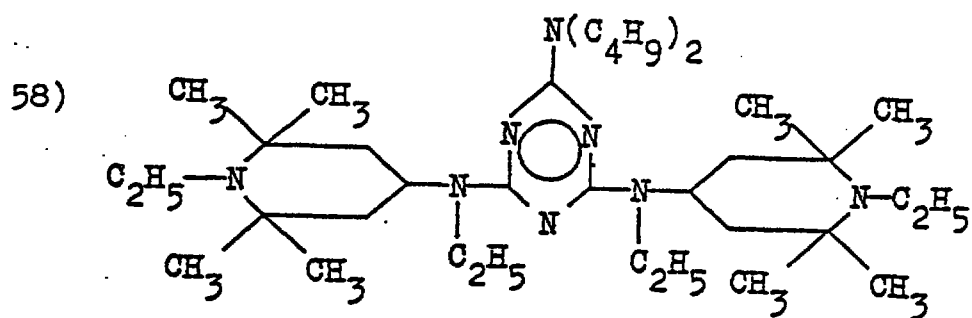
C_2 - C_6 Alkylene A is, for example, ethylene, propylene, 2,2-dimethylpropylene, tetramethylene or hexamethylene.

C_4 - C_5 Alkylene or oxaalkylene formed by R_{11} and R_{12} together is, for example, tetramethylene, pentamethylene or 3-oxa-pentamethylene.

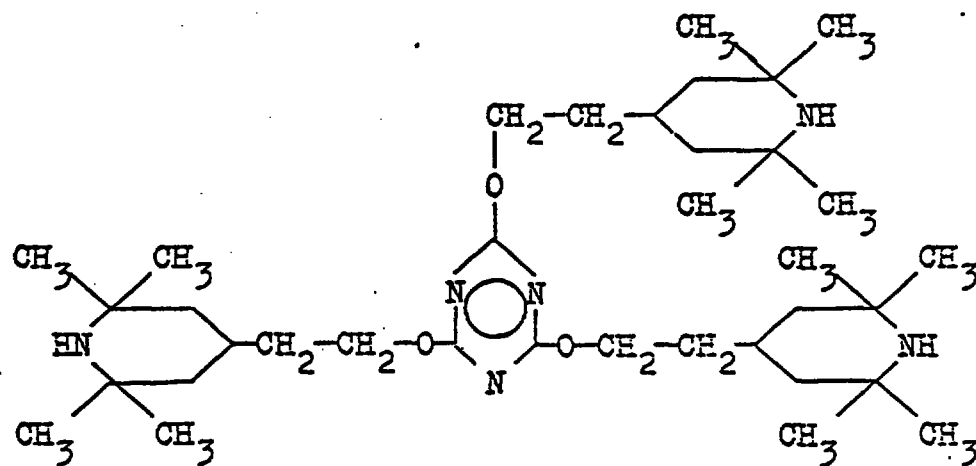
Examples of 2,2,6,6-tetraalkylpiperidine light stabilisers of this category are the compounds of the following formulae:

57)

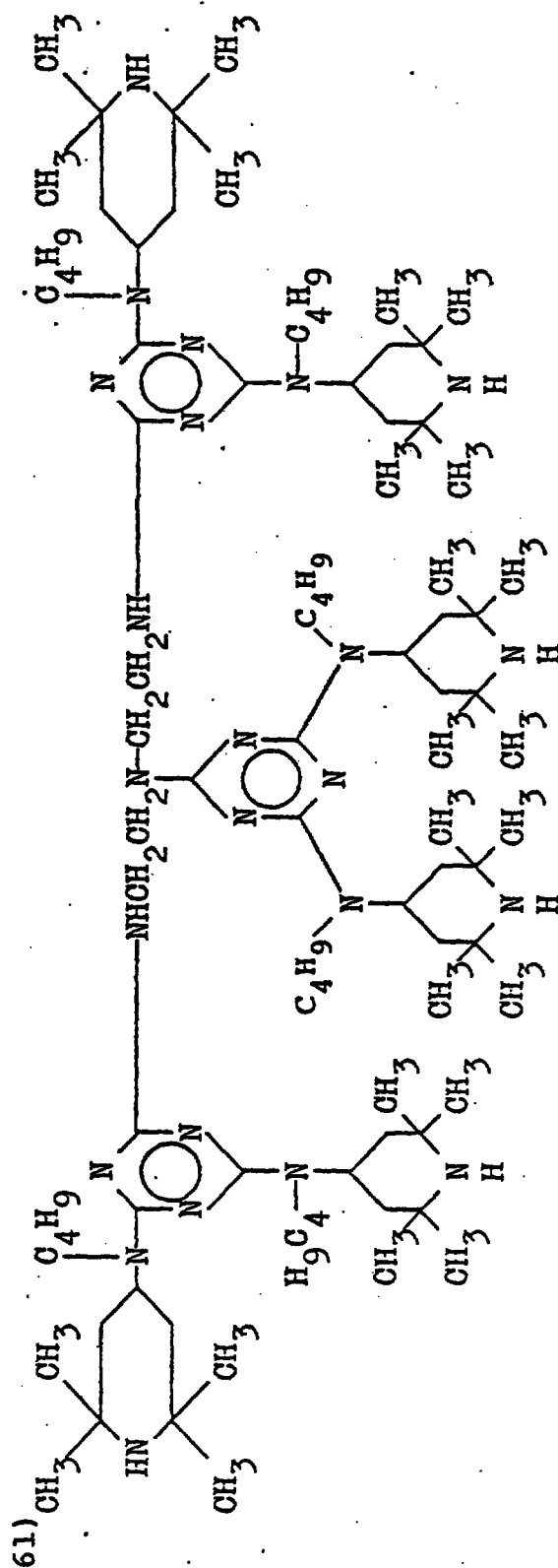
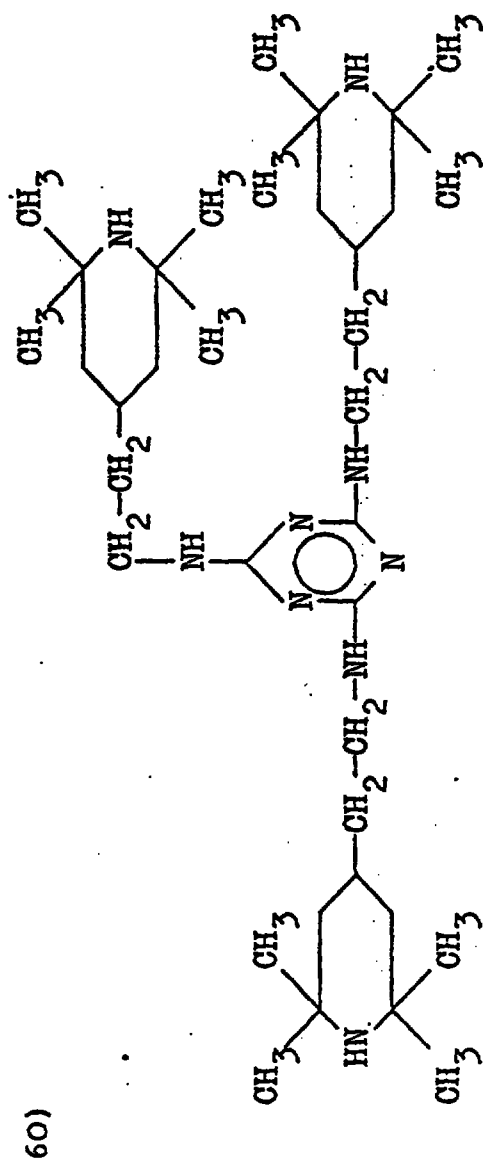




59)

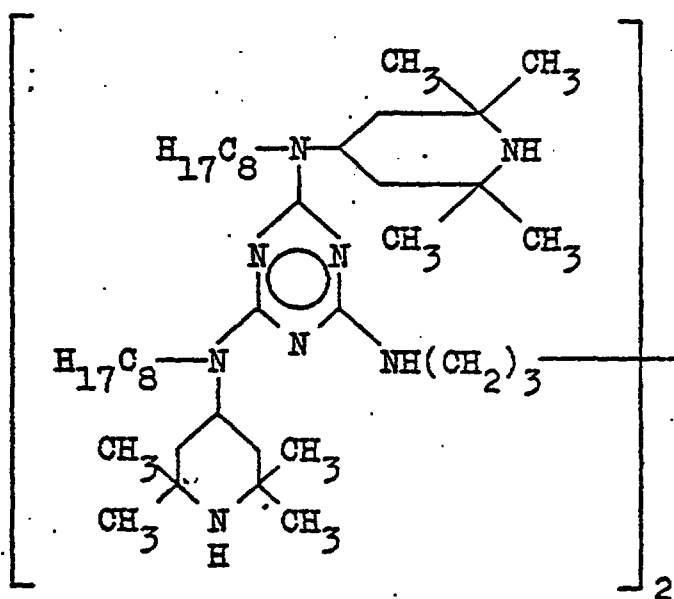


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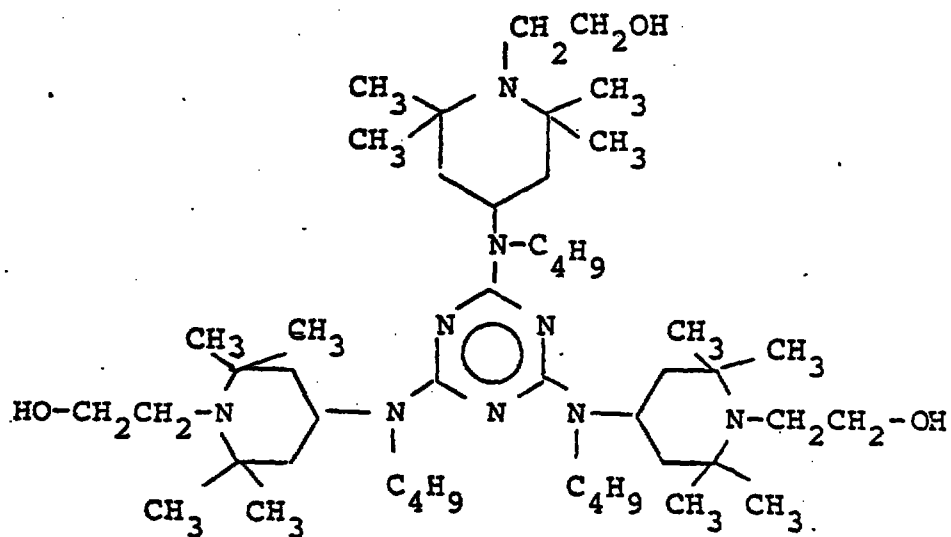


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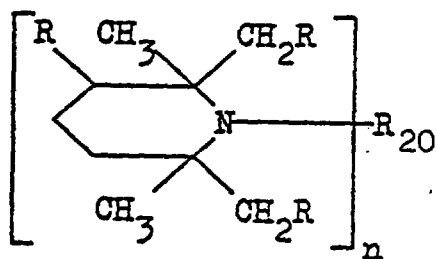
62)



63)



f) Light stabilisers of the formula (VII)



(VII)

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in which n is the number 1 or 2, R is as defined under formula (I) and R_{20} , if $n = 1$, is C_4-C_{18} alkyl, C_7-C_{12} aralkyl, the group $-CO-R_{15}$ or C_1-C_4 alkyl substituted by $-CN$, $-COOR_{16}$, $-OH$ or $-OCOR_{17}$

in which R_{15} is C_1-C_{12} alkyl, C_2-C_4 alkenyl or phenyl, R_{16} is C_1-C_{18} alkyl and R_{17} is C_1-C_{18} alkyl, C_2-C_{10} alkenyl, cyclohexyl, benzyl or C_6-C_{10} aryl, or, if $n = 2$, R_{14} is C_4-C_{12} alkylene, but-2-en-1,4-ylene, xylylene, the group $-(CH_2)_2-OOC-R_{18}-COO-(CH_2)_2-$ or the group $-CH_2-OOC-R_{19}-COO-CH_2-$, in which R_{18} is C_2-C_{10} alkylene, phenylene or cyclohexylene and R_{19} is C_2-C_{10} alkylene, xylylene or cyclohexylene.

Any C_1-C_{12} alkyl substituents are, for example, methyl, ethyl, *n*-propyl, *n*-butyl, sec.-butyl, tert.-butyl, *n*-hexyl, *n*-octyl, 2-ethyl-hexyl, *n*-nonyl, *n*-decyl, *n*-undecyl or *n*-dodecyl.

Any C_1-C_{18} alkyl substituents can be, for example, the groups listed above and, in addition, also, for example, *n*-tridecyl, *n*-tetradecyl, *n*-hexadecyl or *n*-octadecyl.

Any C_2-C_{10} alkylene groups are, for example, ethylene, propylene, 2,2-dimethylpropylene, tetramethylene, hexamethylene, octamethylene or decamethylene.

C_4-C_{18} Alkyl R_{14} is, for example, *n*-butyl, sec.-butyl, tert.-butyl, *n*-hexyl, *n*-octyl, 2-ethyl-hexyl, 1,1-dimethyl-2-tert.-butylethyl, *n*-nonyl, *n*-decyl, *n*-dodecyl, *n*-tridecyl, *n*-tetradecyl, *n*-hexadecyl or *n*-octadecyl.

As C_1-C_4 alkyl substituted by $-CN$, R_{14} is, for example, cyanomethyl, cyanoethyl, 3-cyano-*n*-propyl or 4-cyano-*n*-butyl.

C_4-C_{12} Alkylene R_{14} is, for example, 2,2-dimethylpropylene, tetramethylene, hexamethylene, octamethylene, decamethylene or dodecamethylene.

C_7-C_{12} Aralkyl R_{14} is especially phenethyl or *p*-methyl-benzyl or in particular benzyl.

C_2-C_4 Alkenyl R_{15} is, for example, vinyl, 1-

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propenyl, allyl, methallyl or 2-butenyl.

C_2-C_{10} Alkenyl R_{17} is, for example, the groups listed for alkenyl R_{15} and, in addition, also, for example, crotyl, 2-hexenyl, 2-octenyl or 2-decenyl.

C_6-C_{10} Aryl R_{17} is, for example, phenyl which is unsubstituted or substituted in the o-position or p-position by methyl, ethyl, isopropyl, n-butyl or tert.-butyl.

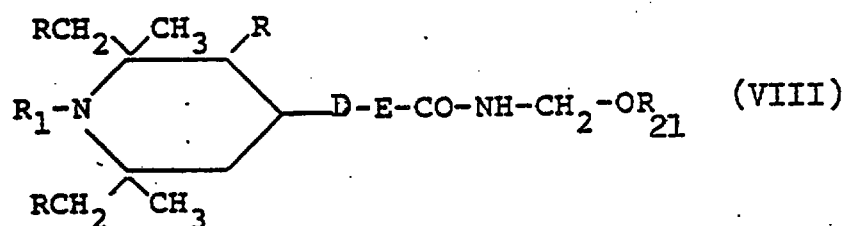
Examples of 2,2,6,6-tetraalkylpiperidine light stabilisers of this category are the following compounds:

64) Bis- $[\beta-(2,2,6,6\text{-tetramethylpiperidino})\text{-ethyl}]$ sebacate

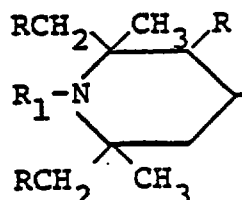
65) n-Octyl $\alpha-(2,2,6,6\text{-tetramethyl-piperidino})\text{-acetate}$

66) 1,4-Bis-(2,2,6,6-tetramethylpiperidino)-2-butene.

g) Light stabilisers of the formula (VIII)

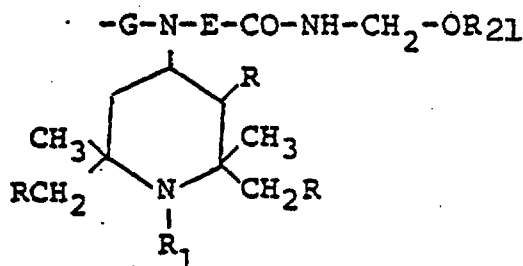


in which D is $-N(R_{22})-$ or $-O-$, E is C_1-C_3 alkylene, the group $-\text{CH}_2-\text{CH}(R_{23})-\text{O}-$, in which R_{23} is hydrogen, methyl or phenyl, the group $-(\text{CH}_2)_3-\text{NH}-$ or a single bond, R is hydrogen or methyl, R_1 is as defined under a), R_{21} is hydrogen or C_1-C_{18} alkyl and R_{22} is hydrogen, C_1-C_{18} alkyl, C_5-C_7 cycloalkyl, C_7-C_{12} aralkyl, cyanoethyl, C_6-C_{10} aryl, the group $-\text{CH}_2-\text{CH}(R_{23})-\text{OH}$, in which R_{23} is as defined above, a group of the formula



or a group of the formula

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in which G can be $\text{C}_2\text{-C}_6$ alkylene or $\text{C}_6\text{-C}_{12}$ arylene, or R_{22} is a group $\text{-E-CO-NH-CH}_2\text{-OR}_{21}$.

Any $\text{C}_1\text{-C}_{18}$ alkyl substituents are, for example, methyl, ethyl, n-propyl, n-butyl, sec.-butyl, tert.-butyl, n-hexyl, n-octyl, 2-ethyl-hexyl, n-nonyl, n-decyl, n-undecyl, n-dodecyl, n-tridecyl, n-tetradecyl, n-hexadecyl or n-octadecyl.

Any $\text{C}_7\text{-C}_{12}$ aralkyl substituents are, for example, phenethyl or especially benzyl.

$\text{C}_3\text{-C}_8$ Alkenyl R_1 can be, for example, 1-propenyl, allyl, methallyl, 2-butenyl, 2-pentenyl, 2-hexenyl, 2-octenyl or 4-tert.-butyl-2-butenyl.

$\text{C}_3\text{-C}_8$ Alkynyl R_1 is preferably propargyl. $\text{C}_1\text{-C}_8$ Alkanoyl R_1 is, for example, formyl, propionyl, butyryl, or octanoyl, but preferably acetyl, and $\text{C}_3\text{-C}_5$ alkenoyl R_1 is especially acryloyl.

$\text{C}_5\text{-C}_7$ Cycloalkyl R_{22} is especially cyclohexyl.

$\text{C}_6\text{-C}_{10}$ Aryl R_{22} is especially phenyl or α - or β -naphthyl, which are unsubstituted or substituted by halogen or $\text{C}_1\text{-C}_4$ alkyl. $\text{C}_1\text{-C}_3$ Alkylene E is, for example, methylene, ethylene or propylene.

$\text{C}_2\text{-C}_6$ Alkylene G is, for example, ethylene, propylene, 2,2-dimethylpropylene, tetramethylene or hexamethylene and $\text{C}_6\text{-C}_{12}$ arylene G is o-, m- or p-phenylene, 1,4-naphthylene or 4,4'-diphenylene.

Examples of 2,2,6,6-tetraalkylpiperidine light stabilisers of this category are the following compounds:

67) N-Hydroxymethyl-N'-2,2,6,6-tetramethylpiperidin-4-yl-urea

68) N-Methoxymethyl-N'-2,2,6,6-tetramethylpiperidin-4-yl-urea

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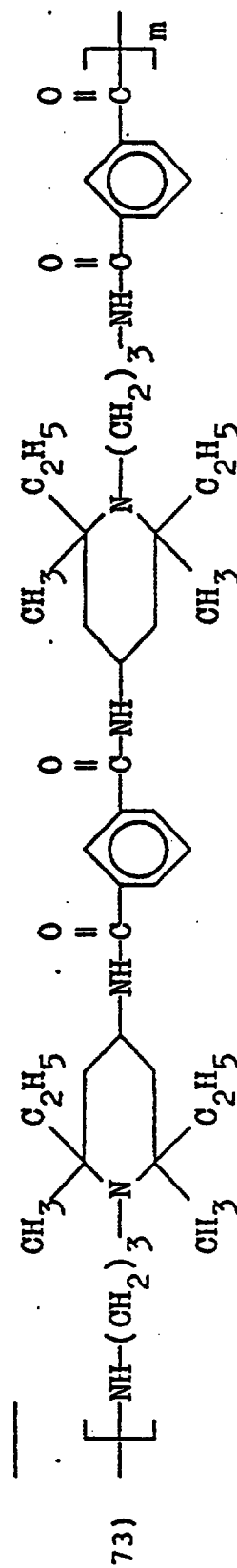
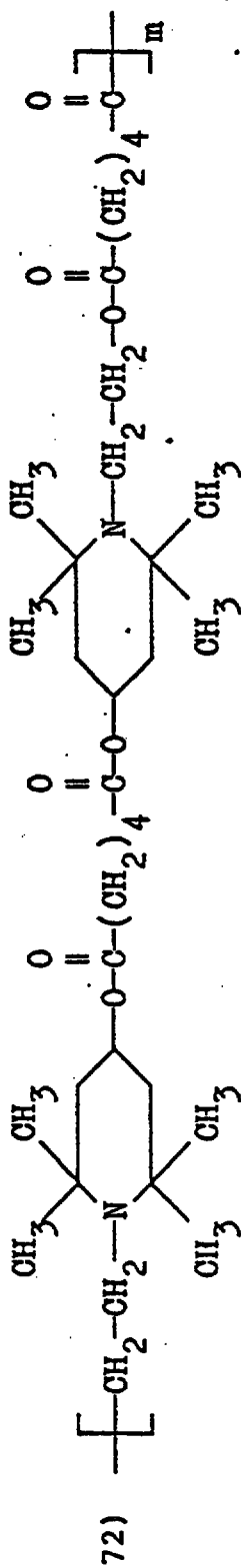
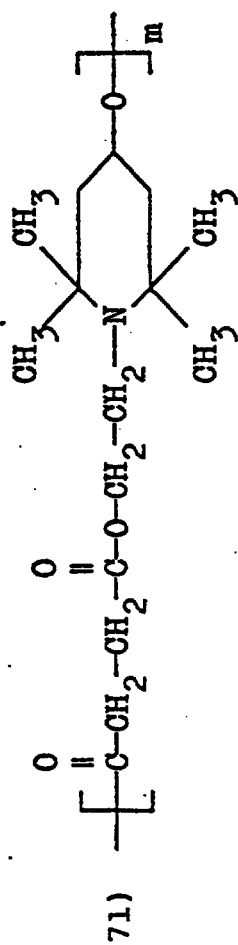
69) N-Methoxymethyl-N'-n-dodecyl-N'-2,2,6,6-tetramethyl-piperidin-4-yl-urea

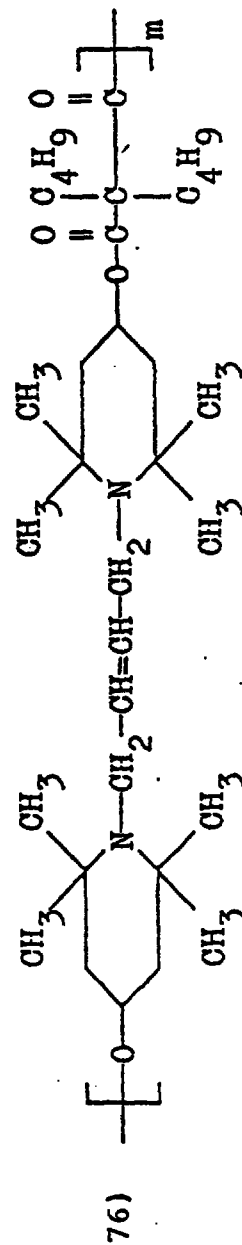
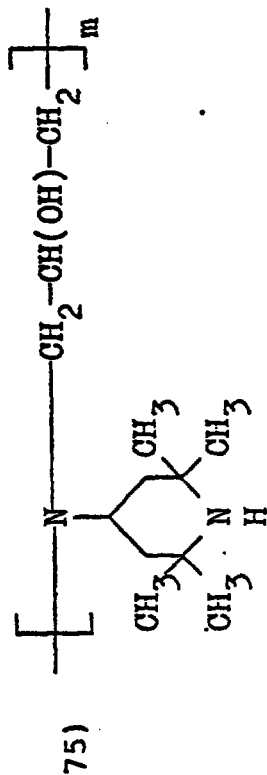
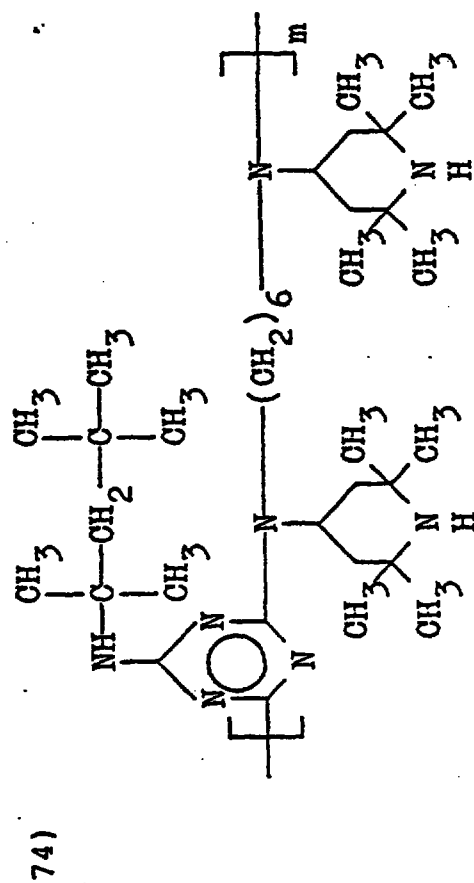
70) O-(2,2,6,6-Tetramethylpiperidin-4-yl)-N-methoxymethyl-urethane.

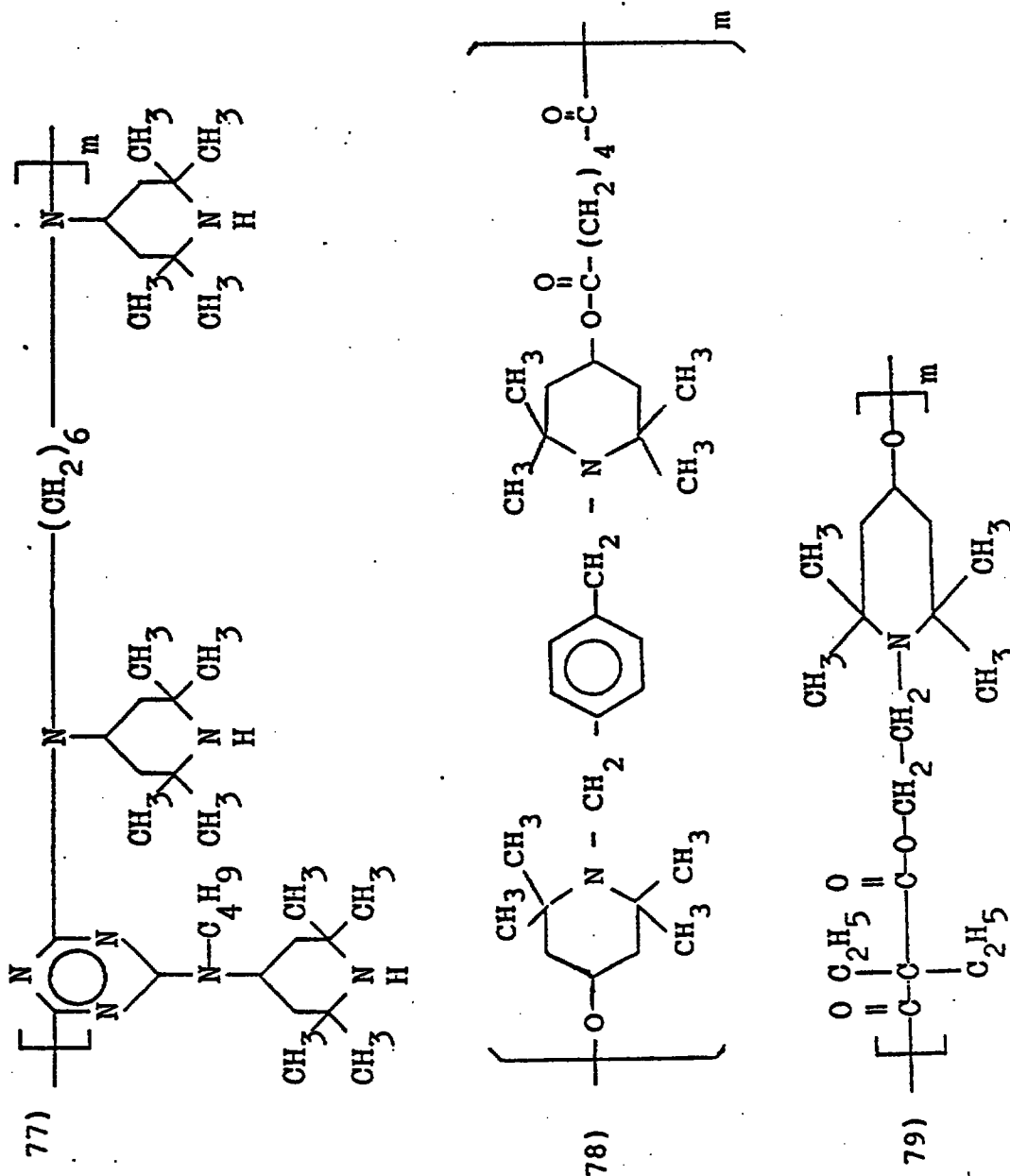
h) Oligomeric or polymeric compounds in which the recurring structural unit contains a 2,2,6,6-tetraalkylpiperidine radical of the formula (I), especially polyesters, polyethers, polyamides, polyamines, polyurethanes, polyureas, polyamino-triazines, poly(meth)acrylates, poly(meth)acrylamides and their copolymers which contain such radicals.

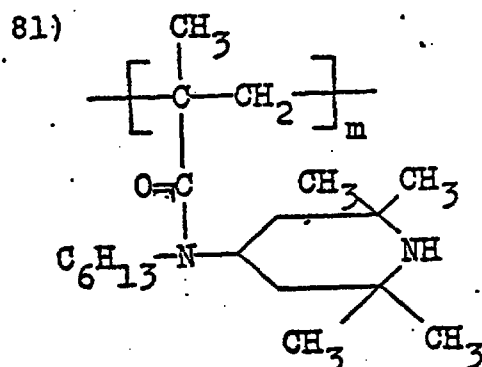
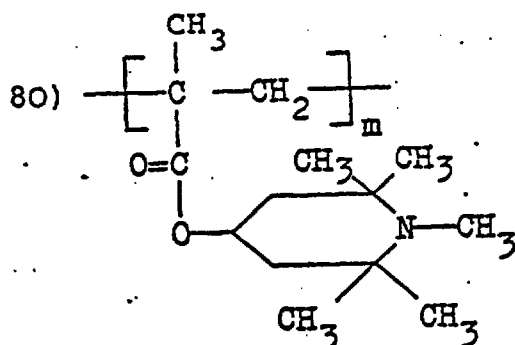
Examples of 2,2,6,6-tetraalkylpiperidine light stabilisers of this category are the compounds of the following formulae, in which m is the numbers 2 to about 200.

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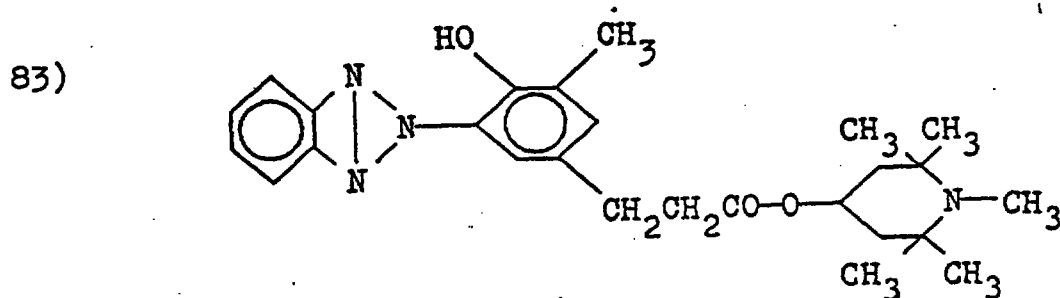
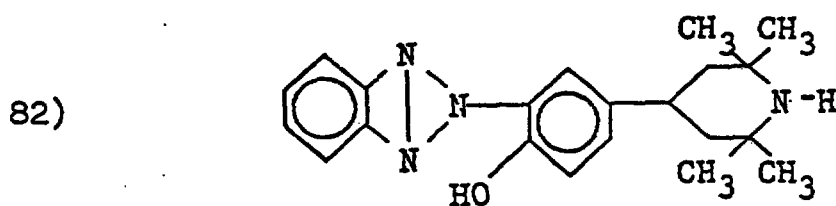


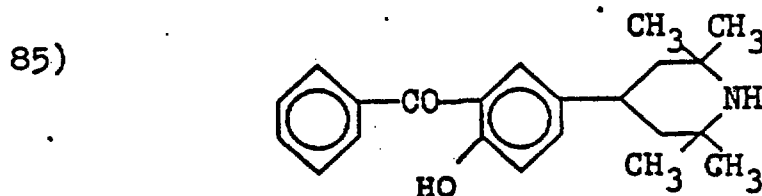
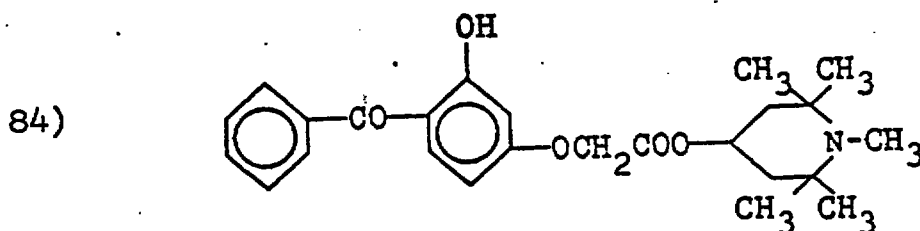




(1) Compounds which contain, in their molecule, at least one 2-(2'-hydroxyphenyl)-benztriazole group or 2-hydroxybenzophenone group and at least one polyalkyl-piperidine group.

Examples of 2,2,6,6-tetraalkylpiperidine light stabilisers of this category are the compounds of the following formulae:





It is also possible to use 2,2,6,6-tetraalkylpiperidine derivatives of categories a) - i) which enter into chemical bonds with the binder of the lacquer. This is the case if the 2,2,6,6-tetraalkylpiperidine derivative possess a reactive group suitable for this purpose, for example a glycidyl group or a methylol group.

Examples of such compounds are the 2,2,6,6-tetraalkylpiperidine derivatives of category g) which contain methylol groups or methylol-ether groups.

If the 2,2,6,6-tetraalkylpiperidine compounds are basic compounds, they can form salts with acids. Suitable acids for this purpose are, for example, inorganic acids or organic carboxylic, sulfonic, phosphonic or phosphinic acids, for example hydrochloric acid, boric acid, phosphoric acid, acetic acid, salicylic acid, toluenesulfonic acid or benzenephosphonic acid.

The 2,2,6,6-tetraalkylpiperidine compounds can form complexes with complex-forming metal compounds, for example with zinc-II acetate, cobalt-II acetylacetonate, nickel-II acetylacetonate, aluminium-III acetylacetonate, nickel-II benzoate or aluminium-III benzoylacetonate.

The customary baking lacquers which are based on acrylic, alkyd or polyester resins, which, if desired, can be crosslinked with melamine/formaldehyde resins,

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epoxide resins or polyisocyanates, and which are described, for example in H. Wagner and H.F. Sarx, Lackkunstharze (Synthetic Lacquer Resins) can be used to prepare the two-layer baked uni-lacquer coatings stabilised according to the invention against light.

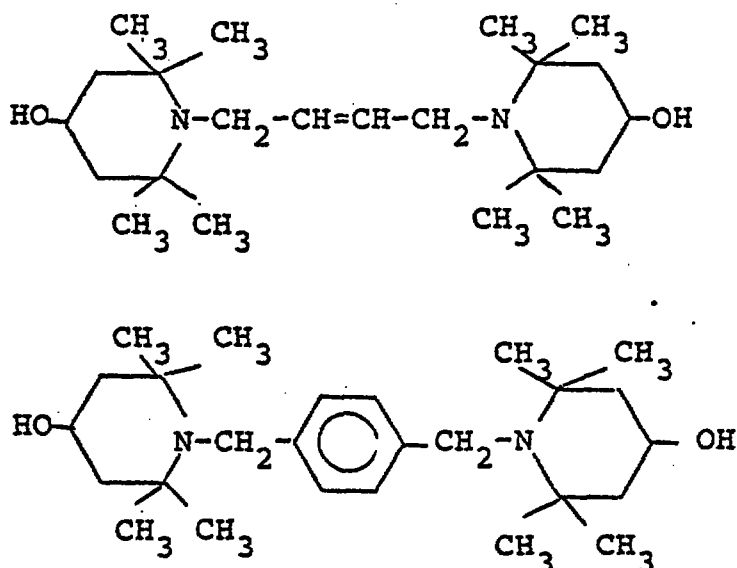
The lacquers are applied by the conventional two-coat process, for example by spraying the undercoat lacquer containing the pigment in a layer thickness of 20 - 30 μm onto coil-coated sheet metal, onto which a commercially available filler had previously been baked in a layer thickness of 20 - 30 μm and, after air-drying for about 5 minutes, applying the topcoat lacquer wet-in-wet in a layer thickness of 35 - 40 μm . After further air-drying for about 15 minutes, the lacquer is baked at 80 - 125°C, depending on the nature of the crosslinking agent, for about 30 minutes.

The amount of 2,2,6,6-tetraalkylpiperidine derivative added is 0.01 to 5% by weight, based on the solvent-free binder, and preferably 0.5 to 1% by weight. The lacquers can contain the customary organic solvents or can be dissolved or dispersed in water or can be free from solvent.

The 2,2,6,6-tetraalkylpiperidine derivative to be used for stabilisation according to the invention can be incorporated either only into the unpigmented topcoat lacquer or both into the unpigmented topcoat lacquer and into the undercoat lacquer containing pigment. Preferably, the light stabiliser is incorporated in the unpigmented topcoat lacquer. Topcoat lacquers based on acrylic/melamine resins are preferred. When preparing acrylic resins or acrylic-modified alkyd resins, polymerisable 2,2,6,6-tetraalkylpiperidine derivatives (for example compound 7 and 42) can be copolymerised in the resin.

Incorporation into the lacquer binder can, however, also be effected by a polycondensation reaction during the preparation or in some cases during baking of the acrylic, alkyd or polyester resins. Examples of co-condensable 2,2,6,6-tetraalkylpiperidine derivatives are compounds 1 and 63 and

also 1-hydroxyethyl-4-hydroxy-2,2,6,6-tetramethylpiperidine or the compounds of the formulae



Incorporation by a polyaddition reaction can take place, for example, via the reaction of free carboxyl groups in the acrylic resin with glycidyl groups of the 2,2,6,6-tetraalkylpiperidine derivative. These carboxyl groups can be incorporated, for example, by the copolymerisation of acrylic acid.

In these cases there is the additional advantage that the light stabilisers are not removable by extraction or migration, so that their action is very long-lasting.

In order to achieve maximum stability to light, it can be advantageous additionally to use other conventional light stabilisers. Examples of these are UV-absorbers of the type comprising the benzophenones, oxalanilides, benztriazoles or acrylic acid derivatives, or metal-containing light stabilisers, for example organic nickel compounds.

In the case of such combinations, the sum of all of the light stabilisers is 0.02 to 5% by weight and preferably 0.5 to 2% by weight, based on the lacquer resin.

Further additives which can be contained in the

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lacquer are antioxidants, for example those of the type comprising sterically hindered phenol derivatives or organic phosphorus compounds, for example phosphites, phosphonites or phosphines, plasticisers, flow control agents, curing accelerators, for example organic Co salts, Mn salts or Zr salts, thickeners, dispersing agents or adhesion improvers.

The stabilisation according to the invention is particularly suitable for lacquer coatings on vehicles.

The following examples describe the use, according to the invention, of 2,2,6,6-tetraalkylpiperidine derivatives in two-layer uni-lacquer coatings. Parts and percentages are by weight.

Example 1

Basic recipe for the lacquers

a) Undercoat lacquer

Alftalat AC 451	51.56 parts
(alkyd resin from H8chst)	
Maprenal MF 590	20.7 parts
(melamine/formaldehyde resin from H8chst)	
TiO ₂	27.6 parts
C.I. Pigment Yellow 24	0.14 part

dissolved in a solvent mixture consisting of 44% of xylene, 26% of petroleum ether and 30% of butyl acetate.

b) Topcoat lacquer

Viacryl VC 1341/60%	62.5 parts
(acrylic resin from Vianova Kunstharz AG)	
in Shellsol A/butyl acetate	
Maprenal MF 825 / 71%	17.6 parts
(melamine/formaldehyde resin from H8chst)	
in isobutanol	
Solvesso 100	19.4 parts
(solvent from Esso)	
Paint Additive 11	0.5 part

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(flow control agent from Dow Corning Corp.)

Production of the two-layer uni-lacquer coating

A commercially available filler (Standex filling primer) is first sprayed in a layer thickness of 30 μm onto coil-coated sheet aluminium and is baked for 15 minutes at 175°C. The pigmented undercoat lacquer is then sprayed on in a layer thickness of about 30 μm and, after air-drying for 5 minutes, the unpigmented topcoat lacquer is applied wet-in-wet in a layer thickness of 35 - 40 μm . The lacquer is then baked for 30 minutes at 130°C.

Weathering

The metal sheets thus obtained are stored for four weeks under standard climatic conditions (23°C/50% relative atmospheric humidity) and then subjected to weathering in a QUV apparatus according to ASTM G53-77.

When the tests described below were carried out, the light stabiliser indicated in column II of the tables 1, 2 and 3 given below (the stabilisers being numbered in accordance with the examples mentioned in the description in the case of the polyalkylpiperidine compounds to be used according to the invention) was added, in each case in the amount indicated in % (based on the lacquer resin) in column I of the said tables, to the topcoat lacquer before the latter was applied.

Yellowing test after weathering for 1,200 hours

The change in the blue-yellow value (ΔBYV) is a measure of the yellowing of the lacquers. It is determined by calculation from the photometrically determined colour coordinates. The corresponding values are listed in column III of Tables 1, 2 and 3 given below.

Reduction in gloss after weathering for 1,200 hours

The gloss values determined after weathering for 1,200 hours and in accordance with ASTM D 523 are listed in column IV of Tables 1, 2 and 3 given below.

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Visual appearance of the lacquer-coated metal sheets after weathering for 1,200 hours

After weathering, the metal sheets were examined for cloudiness, crazing, blistering and delamination. The findings are listed in column V of Tables 1, 2 and 3 given below.

Table 1 Light stabilising action of the polyalkylpiperidine derivatives

I	II	III	IV	V
%	Light stabiliser	Δ BYV after weathering (QUV) for 1,200 hours	20° gloss after weathering (QUV) 0 hours 1,200 hours	Appearance after weathering (QUV) for 1,200 hours
-	-	16	97 16	crazing and blistering and delamination
1	Compound 11	8.7	99 94	isolated blistering
1	Compound 19	9.3	98 91	isolated blistering
1	Compound 53	9.5	97 93	no change
1	Compound 82	8.8	93 80	no change
1	Compound 83	9.5	98 90	no change

Table 2 Light stabilising action in the case of the combination of polyalkyl-piperidine compounds and UV-absorbers

I	II	III	IV	V
%	Light stabiliser	Δ BV after weathering (QUV) for 1,200 hours	20° gloss after weathering (QUV) 0 hours 1,200 hours	Appearance after weathering (QUV) for 1,200 hours
-	-	16	97 16	crazing, blistering and delamination
0.5	Compound 11			
0.5	2-(2-Hydroxy-3,5-di-tert.-amyl-phenyl)-benztriazole	6.2	99 93	no change
0.5	Compound 29			
0.5	2-[2-Hydroxy-3,5-di-(α , α -dimethylbenzyl)-phenyl]-benztriazole	7.2	97 91	no change
0.5	Compound 53			
0.5	2-[2-Hydroxy-3,5-di-(α , α -dimethylbenzyl)-phenyl]-benztriazole	6.4	98 91	no change

I	II	III	IV	V
%	Light stabiliser	Δ BYV after weathering (QUV) for 1,200 hours	20° gloss after weathering (QUV) 0 hours 1,200 hours	Appearance after weathering (QUV) for 1,200 hours
0.5	Compound 80			
0.5	2-[2-Hydroxy-3,5-di-(α , α -dimethylbenzyl)-phenyl]-benztriazole	7.9	92 79	no change
0.5	Compound 63			
0.5	2-[2-Hydroxy-3,5-di-(α , α -dimethylbenzyl)-phenyl]-benztriazole	7.6	97 88	no change
0.5	Compound 30			
0.5	2-[2-Hydroxy-3,5-di-(α , α -dimethylbenzyl)-phenyl]-benztriazole	7.6	97 82	no change
0.5	Compound 31			
0.5	2-[2-Hydroxy-3,5-di-(α , α -dimethylbenzyl)-phenyl]-benztriazole	8.0	97 86	no change

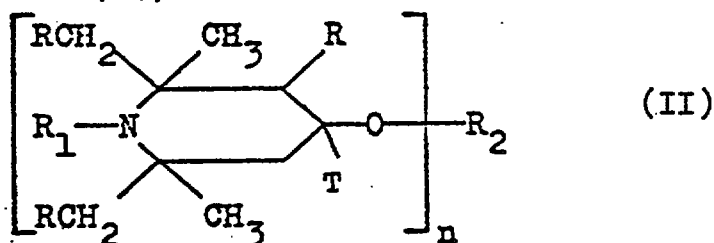
Table 3 Light stabilising action of the UV-absorbers

I	II	III	IV	V
%	Light stabiliser	Δ BYV after weathering (QUV) for 1,200 hours	20° gloss after weathering (QUV) 0 hours 1,200 hours	Appearance after weathering (QUV) for 1,200 hours
-	-	16	97 16	crazing and blistering and delamination
1	2-(2-Hydroxy-3,5-di-tert.-amyl-phenyl)-benztriazole	12.5	97 53	cloudy, extensive blistering
2	2-Hydroxy-4-dodecyloxy-benzophenone	9.5	99 87	cloudy, crazing
2	2,4-Dihydroxy-benzo-phenone	9.4	99 26	cloudy, crazing
2	2,2'-Dihydroxy-4,4'-dimethoxy-benzophenone	10.6	99 36	cloudy, crazing

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WHAT IS CLAIMED IS:

1. The use of 2,2,6,6-tetraalkylpiperidine compounds or their acid addition salts or complexes with metal compounds, if desired together with further stabilisers, for stabilising two-layer baked uni-lacquer coatings based on acrylic, alkyd or polyester resins, which, if desired, can be crosslinked with melamine/formaldehyde resins, epoxide resins or polyisocyanates, against the action of light.
2. The use, according to claim 1, of light stabilisers of the formula (II)



in which n is the numbers 1 - 4, T is hydrogen or $-\text{CONH}_2$, R is hydrogen or methyl, R_1 is hydrogen, oxyl, C_1-C_{18} alkyl, C_3-C_8 alkenyl, C_3-C_8 alkynyl, C_7-C_{12} aralkyl, C_1-C_8 alkanoyl, C_3-C_5 alkenoyl, glycidyl or a group $-\text{CH}_2\text{CH}(\text{OH})-\text{Z}$, in which Z is hydrogen, methyl, ethyl or phenyl and R_2 , if $n = 1$, is hydrogen, C_1-C_{18} alkyl, which can be interrupted by one or more oxygen atoms, cyanoethyl, benzyl, glycidyl, a monovalent radical of an aliphatic, cycloaliphatic, araliphatic, aromatic or heterocyclic (sic) carboxylic acid, carbamic acid or phosphorus-containing acid or a monovalent silyl radical, if $n = 2$ is C_2-C_{12} alkylene, C_4-C_{12} alkenylene, xylylene, a divalent radical of an aliphatic, cycloaliphatic, araliphatic, aromatic or heterocyclic dicarboxylic acid, dicarbamic acid or phosphorus-containing acid or a divalent silyl radical, if $n = 3$ is a trivalent radical of an aliphatic, cycloaliphatic, aromatic or heterocyclic tricarboxylic acid, of an aromatic tricarbamic acid or of a phosphorus-containing acid or a trivalent silyl radical and if $n = 4$ is a tetravalent radical of an aliphatic, cycloaliphatic

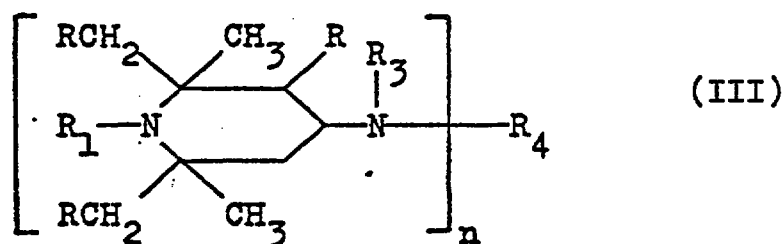




or aromatic tetracarboxylic acid.

3. The use, according to claim 2, of light stabilisers of the formula (II), in which n is the number 1 or 2, R is hydrogen or methyl, R_1 is hydrogen, C_1 - C_{12} alkyl, allyl, benzyl, acetyl or acryloyl and R_2 , if n = 1, is a radical of an aliphatic carboxylic acid having 2 - 18 C atoms, of a cycloaliphatic carboxylic acid having 5 - 12 C atoms or of an aromatic carboxylic acid having 7 - 15 C atoms, and if n = 2 is a radical of an aliphatic dicarboxylic acid having 2 - 36 C atoms, of a cycloaliphatic or aromatic dicarboxylic acid having 8 - 14 C atoms or of an aliphatic, cycloaliphatic or aromatic dicarbamic acid having 8 - 14 C atoms.

4. The use, according to claim 1, of light stabilisers of the formula (III)



in which n is the number 1 or 2, R is hydrogen or methyl, R_1 is hydrogen, oxyl, C_1 - C_{18} alkyl, C_3 - C_8 alkenyl, C_3 - C_8 alkynyl, C_7 - C_{12} aralkyl, C_1 - C_8 alkanoyl, C_3 - C_5 alkenoyl,

glycidyl or a group $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}$, in which Z is hydrogen, methyl, ethyl or phenyl

and R_3 is hydrogen, C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, C_7 - C_8 aralkyl, C_2 - C_{18} alkanoyl, C_3 - C_5 alkenoyl or benzoyl and R_4 , if n = 1, is hydrogen, C_1 - C_{18} alkyl, C_5 - C_7 cycloalkyl, C_2 - C_8 alkenyl, which is unsubstituted or substituted by a cyano, carbonyl or carbamide group, glycidyl or a group of the formula $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}''$ or of the formula $-\text{CONH}-\text{Z}''$, in which Z'' is hydrogen, methyl or phenyl, and if n = 2 is C_2 - C_{12} alkylene, C_6 - C_{12} arylene, xylylene, a

$-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2$ group or a group

$-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2-\text{O}-\text{X}-\text{O}-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2$, in which X is C_2 - C_{10} alkylene, C_6 - C_{15} arylene or C_6 - C_{12} cycloalkylene, or, with the proviso that R_3 is not alkanoyl, alkenoyl or benzoyl, R_4 can also be a divalent radical of an aliphatic,



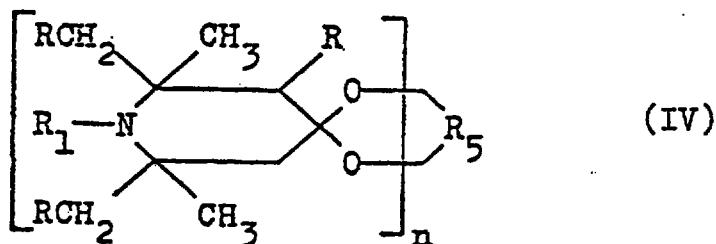
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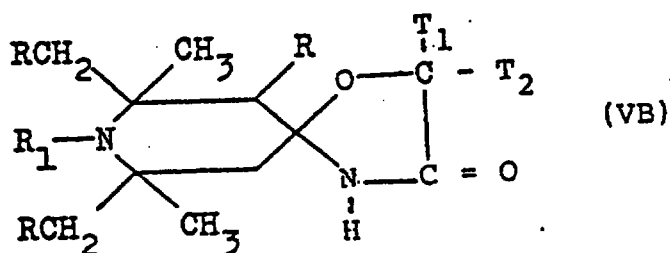
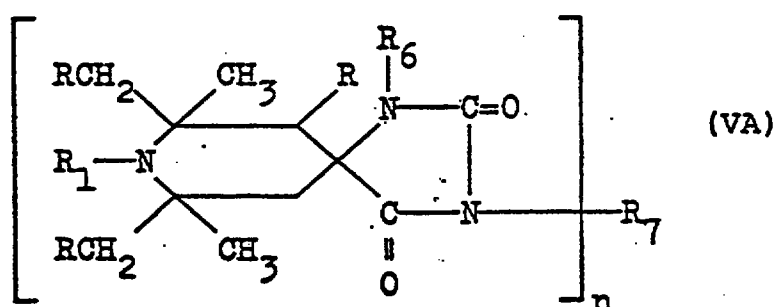
cycloaliphatic or aromatic dicarboxylic acid or dicarbamic acid or the group -CO- , or R_3 and R_4 together, if $n = 1$, can be the imide radical of an aliphatic, cycloaliphatic or aromatic 1,2- or 1,3-dicarboxylic acid.

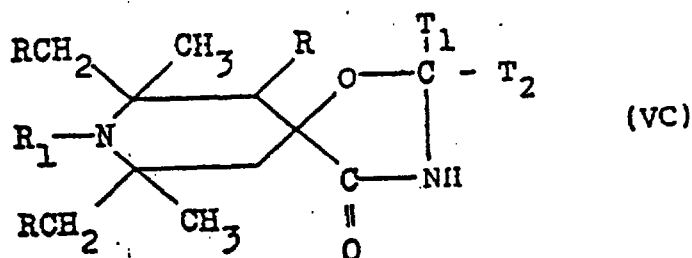
5. The use, according to claim 1, of light stabilisers of the formula (IV)



in which n is the number 1 or 2, R is hydrogen or methyl, R_1 is hydrogen, oxyl, $\text{C}_1\text{-C}_{18}$ alkyl, $\text{C}_3\text{-C}_8$ alkenyl, $\text{C}_3\text{-C}_8$ alkynyl, $\text{C}_7\text{-C}_{12}$ aralkyl, $\text{C}_1\text{-C}_8$ alkanoyl, $\text{C}_3\text{-C}_5$ alkenoyl, glycidyl or a group $\text{-CH}_2\text{CH(OH)-Z}$, in which Z is hydrogen, methyl, ethyl or phenyl and R_5 , if $n = 1$, is $\text{C}_2\text{-C}_8$ alkylene or hydroxyalkylene or $\text{C}_4\text{-C}_{22}$ acyloxyalkylene, and if $n = 2$ is the group $(\text{-CH}_2)_2(\text{CH}_2\text{-})_2$.

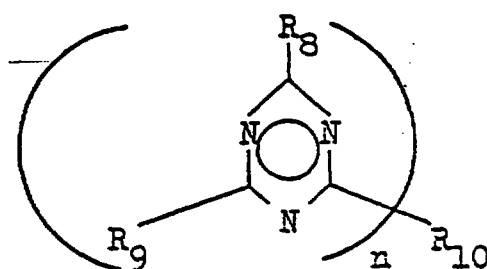
6. The use, according to claim 1, of light stabilisers of the formulae (VA), (VB) or (VC)





in which n is the number 1 or 2, R is hydrogen or methyl, R₁ is hydrogen, oxyl, C₁-C₁₈ alkyl, C₃-C₈ alkenyl, C₃-C₈ alkynyl, C₇-C₁₂ aralkyl, C₁-C₈ alkanoyl, C₃-C₅ alkenoyl, glycidyl or a group -CH₂-CH(OH)-Z, in which Z is hydrogen, methyl, ethyl or phenyl and R₆ is hydrogen, C₁-C₁₂ alkyl, allyl, benzyl, glycidyl or C₂-C₆ alkoxyalkyl and R₇, if n = 1, is hydrogen, C₁-C₁₂ alkyl, C₃-C₅ alkenyl, C₇-C₉ aralkyl, C₅-C₇ cycloalkyl, C₂-C₄ hydroxyalkyl, C₂-C₆ alkoxyalkyl, C₆-C₁₀ aryl, glycidyl or a group of the formula -(CH₂)_m-COO-Q or of the formula -(CH₂)_m-O-CO-Q, in which m is 1 or 2 and Q is C₁-C₁₈ alkyl or phenyl, and if n = 2 is C₂-C₁₂ alkylene or C₆-C₁₂ arylene, C₄-C₁₂ alkenylene, a group -CH₂-CH(OH)-CH₂-O-X-O-CH₂-CH(OH)-CH₂-, in which X is C₂-C₁₀ alkylene, C₆-C₁₅ arylene or C₆-C₁₂ cycloalkylene, or a group -CH₂CH(OZ)CH₂-(OCH₂-CH(OZ)CH₂)₂-, in which Z is hydrogen, C₁-C₁₈ alkyl, allyl, benzyl, C₂-C₁₂ alkanoyl or benzoyl, and T₁ and T₂ independently of one another are hydrogen, C₁-C₁₈ alkyl or C₆-C₁₀ aryl which is unsubstituted or substituted by halogen or C₁-C₄ alkyl, or C₇-C₉ aralkyl, or T₁ and T₂ together with the C atom which bonds them form C₅-C₇ cycloalkyl, pyrrolidinyl or piperidinyl, which are unsubstituted or substituted by C₁-C₄ alkyl.

7. The use, according to claim 1, of light stabilisers of the formula (VI)





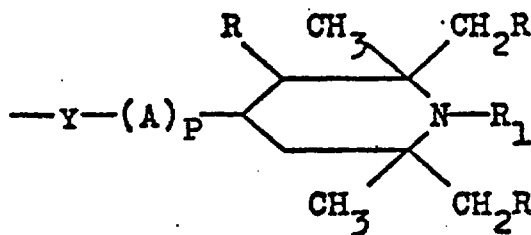
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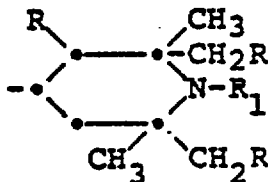
in which n is the number 1 or 2 and R_8 is a group of the formula



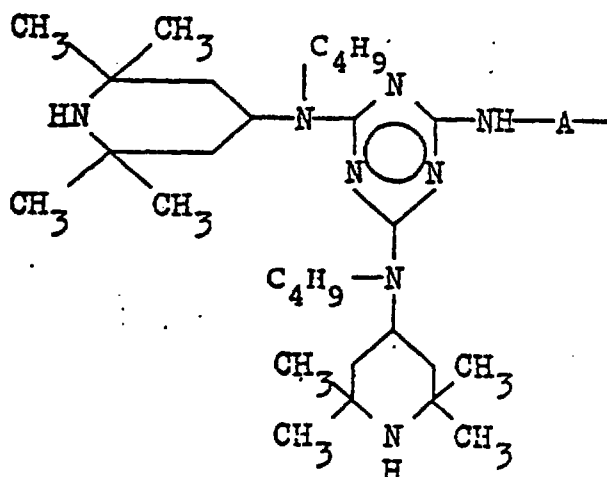
in which R is hydrogen or methyl, R_1 is hydrogen, oxyl, C_1-C_{18} alkyl, C_3-C_8 alkenyl, C_3-C_8 alkynyl, C_7-C_{12} aralkyl, C_1-C_8 alkanoyl, C_3-C_5 alkenoyl

glycidyl or a group $-CH_2-CH(OH)-Z$, in which Z is hydrogen, methyl, ethyl or phenyl, Y is $-O-$ or

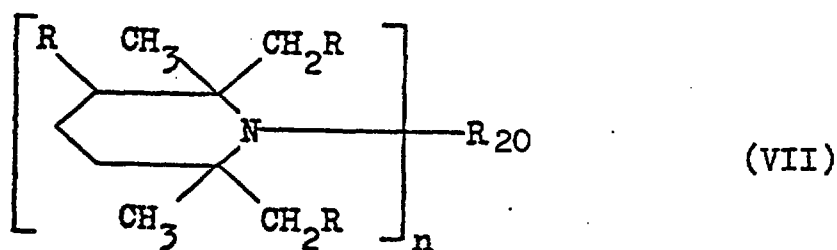
$-NR_{11}-$, A is C_2-C_6 alkylene or $-(CH_2)_3-O-$ and p is the number 0 or 1, R_9 is the groups R_8 , $NR_{11}R_{12}$, $-OR_{13}$, $-NHCH_2OR_{13}$ or $-N(CH_2OR_{13})_2$, and R_{10} , if $n = 1$, is the groups R_8 or R_9 , and if $n = 2$, is the group $-Y-B-Y-$, in which B is C_2-C_6 alkylene which can be interrupted by $-N(R_{14})-$, and R_{11} is C_1-C_{12} alkyl, cyclohexyl, benzyl or C_1-C_4 hydroxyalkyl or a group of the formula



R_{12} is C_1-C_{12} alkyl, cyclohexyl, benzyl or C_1-C_4 hydroxyalkyl, R_{13} is hydrogen, C_1-C_{12} alkyl or phenyl and R_{14} is hydrogen, C_1-C_{12} alkyl, cyclohexyl, benzyl or phenyl, or R_{11} and R_{12} together are C_4-C_5 alkylene or oxaalkylene, or R_{11} and R_{12} are each a group of the formula

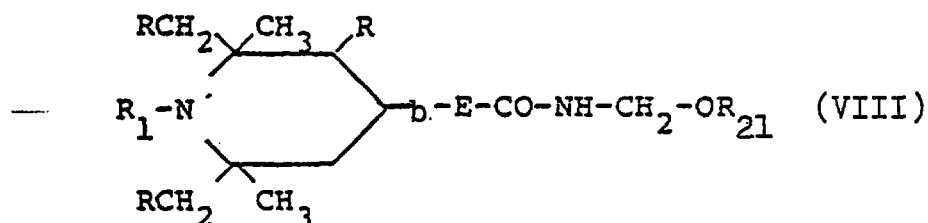


8. The use, according to claim 1, of light stabilisers of the formula (VII)



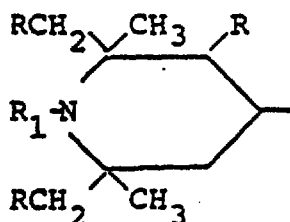
in which n is the number 1 or 2, R is hydrogen or methyl and R_{20} if $n = 1$, is C_4 - C_{18} alkyl, C_7 - C_{12} aralkyl, the group $-CO-R_{15}$ or C_1 - C_4 alkyl substituted by $-CN$, $-COOR_{16}$, $-OH$ or $-OCOR_{17}$, in which R_{15} is C_1 - C_{12} alkyl, C_2 - C_4 alkenyl or phenyl, R_{16} is C_1 - C_{18} alkyl and R_{17} is C_1 - C_{18} alkyl, C_2 - C_{10} alkenyl, cyclohexyl, benzyl or C_6 - C_{10} aryl, or, if $n = 2$, R_{14} is C_4 - C_{12} alkylene, but-2en-1,4-ylene, xylylene, the group $-(CH_2)_2-OOC-R_{18}-COO-(CH_2)_2-$ or the group $-CH_2-OOC-R_{19}-COO-CH_2-$, in which R_{18} is C_2 - C_{10} alkylene, phenylene or cyclohexylene and R_{19} is C_2 - C_{10} alkylene, xylylene or cyclohexylene.

9. The use, according to claim 1, of light stabilisers of the formula (VIII)

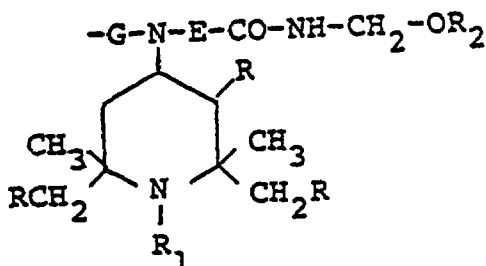




in which D is $-N(R_{22})-$ or $-O-$, E is C_1-C_3 alkylene, the group $-\text{CH}_2-\text{CH}(R_{23})-\text{O}-$, in which R_{23} is hydrogen, methyl or phenyl, the group $-(\text{CH}_2)_3-\text{NH}-$ or a single bond, R is hydrogen or methyl, R_1 is hydrogen, oxyl, C_1-C_{18} alkyl, C_3-C_8 alkenyl, C_3-C_8 alkynyl, C_7-C_{12} aralkyl, C_1-C_8 alkanoyl, C_3-C_5 alkenoyl, glycidyl or a group $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}$, in which Z is hydrogen, methyl, ethyl or phenyl, and R_{21} is hydrogen or C_1-C_{18} alkyl and R_{22} is hydrogen, C_1-C_{18} alkyl, C_5-C_7 cycloalkyl, C_7-C_{12} aralkyl, cyanoethyl, C_6-C_{10} aryl, the group $-\text{CH}_2-\text{CH}(R_{23})-\text{OH}$, in which R_{23} is as defined above, a group of the formula



or a group of the formula



in which G can be C_2-C_6 alkylene or C_6-C_{12} arylene, or R_{22} is a group $-\text{E}-\text{CO}-\text{NH}-\text{CH}_2-\text{OR}_{21}$.

10. Use of compounds 2,2,6,6-tetraalkylpiperidine compounds according to claim 1, characterised in that oligomeric or polymeric compounds are used in which the recurring structural unit contains a 2,2,6,6-tetraalkylpiperidine radical, especially a polyester, polyether, polyamide, polyamine, polyurethane, polyurea, polyaminotriazine, poly(meth)acrylate or poly(meth)acrylamide, and copolymers thereof, which contain such radicals.

11. Use of 2,2,6,6-tetraalkylpiperidine compounds according to claim 1, characterised in that compounds are used which contain, in their molecule, at least one 2-(2'-hydroxyphenyl)benztriazole group or 2-hydroxybenzophenone



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group and at least one 2,2,6,6-tetraalkylpiperidine group.

12. Use according to any one of the preceding claims, characterised in that an acid addition salt of a 2,2,6,6-tetraalkylpiperidine compound is used.

13. Use according to any one of claims 1 to 11, characterised in that a complex of a 2,2,6,6-tetraalkylpiperidine compound with a metal compound is used.

14. Use according to any one of the preceding claims, characterised in that the 2,2,6,6-tetraalkylpiperidine compound is used in an amount of 0.01 to 5% by weight, based on the solvent-free binder (lacquer resin).

15. Use according to claim 14, characterised in that other light stabilisers are additionally used, the amount of these stabilisers being so chosen that the sum of all of the light stabilisers is 0.02 to 5% by weight, based on the solvent-free binder (lacquer resin).

16. Use according to either of claims 14 and 15, characterised in that antioxidants, plasticisers, flow control agents, curing accelerators, thickeners, dispersing agents or adhesion improvers are added as further additives.

17. Use according to claim 1, characterised in that the light stabiliser is incorporated in the topcoat lacquer.

18. Use of 2,2,6,6-tetraalkylpiperidine compounds according to claim 1, characterised in that the topcoat lacquer used is a lacquer based on acrylic/melamine resins.

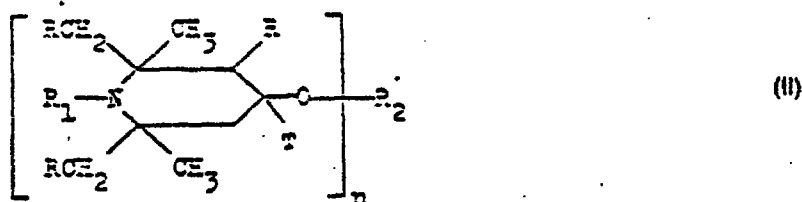
19. Use of 2,2,6,6-tetraalkylpiperidine compounds according to claim 1, characterised in that the coating is a lacquer-coating for vehicles.



Claims (as printed)

1. The use of 2,2,6,6-tetraalkylpiperidine compounds or their acid addition salts or complexes with metal compounds, if desired together with further stabilisers, for stabilising two-layer uni-lacquer coatings based on acrylic, alkyd or polyester resins, which, if desired, can be crosslinked with melamine/formaldehyde resins, epoxide resins or polyisocyanates, against the action of light, humidity and oxygen.

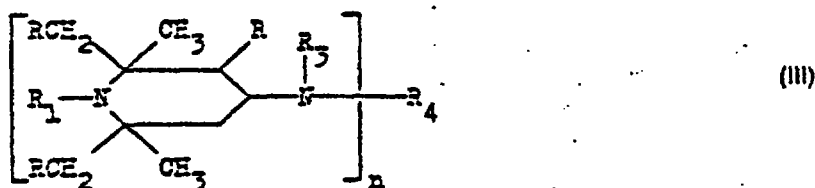
2. The use, according to claim 1, of a light stabiliser of the formula (II)



in which n is the numbers 1-4, T is hydrogen or $-\text{CONH}_2$, R is hydrogen or methyl, R_1 is hydrogen, oxyl, $\text{C}_1\text{-C}_{18}$ alkyl, $\text{C}_3\text{-C}_8$ alkenyl, $\text{C}_3\text{-C}_8$ alkynyl, $\text{C}_7\text{-C}_{12}$ aralkyl, $\text{C}_1\text{-C}_8$ alkanoyl, $\text{C}_3\text{-C}_5$ alkenoyl, glycidyl or a group $-\text{CH}_2\text{CH}(\text{OH})-\text{Z}$, in which Z is hydrogen, methyl, ethyl or phenyl and R_2 , if $n = 1$, is hydrogen, $\text{C}_1\text{-C}_{18}$ alkyl, which can be interrupted by one or more oxygen atoms, cyanoethyl, benzyl, glycidyl, a monovalent radical of an aliphatic, cycloaliphatic, araliphatic, aromatic or heterocyclic carboxylic acid, carbamic acid or phosphorus-containing acid or a monovalent silyl radical, if $n = 2$ is $\text{C}_1\text{-C}_{12}$ alkylene, $\text{C}_4\text{-C}_{12}$ alkenylene, xylene, a divalent radical of an aliphatic, cycloaliphatic, araliphatic, aromatic or heterocyclic dicarboxylic acid, dicarbamic acid, or phosphorus-containing acid or a divalent silyl radical, if $n = 3$ is a trivalent radical of an aliphatic, cycloaliphatic, aromatic or heterocyclic tricarboxylic acid, of an aromatic tricarbamic acid or of a phosphorus-containing acid or a trivalent silyl radical and if $n = 4$ is a tetravalent radical of an aliphatic, cycloaliphatic or aromatic tetracarboxylic acid.

3. The use, according to claim 2, of a light stabiliser of the formula (II), in which n is the number 1 or 2, R is hydrogen or methyl, R_1 is hydrogen, $\text{C}_1\text{-C}_{12}$ alkyl, allyl, benzyl, acetyl or acryloyl and R_2 , if $n = 1$, is a radical of an aliphatic carboxylic acid having 2-18 C atoms, of a cycloaliphatic carboxylic acid having 5-12 C atoms or of an aromatic carboxylic acid having 7-15 C atoms, and if $n = 2$ is a radical of an aliphatic dicarboxylic acid having 2-36 C atoms, of a cycloaliphatic or aromatic dicarboxylic acid having 8-14 C atoms or of an aliphatic, cycloaliphatic or aromatic dicarbamic acid having 8-14 C atoms.

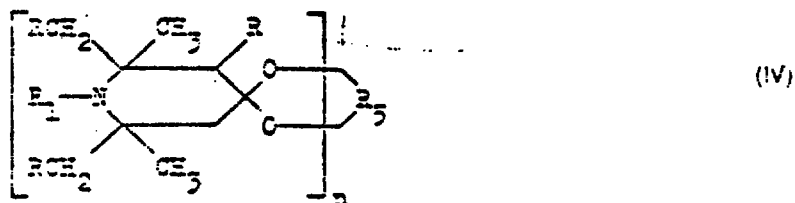
4. The use, according to claim 1, of a light stabiliser of the formula (III)



in which n is the number 1 or 2, R is hydrogen or methyl, R_1 hydrogen, oxyl, $\text{C}_1\text{-C}_{18}$ alkyl, $\text{C}_3\text{-C}_8$ alkenyl,

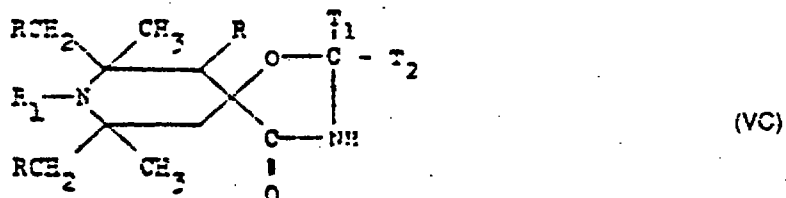
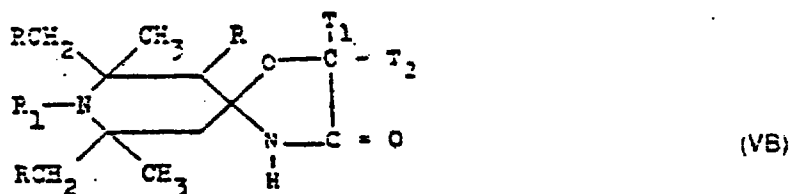
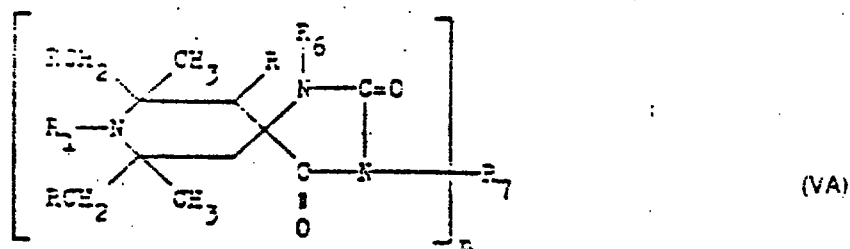
C_2-C_8 alkynyl, C_7-C_{12} aralkyl, C_1-C_8 alkanoyl, C_3-C_5 alkenoyl, glycidyl or a group $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}$, in which Z is hydrogen, methyl, ethyl or phenyl, and R_3 is hydrogen, C_1-C_{12} alkyl, C_5-C_7 cycloalkyl, $C-C_8$ aralkyl, C_2-C_{18} alkanoyl, C_3-C_5 alkenoyl or benzoyl and R_4 , if $n = 1$, is hydrogen, C_1-C_{18} alkyl, C_5-C_7 cycloalkyl, C_2-C_8 alkenyl, which is unsubstituted or substituted by a cyano, carbonyl or carbamide group, glycidyl or a group of the formula $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}'$ or of the formula $-\text{CONH}-\text{Z}'$, in which Z' is hydrogen, methyl or phenyl, and if $n = 2$ is C_2-C_{12} alkylene, C_6-C_{12} arylene, xylylene, a $-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2-$ group or a group $-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2-\text{O}-\text{X}-\text{O}-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2-$, in which X is C_2-C_{10} alkylene, C_6-C_{12} arylene or C_2-C_{12} cycloalkylene, or, with the proviso that R_2 is not alkanoyl, alkenoyl or benzoyl, R_4 can also be a divalent radical of an aliphatic, cycloaliphatic or aromatic dicarboxylic acid or dicarbamic acid or the group $-\text{CO}-$, or R_3 and R_4 together, if $n = 1$, can be the imide radical of an aliphatic, cycloaliphatic or aromatic 1,2- or 1,3-dicarboxylic acid.

5. The use, according to claim 1, of a light stabiliser of the formula (IV)



in which n is the number 1 or 2, R is hydrogen or methyl, R_1 is hydrogen, oxyl, C_1-C_{18} alkyl, C_2-C_8 alkenyl, C_3-C_8 alkynyl, C_7-C_{12} aralkyl, C_1-C_8 alkanoyl, C_3-C_5 alkenoyl, glycidyl or a group $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}$, in which Z is hydrogen, methyl, ethyl or phenyl, and R_2 , if $n = 1$, is C_2-C_8 alkylene or hydroxyalkylene or C_2-C_{12} acyloxyalkylene, and if $n = 2$ is the group $(-\text{CH}_2)_2\text{C}(\text{OH})-$.

6. The use, according to claim 1, of a light stabiliser of the formulae (VA), (VB) or (VC)

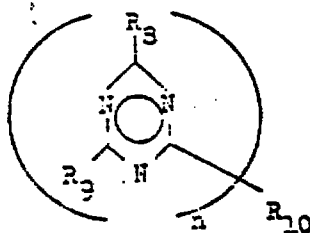


in which n is the number 1 or 2, R is hydrogen or methyl, R_1 is hydrogen, oxyl, C_1-C_{18} alkyl, C_2-C_8 alkenyl, C_3-C_8 alkynyl, C_7-C_{12} aralkyl, C_1-C_8 alkanoyl, C_3-C_5 alkenoyl, glycidyl or a group $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}$, in which Z is hydrogen, methyl, ethyl or phenyl, and R_2 is hydrogen, C_1-C_{12} alkyl, allyl, benzyl, glycidyl or C_2-C_6 alkoxyalkyl and R_7 , if $n = 1$, is hydrogen, C_1-C_{12} alkyl, C_3-C_5 alkenyl, C_7-C_9 aralkyl, C_5-C_7 cycloalkyl, C_2-C_4 hydroxyalkyl, C_2-C_6 alkoxyalkyl, C_6-C_{12} aryl, glycidyl or a group of the formula $-(\text{CH}_2)_m-\text{COO}-\text{Q}$ or of the formula $-(\text{CH}_2)_m-\text{O}-\text{CO}-\text{Q}$, in which m is 1 or 2 and Q is C_1-C_{18} alkyl or phenyl, and if $n = 2$ is C_2-C_{12} alkylene or C_6-C_{12} arylene, C_4-C_{12} alkenylene a group $-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2-\text{O}-\text{X}-\text{O}-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2-$, in which X is C_2-C_{10} alkylene, C_6-C_{12} arylene or C_6-C_{12} cycloalkylene, or a group $-\text{CH}_2\text{CH}(\text{OZ})\text{CH}_2-(\text{OCH}_2-\text{CH}(\text{OZ})\text{CH}_2)_2-$, in which Z is hydrogen,



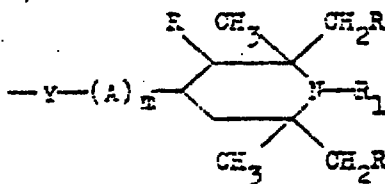
C₁-C₈ alkyl, allyl, benzyl, C₂-C₁₂ alkanoyl or benzoyl, and T₁ and T₂ independently of one another are hydrogen, C₁-C₁₀ alkyl or C₆-C₁₀ aryl which is unsubstituted or substituted by halogen or C₁-C₄ alkyl, or C₂-C₆ aralkyl, or T₁ and T₂ together with the C atom which bonds them form C₅-C₇ cycloalkyl, pyrrolidinyl or piperidinyl, which are unsubstituted or substituted by C₁-C₄ alkyl.

7. The use, according to claim 1, of a light stabiliser of the formula (VI).

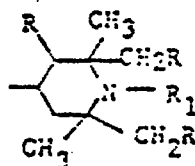


(VI)

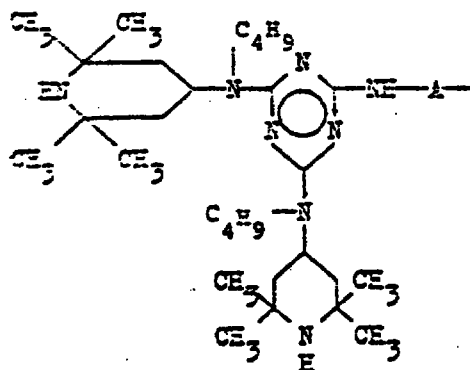
in which n is the number 1 or 2 and R₆ is a group of the formula



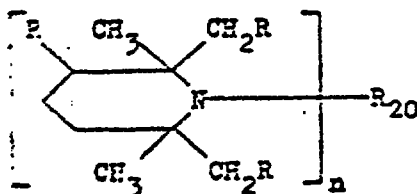
in which R is hydrogen or methyl, R₁ is hydrogen, oxyl, C₁-C₈ alkyl, C₂-C₆ alkenyl, C₃-C₆ alkynyl, C₁-C₁₂ aralkyl, C₁-C₁₂ alkanoyl, C₂-C₆ alkenoyl, glycidyl or a group —CH₂—CH(OH)—Z, in which Z is hydrogen, methyl, ethyl or phenyl, Y is —O— or —NR₁₁—, A is C₂-C₆ alkylene or —(CH₂)₃—O— and m is the numbers 0 or 1, R₂ is the groups R₂, NR₁₁, R₁₂, —OR₁₃, —NHCH₂OR₁₃ or —N(CH₂OR₁₃)₂, and R₁₀, if n = 1, is the group R₁ or R₂, and if n = 2, is the group —Y—B—Y, in which B is C₂-C₆ alkylene which can be interrupted by —R₁₄— and R₁₅ is C₁-C₁₂ alkyl, cyclohexyl, benzyl or C₁-C₄ hydroxyalkyl or a group of the formula



R₁₂ is C₁-C₁₂ alkyl, benzyl or C₁-C₄ hydroxyalkyl, R₁₃ is hydrogen, C₁-C₁₂ alkyl or phenyl and R₁₄ is hydrogen, C₁-C₁₂ alkyl, cyclohexyl, benzyl or phenyl, or R₁₁ and R₁₂ together are C₄-C₆ alkylene or oxalkylene or R₁₁ and R₁₂ are each a group of the formula



8. The use, according to claim 1, of a light stabiliser of the formula (VII)

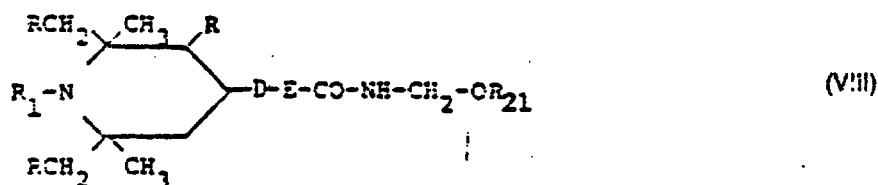


(VII)

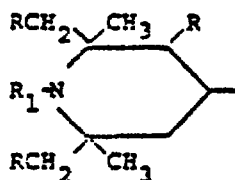


in which n is the number 1 or 2. R is hydrogen or methyl and R_{20} , if $n = 1$, is C_4 - C_{18} alkyl, C_7 - C_{12} aralkyl, the group $-\text{CO}-R_{15}$ or C_1 - C_4 alkyl substituted by $-\text{CN}$, $-\text{COOR}_{16}$, $-\text{OH}$ or $-\text{OCOR}_{17}$, in which R_{15} is C_1 - C_{12} alkyl, C_2 - C_4 alkenyl or phenyl, R_{16} is C_1 - C_{18} alkyl and R_{17} is C_1 - C_{13} alkyl, C_2 - C_{10} alkenyl, cyclohexyl, benzyl or C_6 - C_{10} aryl, or, if $n = 2$, R_{14} is C_4 - C_{12} alkylene, 2-but-1,4-enediene, xylylene, the group $-(\text{CH}_2)_2-\text{OOC}-R_{18}-\text{COO}-(\text{CH}_2)_2-$ or the group $-\text{CH}_2-\text{OOC}-R_{19}-\text{COO}-\text{CH}_2-$, in which R_{18} is C_2 - C_{18} alkylene, phenylene or cyclohexylene and R_{19} is C_2 - C_{10} alkylene, xylylene or cyclohexylene.

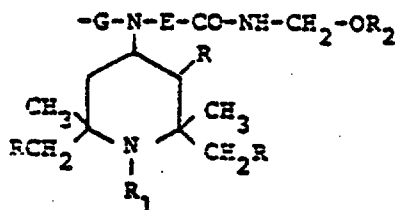
9. The use, according to claim 1, of a light stabiliser of the formula (VIII)



in which D is $-\text{N}(R_{22})-$ or $-\text{O}-$, E is C_1 - C_3 alkylene, the group $-\text{CH}_2-\text{CH}(R_{23})-\text{O}-$, in which R_{23} is hydrogen, methyl or phenyl, the group $-(\text{CH}_2)_3-\text{NH}-$ or a single bond, R is hydrogen or methyl, R_1 is hydrogen, oxyl, C_1 - C_{18} alkyl, C_3 - C_5 alkenyl, C_3 - C_9 alkynyl, C_7 - C_{12} aralkyl, C_1 - C_6 alkanoyl, C_3 - C_5 alkenoyl, glycidyl or a group $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}$, in which Z is hydrogen, methyl or phenyl, and R_{21} is hydrogen or C_1 - C_{18} alkyl and R_{22} is hydrogen, C_1 - C_{18} alkyl, C_5 - C_7 cycloalkyl, C_7 - C_{12} aralkyl, cyanoethyl, C_6 - C_{10} aryl, the group $-\text{CH}_2-\text{CH}(R_{23})-\text{OH}$, in which R_{23} is a defined above, a group of the formula



or a group of the formula



in which G can be C_2 - C_6 alkylene or C_6 - C_{12} arylene, or R_{22} is a group $-\text{E}-\text{CO}-\text{NH}-\text{CH}_2-\text{OR}_{21}$.

10. Use according to claim 1, wherein the light stabiliser used is an oligomeric or polymeric compound in which the recurring structural unit contains a 2,2,6,6-tetraalkylpiperidine radical, especially a polyester, polyether, polyamide, polyamine, polyurethane, polyurea, polyaminotriazine, poly(meth)acrylate or poly(meth)acrylamide, or a copolymer thereof, which contains such a radical.

11. Use according to claim 1, wherein the light stabiliser used is a compound which contains, in its molecule, at least one 2-(2'-hydroxyphenyl)-benztriazole group or 2-hydroxybenzophenone group and at least one polyalkylpiperidine group.

12. Use according to any one of the preceding claims, wherein an acid addition salt of a 2,2,6,6-tetraalkylpiperidine compound is used.

13. Use according to any one of claims 1 to 11, wherein a complex of a 2,2,6,6-tetraalkylpiperidine compound with a metal compound is used.

14. Use according to any one of the preceding claims, wherein the 2,2,6,6-tetraalkylpiperidine compound is used in an amount of 0.01 to 5% by weight, based on the solvent-free binder (lacquer resin).

15. Use according to claim 14, wherein other light stabilisers are additionally used, the amount of these stabilisers being so chosen that the sum of all of the light stabilisers is 0.02 to 5% by weight, based on the solvent-free binder (lacquer resin).

16. Use according to either of claims 14 and 15, wherein antioxidants, plasticisers, flow control agents, curing accelerators, thickeners, dispersing agents or adhesion improvers are added as further additives.

17. Use according to claim 1, wherein the light stabiliser is incorporated in the topcoat lacquer.



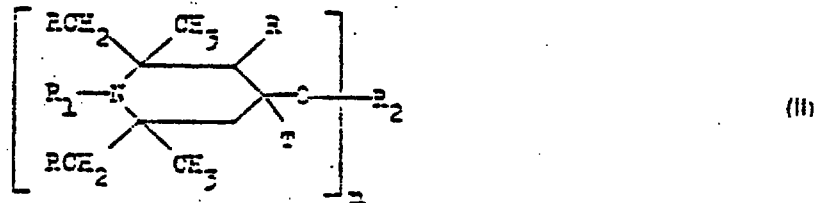
18. Use according to claim 1, wherein the topcoat lacquer used is a lacquer based on acrylic/melamine resins.

19. Use of 2,2,6,6-tetraalkylpiperidine compounds according to Claim 1 for the lacquer-coating of vehicles.

Revendications (as printed)

1. Utilisation de tetraalkyl-2,2,6,6 pipéridines, de leurs sels d'addition d'acide ou de leurs complexes avec des composés métalliques, éventuellement avec d'autres stabilisants, pour la stabilisation de peintures à deux couches à unicuisson, à base de résines acryliques, alkydes ou polyesters, qui sont éventuellement réticulées par des résines méla mine formaldéhyde, par des résines époxydes ou par des polyisocyanates, pour lutter contre l'action de la lumière.

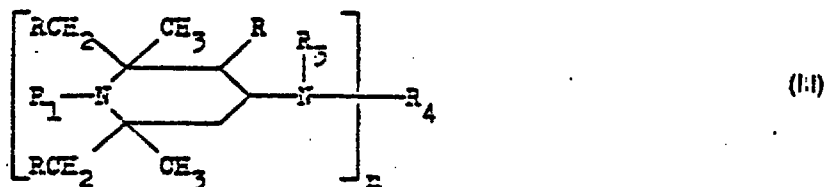
2. Utilisation selon la revendication 1 de stabilisant à la lumière, répondant à la formule (II) :



dans laquelle n représente les nombres 1 à 4 ; T est un atome d'hydrogène ou ---CONH_2 ; R est un atome d'hydrogène ou un groupe méthyle ; R₁ est un atome d'hydrogène ou un groupe hydroxyle, alkyle ayant 1 à 18 atomes de carbone, alcényle ayant 3 à 8 atomes de carbone, alcynyle ayant 3 à 8 atomes de carbone, aralkyle ayant 7 à 12 atomes de carbone, alcanoyloyle ayant 1 à 8 atomes de carbone, alcénoyloyle ayant 3 à 5 atomes de carbone, glycidyle ou un groupe $\text{---CH}_2\text{---CH(OH)---Z}$ (dans laquelle Z représente un atome d'hydrogène ou un groupe méthyle, éthyle ou phényle) ; et, lorsque n vaut 1, R₂ représente un atome d'hydrogène, un groupe alkyle ayant 1 à 18 atomes de carbone (éventuellement interrompu par un ou plusieurs atomes d'oxygène), cyanéthyle, benzyle, glycidyle, un radical monovalent d'un acide carboxylique, carbamique ou d'un acide contenant du phosphore, aliphatique, cycloaliphatique, araliphatique, aromatique ou hétérocyclique, ou un radical silyle monovalent ; lorsque n vaut 2, R₂ représente un groupe alkylène ayant 2 à 12 atomes de carbone, alcénylène ayant 4 à 12 atomes de carbone, xylylène, un radical divalent d'un acide dicarboxylique, dicarbamique ou contenant du phosphore, aliphatique, cycloaliphatique, araliphatique, aromatique ou hétérocyclique, ou un radical silyle divalent ; lorsque n vaut 3, R₂ représente un radical trivalent d'un acide tricarboxylique aliphatique, cycloaliphatique, aromatique ou hétérocyclique, d'un acide tricarbamique aromatique ou d'un acide contenant du phosphore, ou il représente un radical silyle trivalent ; lorsque n vaut 4, R₂ représente un radical tétravalent d'un acide tétracarboxylique aliphatique, cycloaliphatique ou aromatique.

3. Utilisation, selon la revendication 2, d'agents de stabilisation à la lumière, répondant à la formule (II) dans laquelle n représente les nombres 1 ou 2 ; R est un atome d'hydrogène ou un groupe méthyle ; R₁ est un atome d'hydrogène, un groupe hydroxyle, alkyle ayant 1 à 12 atomes de carbone, alcényle, acétyle, acryloyle ; et, lorsque n vaut 1, R₂ représente un radical d'un acide carboxylique aliphatique ayant 2 à 18 atomes de carbone, d'un acide carboxylique cycloaliphatique ayant 5 à 12 atomes de carbone ou d'un acide carboxylique aromatique ayant 7 à 15 atomes de carbone ; lorsque n vaut 2, R₂ représente un radical d'un acide dicarboxylique aliphatique contenant 2 à 36 atomes de carbone, d'un acide dicarboxylique cycloaliphatique ou aromatique comportant 8 à 14 atomes de carbone, d'un acide dicarbamique aliphatique, cycloaliphatique ou aromatique ayant 8 à 14 atomes de carbone.

4. Utilisation, selon la revendication 1, de stabilisants à l'égard de la lumière, répondant à la formule (III) :

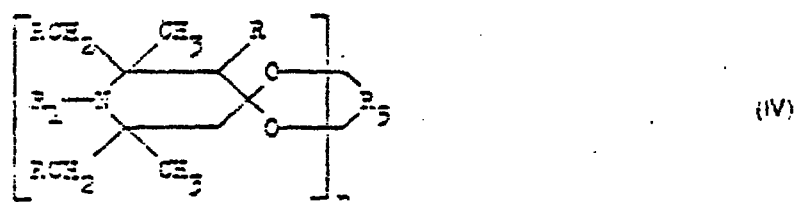


dans laquelle n représente les nombres 1 ou 2 ; R est un atome d'hydrogène ou un groupe méthyle ; R₁ représente un atome d'hydrogène, un groupe hydroxyle, alkyle ayant 1 à 18 atomes de carbone, alcényle ayant 3 à 8 atomes de carbone, alcynyle ayant 3 à 8 atomes de carbone, aralkyle ayant 7 à 12 atomes de carbone, alcanoyloyle ayant 1 à 8 atomes de carbone, alcénoyloyle ayant 3 à 5 atomes de carbone, glycidyle ou un groupe $\text{---CH}_2\text{---CH(OH)---Z}$ (dans lequel Z représente un atome d'hydrogène ou un groupe méthyle,



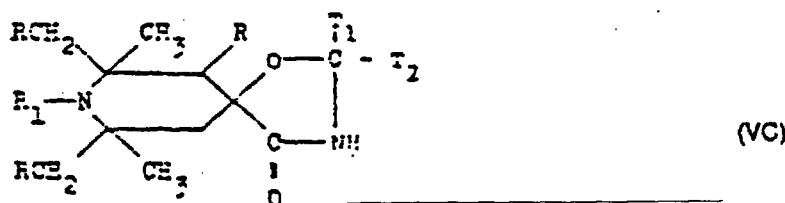
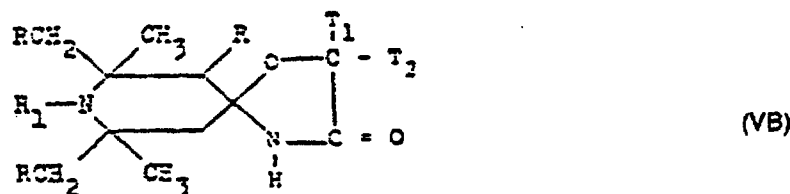
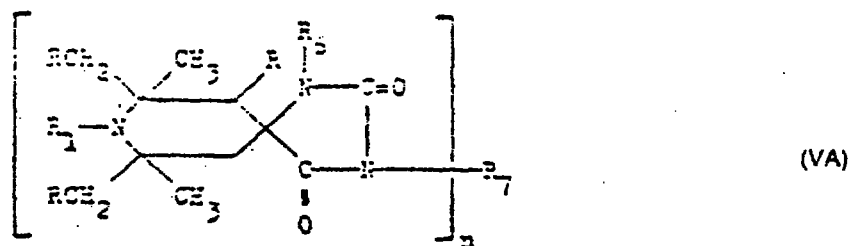
éthyle ou phényle], et R_3 est un atome d'hydrogène, un groupe alkyle ayant 1 à 12 atomes de carbone, cycloalkyle ayant 5 à 7 atomes de carbone, aralkyle ayant 7 à 8 atomes de carbone, alcanoyl ayant 2 à 18 atomes de carbone, alcénoyl ayant 3 à 5 atomes de carbone ou benzoyl; et, lorsque n vaut 1, R_1 représente un atome d'hydrogène, un groupe alkyle ayant 1 à 18 atomes de carbone, cycloalkyle ayant 5 à 7 atomes de carbone, alcényle ayant 2 à 6 atomes de carbone (et éventuellement substitué par un groupe cyano, carbonyle ou carbamyle), glycidyle, un groupe de formule $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}''$ ou de formule $-\text{CONH}-\text{Z}''$ (dans lesquelles Z'' représente un atome d'hydrogène, un groupe méthyle ou phényle); lorsque n vaut 2, R_1 représente un groupe alkylène ayant 2 à 12 atomes de carbone, arylène ayant 6 à 12 atomes de carbone, xylène, un groupe $-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2-$ ou un groupe $-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2-\text{O}-\text{X}-\text{O}-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2-$ (dans laquelle X représente un groupe alkylène ayant 2 à 10 atomes de carbone, arylène ayant 6 à 15 atomes de carbone ou cycloalkylène ayant 6 à 12 atomes de carbone) ou, si R_1 ne représente pas un groupe alcanoyl, alcénoyl ou benzoyl, R_1 peut aussi représenter un radical divalent d'un acide dicarboxylique ou dicarbamique aliphatique, cycloaliphatique ou aromatique ou également le groupe $-\text{CO}-$; ou bien, lorsque n vaut 1, R_2 et R_3 peuvent, lorsqu'ils sont pris ensemble, représenter le radical imide d'un acide dicarboxylique-1.2 ou -1.3 aliphatique, cycloaliphatique ou aromatique.

5. Utilisation selon la revendication 1 de stabilisants à l'égard de la lumière, de formule (IV):



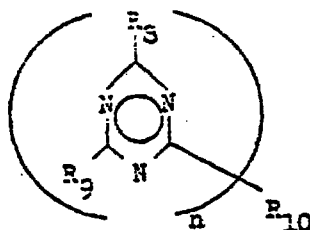
dans laquelle n représente les nombres 1 ou 2; R est un atome d'hydrogène ou un groupe méthyle; R_1 est un atome d'hydrogène ou un groupe hydroxyle, alkyle ayant 1 à 18 atomes de carbone, alcényle ayant 3 à 6 atomes de carbone, alcynyle ayant 3 à 8 atomes de carbone, aralkyle ayant 7 à 12 atomes de carbone, alcanoyl ayant 1 à 8 atomes de carbone, alcénoyl ayant 3 à 5 atomes de carbone, glycidyle ou un groupe $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}$ (dans laquelle Z représente un atome d'hydrogène ou un groupe méthyle, éthyle ou phényle); lorsque n vaut 1, R_2 représente un groupe alkylène ou hydroxyalkylène ayant 2 à 8 atomes de carbone ou un groupe acyloxyalkylène ayant 4 à 22 atomes de carbone et, lorsque n vaut 2, R_2 représente le groupe $-(\text{CH}_2)_2(\text{CH}_2)_2$.

6. Utilisation selon la revendication 1 de stabilisants à l'égard de la lumière, répondant aux formules (VA), (VB) ou (VC):



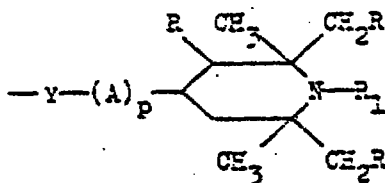
dans lesquelles n représente les nombres 1 ou 2 ; R est un atome d'hydrogène ou un groupe méthyle ; R₁ est un atome d'hydrogène, un groupe hydroxyle, alkyle ayant 1 à 18 atomes de carbone, alcényle ayant 3 à 8 atomes de carbone, alcynyle ayant 3 à 8 atomes de carbone, aralkyle ayant 7 à 12 atomes de carbone, alcanoyle ayant 1 à 8 atomes de carbone, alcénoyle ayant 3 à 5 atomes de carbone, glycidyle ou un groupe $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}$ (dans lequel Z représente un atome d'hydrogène, un groupe méthyle, éthylyle ou phényle), et R₂ est un atome d'hydrogène, un groupe alkyle ayant 1 à 12 atomes de carbone, allyle, benzyle, glycidyle, alcoxyalkyle ayant 2 à 6 atomes de carbone ; et, lorsque n vaut 1, R₇ représente un atome d'hydrogène, un groupe alkyle ayant 1 à 12 atomes de carbone, alcényle ayant 3 à 5 atomes de carbone, aralkyle ayant 7 à 9 atomes de carbone, cycloalkyle ayant 5 à 7 atomes de carbone, hydroxyalkyle ayant 2 à 4 atomes de carbone, alcoxyalkyle ayant 2 à 6 atomes de carbone, aryle ayant 6 à 10 atomes de carbone, glycidyle, un groupe de formule $-(\text{CH}_2)_m-\text{COO}-\text{Q}$ ou de formule $-(\text{CH}_2)_m-\text{O}-\text{CO}-\text{Q}$ [dans lesquelles m vaut 1 ou 2 et Q est un groupe alkyle ayant 1 à 18 atomes de carbone ou phényle] ; lorsque n vaut 2, R₇ représente un groupe alkylène ayant 2 à 12 atomes de carbone ou arylène ayant 6 à 12 atomes de carbone, alcénylène ayant 4 à 12 atomes de carbone ou un groupe $-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2-\text{O}-\text{X}-\text{O}-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_2-$ (dans lequel X est un groupe alkylène ayant 2 à 10 atomes de carbone, arylène ayant 6 à 15 atomes de carbone, arylène ayant 6 à 15 atomes de carbone ou cycloalkylène ayant 6 à 12 atomes de carbone) ou un groupe $-\text{CH}_2\text{CH}(\text{OZ})\text{CH}_2-(\text{OCH}_2-\text{CH}(\text{OZ})\text{CH}_2)_2-$, [dans lequel Z est un atome d'hydrogène, un groupe alkyle ayant 1 à 18 atomes de carbone, allyle, benzyle, alcanoyle ayant 2 à 12 atomes de carbone ou benzoyle] ; T₁ et T₂ représentent chacun, indépendamment l'un de l'autre, un atome d'hydrogène, un groupe alkyle ayant 1 à 18 atomes de carbone ou un groupe aryle ayant 6 à 10 atomes de carbone (éventuellement substitué par de l'halogène ou par un groupe alkyle ayant 1 à 4 atomes de carbone) ou aralkyle ayant 7 à 9 atomes de carbone, ou bien T₁ et T₂, pris avec l'atome de carbone qui les relie, forment un groupe cycloalkyle ayant 5 à 7 atomes de carbone (éventuellement substitué par un groupe alkyle ayant 1 à 4 atomes de carbone) pyrrolidinyle ou pipéridinyle.

7. Utilisation selon la revendication 1 de stabilisants à l'égard de la lumière répondant à la formule (VI) :

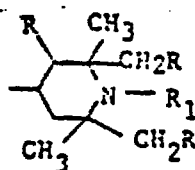


(VI)

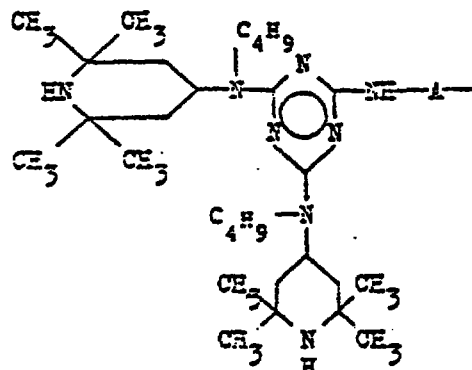
dans laquelle n représente les nombres 1 ou 2 et R₂ est un groupe de formule :



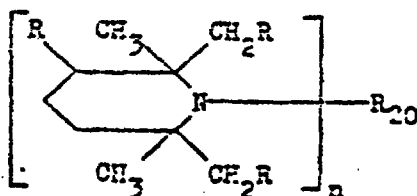
dans laquelle R est un atome d'hydrogène ou un groupe méthyle ; R₁ est un atome d'hydrogène, un groupe hydroxyle, alkyle ayant 1 à 18 atomes de carbone, alcényle ayant 3 à 8 atomes de carbone, alcynyle ayant 3 à 8 atomes de carbone, aralkyle ayant 7 à 12 atomes de carbone, alcanoyle ayant 1 à 8 atomes de carbone, alcénoyle ayant 3 à 5 atomes de carbone, glycidyle ou un groupe $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}$ (dans laquelle Z représente un atome d'hydrogène ou un groupe méthyle, éthylyle ou phényle) ; Y représente $-\text{O}-$ ou $-\text{NR}_{11}-$; A représente un groupe alkylène ayant 2 à 6 atomes de carbone ou $-(\text{CH}_2)_3-\text{O}-$ et p représente l'un des nombres 0 ou 1 ; R₂ représente les groupes R₂, NR₁₁R₁₂, $-\text{OR}_{13}$, $-\text{NHCH}_2\text{OR}_{13}$ ou $-\text{N}(\text{CH}_2\text{OR}_{13})_2$; lorsque n vaut 1, R₁₀ représente les groupes R₂ ou R₂ et lorsque n vaut 2, R₁₀ représente le groupe $-\text{Y}-\text{B}-\text{Y}-$ (dans lequel B représente un groupe alkylène ayant 2 à 6 atomes de carbone et éventuellement interrompu par $-\text{N}(\text{R}_{14})-$) ; R₁₁ représente un groupe alkyle ayant 1 à 12 atomes de carbone, cyclohexyle, benzyle ou hydroxyalkyle ayant 1 à 4 atomes de carbone ou un groupe de formule :



R_{12} représente un groupe alkyle ayant 1 à 12 atomes de carbone, cyclohexyle, benzyle, hydroxyalkyle ayant 1 à 4 atomes de carbone ; R_{13} représente un atome d'hydrogène, un groupe alkyle ayant 1 à 12 atomes de carbone ou phényle ; et R_{14} représente un atome d'hydrogène, un groupe alkyle ayant 1 à 12 atomes de carbone, cyclohexyle, benzyle ou phényle ; ou R_{11} et R_{12} , pris ensemble, représentent un groupe alkylène ou cxaalkylène ayant 4 ou 5 atomes de carbone, ou bien R_{11} et R_{12} peuvent aussi représenter chacun un groupe de formule :



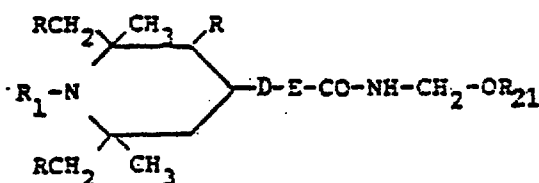
8. Utilisation selon la revendication 1, de stabilisants à l'égard de la lumière, répondant à la formule (VII) :



(VII)

dans laquelle n représente l'un des nombres 1 ou 2 ; R est un atome d'hydrogène ou un groupe méthyle ; et, lorsque n vaut 1, R_{20} est un groupe alkyle ayant 4 à 18 atomes de carbone, aralkyle ayant 7 à 12 atomes de carbone, le groupe $-\text{CO}-R_{15}$, un groupe alkyle ayant 1 à 4 atomes de carbone et substitué par $-\text{CN}$, $-\text{COOR}_{16}$, $-\text{OH}$, $-\text{OCOR}_{17}$ [où R_{15} est un groupe alkyle ayant 1 à 12 atomes de carbone, alcényle ayant 2 à 4 atomes de carbone ou phényle ; R_{16} est un groupe alkyle ayant 1 à 18 atomes de carbone ; R_{17} est un groupe alkyle ayant 1 à 18 atomes de carbone, alcényle ayant 2 à 10 atomes de carbone, cyclohexyle, benzyle ou aryle ayant 6 à 10 atomes de carbone] ou, lorsque n vaut 2, R_{20} est un groupe alkylène ayant 4 à 12 atomes de carbone, butène-2 ylène-1,4, xylylène, le groupe $-(\text{CH}_2)_2-\text{OOC}-R_{18}-\text{COO}-(\text{CH}_2)_2-$ ou le groupe $-\text{CH}_2-\text{OOC}-R_{19}-\text{COO}-\text{CH}_2-$, où R_{18} est un groupe alkylène ayant 2 à 10 atomes de carbone, phénylène ou cyclohexylène, et R_{19} représente un groupe alkylène, xylylène ou cyclohexylène.

9. Utilisation selon la revendication 1 de stabilisants à l'égard de la lumière, répondant à la formule (VIII) :

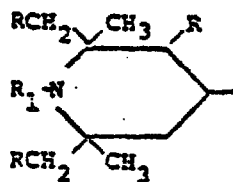


(VIII)

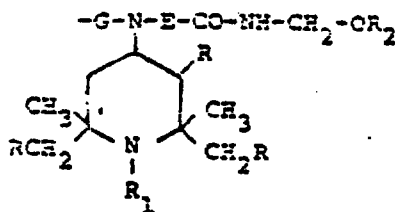
dans laquelle D représente $-\text{N}(R_{22})-$ ou $-\text{O}-$; E représente un groupe alkylène ayant 1 à 3 atomes de carbone, le groupe $-\text{CH}_2-\text{CH}(R_{23})-\text{O}-$ [dans lequel R_{23} est un atome d'hydrogène ou un groupe méthyle ou phényle], le groupe $-(\text{CH}_2)_3-\text{NH}-$ ou une liaison simple ; R est un atome d'hydrogène ou un groupe méthyle ; R_1 représente un atome d'hydrogène, un groupe hydroxyle, alkyle ayant 1 à 18 atomes de carbone, alcényle ayant 3 à 8 atomes de carbone, alcynyle ayant 3 à 8 atomes de carbone, aralkyle ayant 7 à 12 atomes de carbone, alcanoylène ayant 1 à 8 atomes de carbone, alcénoylène ayant 3 à 5 atomes de carbone, glycidyle ou un groupe $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}$ [dans lequel Z est un atome d'hydrogène ou un groupe méthyle, éthyle ou phényle] et R_{21} est un atome d'hydrogène ou un groupe alkyle ayant 1 à 18 atomes de carbone ; R_{22} représente un atome d'hydrogène, un groupe alkyle ayant 1 à 18 atomes de carbone, cycloalkyle ayant 5 à 7 atomes de carbone, aralkyle ayant 7 à 12 atomes de carbone, cyanéthyle, aryle ayant 6 à 10 atomes de carbone, le groupe $-\text{CH}_2-\text{CH}(R_{23})-\text{OH}$, où R_{23} a le sens précité, un groupe de formule :



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ou un groupe de formule :



[où G peut être un groupe alkylène ayant 2 à 6 atomes de carbone ou arylène ayant 6 à 12 atomes de carbone] où R_{22} est un groupe $-E-CO-NH-CH_2-OR_{21}$.

10. Utilisation de tétraalkyl-2,2,6,6 pipéridines selon la revendication 1, caractérisée en ce qu'on utilise des oligomères ou polymères dont le motif récurrent contient un radical tétraalkyl-2,2,6,6 pipéridine, en particulier des polyesters, des polyéthers, des polyamides, des polyamines, des polyuréthanes, des polyurées, des polyaminotriazines, des poly(méth)acrylates, des poly(méth)acrylamides et leurs copolymères, qui contiennent de tels radicaux.

11. Utilisation de tétraalkyl-2,2,6,6 pipéridines selon la revendication 1, caractérisée en ce qu'on utilise des composés contenant dans leurs molécules au moins un groupe [hydroxy-2' phenyl]-2 benzotriazole ou un groupe hydroxy-2 benzophénone et au moins un groupe tétraalkyl-2,2,6,6 pipéridine.

12. Utilisation selon l'une quelconque des revendications précédentes, caractérisée en ce qu'on utilise un sel d'addition d'acide d'une tétraalkyl-2,2,6,6 piperidine.

13. Utilisation selon l'une quelconque des revendications 1 à 11, caractérisée en ce qu'on utilise un complexe d'une tétraalkyl-2,2,6,6 pipéridine avec un composé métallique.

14. Utilisation selon l'une quelconque des revendications précédentes, caractérisée en ce qu'on utilise la tétraalkyl-2,2,6,6 pipéridine en une quantité de 0.01 à 5 % en poids, par rapport au liant (résine pour vernis ou peintures) sans solvant.

15. Utilisation selon la revendication 14, caractérisée en ce qu'on utilise en outre d'autres stabilisants à l'égard de la lumière, dont la proportion est choisie de manière que la somme de tous les stabilisants à l'égard de la lumière représente 0.02 à 5 % en poids, par rapport au liant (résine pour vernis ou peintures) sans solvant.

16. Utilisation selon l'une des revendications 14 ou 15, caractérisée en ce qu'on ajoute comme autres additifs des antioxygènes, des plastifiants, des agents de fluidité ou d'étalement, des accélérateurs de durcissement, des épaississants, des agents de dispersion ou des agents d'amélioration de l'adhérence.

17. Utilisation selon la revendication 1, caractérisée en ce qu'on incorpore au vernis de couverture, ou à la couche de peinture de couverture, le stabilisant à l'égard de la lumière.

18. Utilisation des tétraalkyl-2,2,6,6 pipéridines selon la revendication 1, caractérisée en ce qu'on utilise comme couche de vernis ou de peinture de couverture un vernis ou une peinture à base de résine acrylique/mélatamine.

19. Utilisation de tétraalkyl-2,2,6,6 pipéridines selon la revendication 1, caractérisée en ce que la peinture-émail est une peinture ou un vernis pour automobile.

