

PATENT SPECIFICATION

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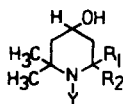


(54) SUBSTITUTED PIPERIDINOL DERIVATIVES AND THEIR
 USE AS STABILIZERS

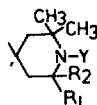
(71) We, CIBA-GEIGY AG, a Swiss Body Corporate of Basle, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to compounds useful as stabilisers and in particular to 1,2,2,6,6-penta-substituted piperidin-4-ols, some of which are new compounds, useful as stabilisers for polymers.

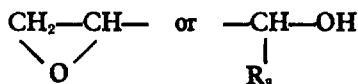
According to the present invention, there is provided a composition comprising an organic material and, as stabiliser, a compound having the formula:—



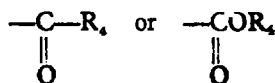
wherein R_1 and R_2 are the same or different and each is a straight- or branched alkyl residue having from 1 to 12 carbon atoms, or R_1 and R_2 , together with the carbon atom to which they are attached, form a cycloalkyl residue having from 5 to 12 carbon atoms or the group:—



wherein R_1 and R_2 have their previous significance and Y is a straight- or branched alkyl residue having from 1 to 20 carbon atoms, an alkenyl or alkynyl residue having from 3 to 20 carbon atoms, an aralkyl residue having from 7 to 12 carbon atoms or the group $-\text{CH}_2\text{X}$ wherein X is the group



wherein R_3 is hydrogen, a methyl or phenyl residue, the group

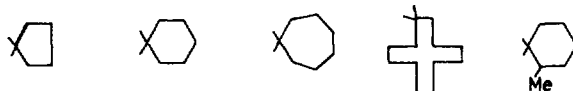


wherein R_4 is an alkyl residue having from 1 to 20 carbon atoms.

[Pri.]

Examples of the substituents R_1 and R_2 are methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, n-hexyl, n-octyl and n-dodecyl residues, and when R_1 and R_2 , together with the carbon atom to which they are attached, form a cycloalkyl residue, examples of such residues are those having the formulae:—

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Particularly preferred substituents R_1 and R_2 are straight or branched alkyl groups having 1 to 4 carbon atoms and the most preferred substituents R_1 and R_2 are methyl residues.

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When Y is an alkyl residue, it may be for instance a methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, n-hexyl, n-octyl, n-dodecyl, n-octadecyl or eicosyl residue. Preferred alkyl groups Y are those having from 1 to 4 carbon atoms, the methyl residue being particularly preferred.

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Examples of alkenyl residues Y include 10-undecenyl and oleyl, and, more preferably, allyl and α -methallyl groups.

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The preferred alkynyl residues Y are those containing 3 or 4 carbon atoms, in particular the propargyl group.

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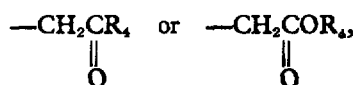
Preferred examples of aralkyl residues Y are those containing from 7 to 11 carbon atoms for instance benzyl, α -methylbenzyl, p-methyl- α -methylbenzyl and α -naphthylmethyl groups.

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Examples of residues $-\text{CH}_2\text{X}$ include 2-hydroxyethyl, 2-hydroxy-2-phenylethyl and 2,3-epoxy-n-propyl groups; 2-hydroxyethyl and 2-hydroxypropyl groups being preferred.

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When the substituent Y has the formula



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examples of such substituents include methylcarbonylmethyl, n-butylcarbonylmethyl, n-dodecylcarbonylmethyl, eicosylcarbonylmethyl, methoxycarbonylmethyl, ethoxycarbonylmethyl, n-decyloxycarbonylmethyl and n-octadecyloxycarbonylmethyl groups.

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Examples of the compounds of formula I useful according to the invention are given in the following list:—

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1-methyl-2,2,6,6-tetramethylpiperidin-4-ol

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1-ethyl-2,2,6,6-tetramethylpiperidin-4-ol

1-n-propyl-2,2,6,6-tetramethylpiperidin-4-ol

1-isopropyl-2,2,6,6-tetramethylpiperidin-4-ol

1-n-butyl-2,2,6,6-tetramethylpiperidin-4-ol

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1-sec-butyl-2,2,6,6-tetramethylpiperidin-4-ol

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1-n-hexyl-2,2,6,6-tetramethylpiperidin-4-ol

1-n-octyl-2,2,6,6-tetramethylpiperidin-4-ol

1-n-dodecyl-2,2,6,6-tetramethylpiperidin-4-ol

1-eicosyl-2,2,6,6-tetramethylpiperidin-4-ol

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1-allyl-2,2,6,6-tetramethylpiperidin-4-ol

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1- α -methallyl-2,2,6,6-tetramethylpiperidin-4-ol

1-(10'-undecenyl)-2,2,6,6-tetramethylpiperidin-4-ol

1-oleyl-2,2,6,6-tetramethylpiperidin-4-ol

1-propargyl-2,2,6,6-tetramethylpiperidin-4-ol

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1-benzyl-2,2,6,6-tetramethylpiperidin-4-ol

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1-(α -methylbenzyl)-2,2,6,6-tetramethylpiperidin-4-ol

1-(p-methylbenzyl)-2,2,6,6-tetramethylpiperidin-4-ol

1- α -naphthylmethyl-2,2,6,6-tetramethylpiperidin-4-ol

1-(2'-hydroxyethyl)-2,2,6,6-tetramethylpiperidin-4-ol

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1-(2'-hydroxypropyl)-2,2,6,6-tetramethylpiperidin-4-ol

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1-(2',3'-epoxy-n-propyl)-2,2,6,6-tetramethylpiperidin-4-ol

1-(2'-hydroxy-2'-phenylethyl)-2,2,6,6-tetramethylpiperidin-4-ol

1-(methylcarbonylmethyl)-2,2,6,6-tetramethylpiperidin-4-ol

1-(n-dodecylcarbonylmethyl)-2,2,6,6-tetramethylpiperidin-4-ol

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—	1-(eicosylcarbonylmethyl)-2,2,6,6-tetramethylpiperidin-4-ol	(14)
—	1-(methoxycarbonylmethyl)-2,2,6,6-tetramethylpiperidin-4-ol	
—	1-(ethoxycarbonylmethyl)-2,2,6,6-tetramethylpiperidin-4-ol	
—	1-(octadecyloxycarbonylmethyl)-2,2,6,6-tetramethylpiperidin-4-ol	
5	1-methyl-2,2-dimethyl-6,6-diethylpiperidin-4-ol	5
—	1-methyl-2,2,2-trimethyl-6-isopropylpiperidin-4-ol	
—	1-methyl-2,2-dimethyl-6,6-di-n-dodecylpiperidin-4-ol	
—	1-aza-1,2,2-trimethylspiro-[5,5]-undecan-4-ol	
10	1-n-butyl-2,2-dimethyl-6,6-diethylpiperidine-4-ol	
—	1-aza-1-allyl-2,2-dimethylspiro[5,5]-undecan-4-ol	10
—	1-aza-1-benzyl-2,2-dimethylspiro[5,5]-undecan-4-ol.	

Compounds of formula I have been found to impart to polyolefines an exceptionally high degree of stability towards deterioration normally induced by the effects of ultra-violet radiation or exposure to heat. Moreover, this improved stability is achieved without affecting the colour properties of the treated polyolefine. The stabilisers of the invention provide effective light and/or heat stabilisation, especially for low- and high-density polyethylene and polypropylene and polystyrene as well as polymers of butene-1, pentene-1, 3-methylbutene-1, hexene-1, 4-methylpentene-1, 4-methylhexene-1 and 4,4-dimethyl-pentene-1, and also co- and terpolymers of olefines, particularly of ethylene or propylene.

Other organic materials susceptible to degradation by the effects of light and the properties of which are improved by the incorporation therein of a compound of Formula I include natural and synthetic polymeric materials, for instance natural and synthetic rubbers, the latter including, for example, homo-, co- and terpolymers of acrylonitrile, butadiene and styrene.

Specific synthetic polymers include polyvinyl chloride and vinyl chloride co-polymers, polyvinylidene chloride, polyvinyl acetate as well as condensation polymers containing ether, ester (derived from carboxylic, sulphonic or carbonic acids), amide or urethane groupings; polyvinyl acetals; polyacrylates such as polymers and co-polymers of methyl acrylate, ethyl acrylate, methyl methacrylate and ethyl methacrylate; polyamides; urea-formaldehyde and melamine-formaldehyde resins; cellulose plastics such as cellulose acetate, cellulose butyrate and cellulose nitrate. Certain of these polymers can, for instance, form the basis of surface coating media such as paints and lacquers having an oil or resin base, such as an alkyd or polyamide resin.

The amount of the compound of formula I which is incorporated into the organic material in order to achieve maximum protection against degradation by light varies according to the properties of the organic material treated and according to the properties of the organic material treated and according to the severity of the light radiation and to the length of exposure. However, for most purposes it is sufficient to use an amount of the compound of formula I within the range of from 0.01% to 5% by weight, more preferably within the range of from 0.1% to 2% by weight based on the weight of untreated organic material.

The compounds of formula I may be incorporated into the polymeric material by any of the known techniques for compound additives with a polymer. For example, the compound of formula I and the polymer may be compounded in an internal mixer. Alternatively, the compound of formula I may be added as a solution or slurry in a suitable solvent or dispersant, for instance an inert organic solvent such as methanol, ethanol or acetone to powdered polymer and the whole mixed intimately in a mixer, and the solvent subsequently removed. As a further alternative the compound of formula I may be added to the polymer during the preparation of the latter, for instance at the latex stage of polymer production, to provide pre-stabilised polymer material.

Optionally, the composition of the invention may contain further additives, especially those used in polymer e.g. polyolefine formulations, such as antioxidants e.g. of the phenol or amine type, U.V. absorbers and light protectants, phosphite stabilisers, peroxide decomposers, polyamide stabilisers, basic co-stabilisers, polyvinyl chloride stabilisers, nucleation agents, plasticizers, lubricants, emulsifiers, anti-static agents, flame-protectants, pigments, carbon black, asbestos, glass fibres, kaolin and talc.

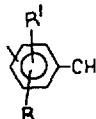
The present invention therefore includes binary, ternary and multi-component compositions containing the stabiliser of formula I together with one or more other functional additives for polymers.

Examples of suitable antioxidants are those of the hindered phenol type such as those selected from the following groups:—

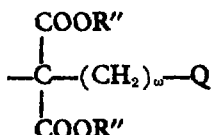
(1) Phenolic compounds having the general formula



wherein
Q is



A is $-CR(COOR'')_2$ or



P is hydrogen or alkyl of 1 to 6 carbon atoms,
R' is alkyl of 1 to 6 carbon atoms,
R'' is an alkyl group having from 6 to 24 carbon atoms, and
 w is 0 or an integer from 1 to 4.

Illustrative examples of the compounds shown above are

di-n-octadecyl α -(3,5-di-t-butyl-4-hydroxybenzyl)malonate,
di-n-octadecyl α -(3-t-butyl-4-hydroxy-5-methylbenzyl)malonate which is disclosed in the Netherlands Patent Specification No. 6,711,199, and
di-n-octadecyl- α,α' -bis-(3-t-butyl-4-hydroxy-5-methylbenzyl)malonate which is disclosed in the Netherlands Patent Specification No. 6,803,498.

(2) Phenolic compounds having the general formula



wherein Q is as hereinbefore defined and R''' represents hydrogen or one or two monovalent residues derived from aliphatic hydrocarbons having from 1 to 30 carbon atoms.

Illustrative examples of the compounds shown above are

2,6-di-t-butyl-p-cresol,
2-methyl-4,6-di-t-butylphenol, and
2,6-di-Octadecyl-p-cresol.

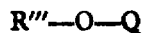
(3) Phenolic compounds having the formula



wherein Q and w are as hereinbefore defined.
Illustrative examples of the compounds shown are:—

2,2'-methylene-bis-(6-t-butyl-4-methylphenol),
2,2'-methylene-bis-(6-t-butyl-4-ethylphenol),
4,4'-butylidene-bis-(2,6-di-t-butylphenol),
4,4'-(2-butylidene)-bis-(2-t-butyl-5-methylphenol),
2,2'-methylene-bis-(3-t-butyl-5-ethylphenol),
4,4'-methylene-bis-(3,5-di-t-butylphenol),
4,4'-methylene-bis-(3-t-butyl-5-methylphenol), and
2,2'-methylene-bis-(3-t-butyl-5-methylphenol).

(4) Phenolic compounds having the formula



wherein Q and R''' are as hereinbefore defined.
Illustrative examples of such compounds are

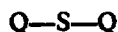
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2,5-di-t-butylhydroquinone,
2,6-di-t-butylhydroquinone, and
2,5-di-t-butyl-4-hydroxyanisole.

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(5) Phenolic compounds having the formula



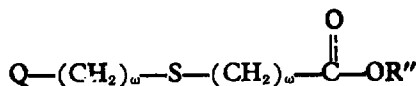
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wherein Q is as hereinbefore defined.
4,4'-thiobis-(2-t-butyl-5-methylphenol),
4,4'-thiobis-(2-t-butyl-6-methylphenol),
2,2'-thiobis-(6-t-butyl-4-methylphenol), and
4,4'-thiobis-(2-methyl-5-t-butylphenol).

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(6) Phenolic compounds having the formula

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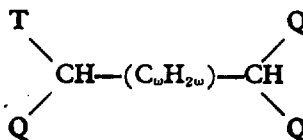
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wherein Q, R'' and ω are as hereinbefore defined.
Illustrative examples of such compounds are
octadecyl-(3,5-dimethyl-4-hydroxybenzylthio)-acetate, and
dodecyl-(3,5-di-t-butyl-4-hydroxybenzylthio)-propionate.

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(7) Phenolic compounds having the formula

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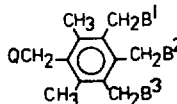
wherein T is hydrogen or Q, and
Q and ω are as defined above.
Illustrative examples of such compounds are

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1,1,3-tris(3,5-dimethyl-4-hydroxyphenyl)-propane,
1,1,3-tris(5-t-butyl-4-hydroxy-2-methylphenyl)-butane, and
1,1,5,5-tetrakis-(3'-t-butyl-4'-hydroxy-6'-methylphenyl)-n-pentane.

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(8) Phenolic compounds having the formula



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wherein B¹, B² and B³ are each independently methyl or Q provided that when
B¹ and B³ are Q then B² is hydrogen or methyl and when B² is Q and B¹
and B³ are each independently hydrogen or methyl, and
Q is as hereinbefore defined.
Illustrative examples of such compounds are

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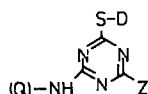
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1,4-di(3,5-di-t-butyl-4-hydroxybenzyl)-2,3,5,6-tetramethylbenzene and
1,3,5-tri(3,5-di-t-butyl-4-hydroxybenzyl)-2,4,6-trimethylbenzene.

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(9) Phenolic compounds having the formula

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wherein

Z is NHQ, —S—D or —O—Q

D is an alkyl group having from 4 to 18 carbon atoms or —(C_ωH_{2ω})—S—R'',

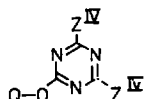
Q, R'' and ω are as hereinbefore defined.

Illustrative examples of such compounds are

2,4-bis-(n-octylthio)-6-(3,5-di-t-butyl-4-hydroxyanilino)-1,3,5-triazine,
6-(4-hydroxy-3-methyl-5-t-butylanilino)-2,4-bis-(n-octylthio)-1,3,5-triazine,
6-(4-hydroxy-3,5-dimethylanilino)-2,4-bis-(n-octylthio)-1,3,5-triazine,
6-(4-hydroxy-3,5-di-t-butylanilino)-4-(4-hydroxy-3,5-di-t-butylphenoxy)-2-
(n-octylthio)-1,3,5-triazine, and
2,4-bis-(4-hydroxy-3,5-di-t-butylanilino)-6-(n-octylthio)-1,3,5-triazine.

The above phenolic triazine stabilizers are more fully described in U.S. Patent Specification No. 3,255,191.

(10) Phenolic compounds having the formula



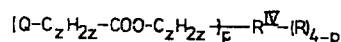
wherein the Z^{IV}'s which may be the same or different are —O—Q, —S—D or —S—(C_ωH_{2ω})—SD, and Q, D and ω are as hereinbefore defined.

Illustrative examples of such compounds are

2,4-bis(3,5-di-t-butyl-4-hydroxyphenoxy)-6-(n-octylthio)-1,3,5-triazine,
2,4,6-tris-(4-hydroxy-3,5-di-t-butylphenoxy)-1,3,5-triazine,
6-(4-hydroxy-3,5-di-t-butylphenoxy)-2,4-bis-(n-octylthioethylthio)-1,3,5-triazine,
6-(4-hydroxy-3-methylphenoxy)-2,4-bis-(n-octylthio)-1,3,5-triazine,
6-(4-hydroxy-3-t-butylphenoxy)-2,4-bis-(n-octylthioethylthio)-1,3,5-triazine,
6-(4-hydroxy-3-methyl-5-t-butylphenoxy)-2,4-bis-(n-octylthio)-1,3,5-triazine,
2,4-bis-(4-hydroxy-3-methyl-5-t-butylphenoxy)-6-(n-octylthio)-1,3,5-triazine,
2,4,6-tris-(4-hydroxy-3-methyl-5-t-butylphenoxy)-1,3,5-triazine,
6-(4-hydroxy-3,5-di-t-butylphenoxy)-2,4-bis-(n-octylthiopropylthio)-1,3,5-triazine,
6-(4-hydroxy-3,5-di-t-butylphenoxy)-2,4-bis-(n-dodecylthioethylthio)-1,3,5-triazine,
2,4-bis-(4-hydroxy-3,5-di-t-butylphenoxy)-6-butylthio-1,3,5-triazine,
2,4-bis-(4-hydroxy-3,5-di-t-butylphenoxy)-6-(n-octadecylthio)-1,3,5-triazine,
2,4-bis-(4-hydroxy-3,5-di-t-butylphenoxy)-6-(n-dodecylthio)-1,3,5-triazine,
2,4-bis-(4-hydroxy-3,5-di-t-butylphenoxy)-6-(n-octylthiopropylthio)-1,3,5-triazine,
2,4-bis-(4-hydroxy-3,5-di-t-butylphenoxy)-6-(n-octylthioethylthio)-1,3,5-triazine, and
2,4-bis-(4-hydroxy-3,5-di-t-butylphenoxy)-6-(n-dodecylthioethylthio)-1,3,5-triazine.

The above phenolic triazine stabilizers are more fully described in U.S. Patent Specification No. 3,255,191.

(11) Phenolic compounds having the formula



wherein

p is an integer from 1 to 4; Q and R are as hereinbefore defined,

R^{IV} is a tetravalent radical derived from an aliphatic hydrocarbon having from 1 to 30 carbon atoms,

aliphatic mono or dithioether having from 1 to 30 carbon atoms,
aliphatic mono or diether having from 1 to 30 carbon atoms and
z is 0 or an integer from 1 to 6.

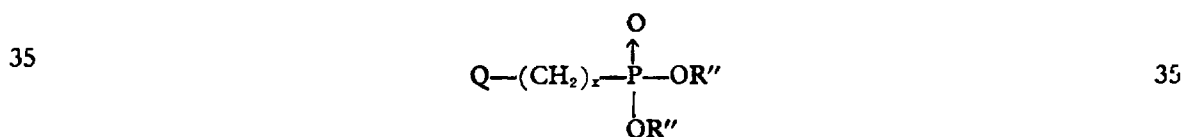
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Illustrative examples of such compounds are

- 5 Sub-class I. 5
n-Octadecyl 3-(3,5-di-t-butyl-4-hydroxyphenyl)-propionate,
n-Octadecyl 2-(3,5-di-t-butyl-4-hydroxyphenyl)-acetate,
n-Octadecyl 3,5-di-t-butyl-4-hydroxybenzoate,
n-Hexyl 3,5-di-t-butyl-4-hydroxybenzoate,
10 n-Dodecyl 3,5-di-t-butyl-4-hydroxybenzoate, 10
Neo-dodecyl 3-(3,5-di-t-butyl-4-hydroxyphenyl)-propionate,
Dodecyl 3-(3,5-t-butyl-4-hydroxyphenyl)-propionate,
Ethyl α -(4-hydroxy-3,5-di-t-butylphenyl)-isobutyrate,
Octadecyl α -(4-hydroxy-3,5-di-t-butylphenyl)-isobutyrate, and
15 Octadecyl α -(4-hydroxy-3,5-di-t-butylphenyl)-propionate, 15
- Sub-class II.
2-(n-octylthio)ethyl 3,5-di-t-butyl-4-hydroxybenzoate,
2-(n-octylthio)ethyl, 3,5-di-t-butyl-4-hydroxyphenylacetate,
20 2-(n-octadecylthio)ethyl 3,5-di-t-butyl-4-hydroxyphenylacetate, 20
2-(n-octadecylthio)ethyl 3,5-di-t-butyl-4-hydroxybenzoate, and
- Sub-class III.
1,2-propylene glycol bis-[3-(3,5-di-t-butyl-4-hydroxyphenyl)propionate],
Ethylene glycol bis-[3-(3,5-t-butyl-4-hydroxyphenyl)propionate],
Neopentyl glycol bis-[3-(3,5-di-t-butyl-4-hydroxyphenyl)propionate],
25 Ethylene glycol bis-(3,5-di-t-butyl-4-hydroxyphenylacetate), 25
Glycerine-1-n-octadecanate-2,3-bis-(3,5-di-t-butyl-4-hydroxyphenylacetate),
Pentaerythritol-tetrakis-[3-(3,5-di-t-butyl-4-hydroxyphenyl)propionate],
1,1,1-trimethylol ethane-tris-3-(3,5-di-t-butyl-4-hydroxyphenyl)propionate,
1,2,3-butanetriol tris-[3-(3,5-di-t-butyl-4-hydroxyphenyl)propionate],
30 2-stearoyloxyethyl 7-(3-methyl-5-t-butyl-4-hydroxyphenyl)heptanoate, and 30
1,6-n-hexanediol-bis(3',5'-di-t-butyl-4-hydroxyphenyl)propionate].

The above phenolic ester stabilizers of sub-classes I, II and III are more fully described in British Patent Specifications Nos. 1 103 144, 1 105 699 and 1 001 098.

(12) Phenolic compounds having the formula



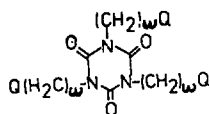
where X is 1 or 2, Q and R'' are as hereinbefore defined.
Illustrative examples of such compounds are

- 40 Di-n-octadecyl 3,5-di-t-butyl-4-hydroxybenzylphosphonate,
Di-n-octadecyl 3-t-butyl-4-hydroxy-5-methyl-benzylphosphonate,
Di-n-octadecyl 2-(3,5-di-t-butyl-4-hydroxyphenyl)-ethanephosphonate, 40
Di-n-tetradecyl 3,5-di-butyl-4-hydroxybenzylphosphonate,
Di-n-hexadecyl 3,5-di-t-butyl-4-hydroxybenzylphosphonate, and
Di-n-docosyl-3,5-di-t-butyl-4-hydroxybenzylphosphonate.

45 The above di-(higher)alkyl phenolic phosphates are more fully described in U.S. Patent Specification No. 3,281,505. 45

(13) Phenolic compounds having the formula

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wherein w and Q are defined above.

An illustrative example of such compound is:

tric-(3,5-di-*t*-butyl-4-hydroxybenzyl) isocyanurate.

5 The above hydroxyphenylalkyl isocyanurates are more fully described in U.S. 5
Patent Specification No. 3,531,483.

The above phenolic stabilizers are known and many are commercially available.

10 While any of the above mentioned antioxidants can be useful in combination with 10
the ultraviolet light stabilizers of this invention, the preferred antioxidants consist of
the hindered phenols in groups 1, 8, 9, 10, 11, 12 and 13 are mentioned above. The
most preferred hindered phenols are those of groups 1, 9, 11, 12 and 13.

Further examples of antioxidants are those of the aminoaryl series for instance
aniline and naphthylamine derivatives as well as their heterocyclic derivatives such as:—

15 phenyl-1-naphthylamine, 15
phenyl-2-naphthylamine,
N,N'-diphenyl-*p*-phenylenediamine,
N,N'-di-sec.butyl-*p*-phenylenediamine,
6-ethoxy-2,2,4-trimethyl-1,2-dihydroquinoline,
20 6-dodecyl-2,2,4-trimethyl-1,2-dihydroquinoline, 20
Mono- and di-octyliminodibenzyl, and
polymerised 2,2,4-trimethyl-1,2-dihydroquinoline.

Ultraviolet absorbers and light protectants include

25 (a) 2 - (2' - hydroxyphenyl)benzotriazoles, for instance 5' - methyl; 3',5' - di- 25
- *t* - butyl; 5 - chloro - 3',5' - di - *t* - butyl; 5 - chloro - 3' - *t* - butyl - 5' -
methyl; 3' - sec.butyl - 5' - tert.butyl; 3' - (α - methylbenzyl) - 5' - methyl;
3' - [α - methylbenzyl) - 5' - methyl - 5 - chloro-; 4' - octoxy-; 3',5' - di-
- *t* - amyl; 3' - methyl - 5' - carbomethoxyethyl; 5 - chloro - 3',5' - di - *t* - amyl
derivatives;

30 (b) 2,4 - bis - (2' - hydroxyphenyl) - 6 - alkyl - S - triazines, for instance the 30
6-ethyl or 6-undecyl derivatives;

(c) 2 - hydroxybenzophenones, for instance the 4 - hydroxy, 4 - methoxy, 4-
octoxy-, 4 - decyloxy-, 4 - dodecyloxy-, 4,2',4' - trihydroxy or 2' - hydroxy-
4,4' - dimethoxy derivatives;

35 (d) 1,3-bis-(2'-hydroxybenzoyl)-benzenes for instance, 35
1,3-bis-(2'-hydroxy-4'-hexyloxybenzoyl)benzene,
1,3-bis-(2'-hydroxy-4'-octyloxybenzoyl)benzene, and
1,3-bis-(2'-hydroxy-4'-dodecyloxybenzoyl)benzene;

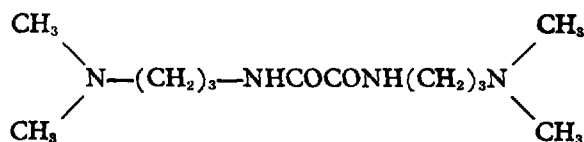
40 (e) aryl esters of optionally substituted benzoic acids such as phenylsalicylate, 40
octylphenyl salicylate, dibenzoyl resorcinol, bis - O - (4 - tert.butylbenzoyl)-
resorcinol, O - benzoylresorcinol and 3,5 - di - tert.butyl - 4 - hydroxy-
benzoic acid 2,4 - di - tert.butyl phenyl ester and -octadecyl ester and -2-
methyl - 4,6 - di - tert.butyl phenyl ester;

45 (f) acrylates, for instance 45
 α - Cyano - β,β - diphenylacrylic acid ethyl - or iso - octyl - ester, α - carbo-
methoxy - cinnamic acid methyl- or butyl ester and N - (β - carbomethoxy-
vinyl) - 2 - methylindoline;

(g) Nickel compounds such as nickel complexes of 2,2' - thiobis - (4 - tert.octyl-
phenol), for instance the 1:1 and 1:2 complexes, optionally having other
ligands such as *n*-butylamine, triethanolamine or N - cyclohexyl - diethanol-

amine; nickel complexes of bis - (4 - tert.octylphenyl) sulphone such as the 2:1 complex, optionally having other ligands such as 2 - ethylcaproic acid; nickel dibutyl dithiocarbamates; nickel salts of 4 - hydroxy - 3,5 - di - tert-butylbenzylphosphonic acid mono-alkyl esters such as the methyl-, ethyl- or butyl esters; the nickel complex of 2 - hydroxy - 4 - methyl - phenyl-undecylketonoxime; and nickel - 3,5 - di - tert.butyl - 4 - hydroxy benzoate, and

(h) Oxalic acid diamides, for instance
 4,4'-dioctyloxylanilide,
 2,2'-dioctyloxy-5,5'-di-tert.butyl-oxanilide,
 2,2'-di-dodecyloxy-5,5'-di-tert.butyl-oxanilide,
 2-ethoxy-5-tertiarybutyl-2'-ethyl-oxanilide,
 2-ethoxy-2'-ethyl-oxanilide, and
 mixtures of o- and p-methoxy and ethoxy- di-substituted oxanilides and the compound of formula:—



Phosphite stabilisers include triphenyl phosphite, diphenylalkyl phosphites, phenyl dialkyl phosphites, trinonylphenyl phosphite, trilauryl phosphite, triocadecyl phosphite, 3,9 - di - isodecyloxy - 2,4,8,10 - tetraoxa - 3,9 - diphosphaspiro - (5,5) - undecane and tri - (4 - hydroxy - 3,5 - di - tert.butylphenyl)phosphite.

Peroxide-decomposing compounds for polyolefins include esters of β -thiodipropionic acids, for instance the lauryl-, stearyl-, myristyl- or tridecyl esters, and salts of mercaptobenzimidazoles such as the zinc salt and diphenylthiourea.

Suitable polyamide stabilisers include copper salts in combination with iodides and/or further phosphorus compounds and salts of bivalent manganese.

Basic co-stabilisers are, for example, polyvinylpyrrolidone, melamine, benzoguanamine, triallyl cyanurate, dicyandiamide, urea derivatives, hydrazine derivatives, amines, polyamides, polyurethanes, and alkali and alkaline earth salts of higher saturated or unsaturated fatty acids such as calcium stearate.

Polyvinyl chloride stabilisers include organotin compounds, organo lead compounds and Ba/Cd salts of fatty acids.

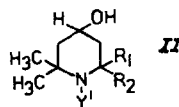
Examples of nucleation agents are 4-tert.butyl benzoic acid, adipic acid and diphenylacetic acid.

As with the compound of formula I, any further additive is advantageously employed in a proportion within the range of from 0.01% to 5% by weight, based on the weight of untreated polymeric material.

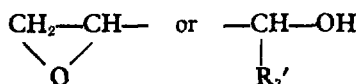
In binary combinations with one or more antioxidants listed above or in tertiary combinations with such antioxidants and U.V. absorbers listed above, the compounds of formula I provide very effective stabiliser packages in polyolefine formulations.

Many of the compounds of formula I are novel and where these compounds are new, they form part of the present invention.

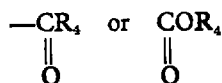
Accordingly, the present invention also provides compounds having the formula:—



wherein R_1 , R_2 and Y have their previous significance and Y' is a straight- or branched alkyl residue having from 5 to 20 carbon atoms, an alkenyl or alkynyl residue having from 3 to 20 carbon atoms, an aralkyl residue having from 7 to 12 carbon atoms, or the group $-\text{CH}_2\text{X}'$ wherein X' is the group



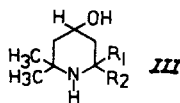
wherein R_3^1 is hydrogen or a methyl residue, or X^1 is the group



wherein R_4 has its previous significance.

The preferences previously expressed for substituents Y of compounds of formula I apply equally, within the limits of the restricted definition, to substituent Y^1 of the compounds of formula II.

The present invention also provides a process of producing a compound of formula II comprising reacting a piperidinol having the formula:—

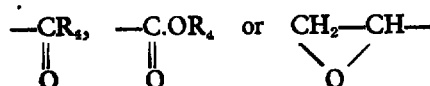


wherein R_1 and R_2 have their previous significance with a compound IV capable of replacing the hydrogen atom on the nitrogen atom of the compound of formula III by the substituent Y^1 .

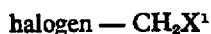
Thus, to produce by this process a compound of formula II in which Y^1 is an alkyl, alkenyl, alkynyl or aralkyl residue, the compound of formula III is reacted with a compound IV which is alkylating, alkenylating, alkynylating or aralkylating agent. Preferably, the compound IV in this case is an alkyl, alkenyl, alkynyl or aralkyl halide.

To produce a compound of formula II wherein Y^1 is alkyl or aralkyl, compound IV may also be the aldehyde or ketone corresponding to the substituent Y^1 , together with formic acid under Leuckart reaction conditions.

Similarly, to produce a compound of formula II wherein Y^1 is a substituent —CH_2X^1 wherein X^1 is



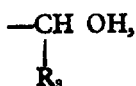
the compound of formula III may be reacted with a compound having the formula:—



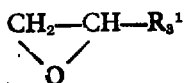
wherein X^1 has its previous significance.

The reaction is conveniently effected by heating compounds III and V together in the presence of an acid-binding agent which may be an excess of the compound of formula III or another base, for instance triethylamine.

To introduce a substituent Y^1 wherein Y^1 is —CH_2X^1 and X^1 is a residue

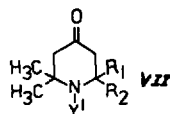


the compound of formula III may be reacted with an olefine oxide having the formula:



wherein R_3^1 has its previous significance.

The present invention further provides a process of producing a compound of formula I comprising hydrogenating or reducing a compound having the formula:—



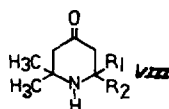
wherein R_1 , R_2 and Y^1 have the previous significance, with the proviso that Y^1 is not an unsaturated residue.

When this process is effected by a hydrogenation technique, the reaction is preferably effected in the presence of a metal hydrogenation catalyst and in the presence of an organic solvent inert under the reaction conditions. Suitable metal hydrogenation catalysts include platinum, palladium, ruthenium, rhodium and Raney nickel, optionally supported on an inert carrier such as calcium carbonate or carbon black. Examples of inert solvents for use in the hydrogenation reaction include toluene and cyclohexane.

When the reaction is effected by chemical reduction, suitable reducing agents include metal hydrides such as $LiAlH_4$, $NaBH_4$ or secondary alcohols in the presence of a catalyst, e.g. aluminium isopropoxide, for example the Meerwein-Ponndorf-Varley reduction.

Many of the starting materials of formula VII are new compounds. They may be prepared for instance, by any of the following methods.

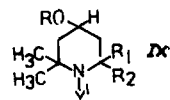
Firstly, the compounds VII may be prepared by reacting the corresponding $>NH$ compound having the formula:—



with a compound capable of replacing the hydrogen atom on the nitrogen atom by the group Y^1 . In modifications of this reaction, the compound VIII may be replaced by derivatives thereof, for instance by a ketal derived from a compound of formula VIII.

The compounds of formula VIII are known compounds and may, in turn, be prepared by methods well-known per se, for instance by the method described in French Patent Specification No. 1,535,012.

According to a third, less preferred, process there is provided a process of producing a compound of formula II, comprising hydrolysing an O-substituted derivative having the formula:—



wherein R_1 , R_2 and Y^1 have their previous significance and R is an alkyl residue, which optionally substituted, having from 1 to 20 carbon atoms, a cycloalkyl residue having from 5 to 12 carbon atoms, an alkenyl or alkynyl residue having from 3 to 20 carbon atoms, an acyl residue having from 1 to 20 carbon atoms or a carbamoyl or thiocarbamoyl residue having from 1 to 20 carbon atoms.

The hydrolysis reaction may be carried out, for example, by contacting the compound of formula IX with an aqueous acidic or alkaline medium, preferably at an elevated temperature.

Examples of compounds of formula IX which may be used in the third process according to the invention include 1 - (2' - hydroxyethyl) - 4 - butoxy - 2,2,6,6-tetramethylpiperidine, 1 - n - propyl - 2,2,6,6 - tetramethyl - piperidine - 4 - octanoate and 1 - n - butyl - 2,2,6,6 - tetramethylpiperidine - 4 - benzoate. (These compounds are described in our co-pending patent applications Nos. 55487/71, 28458/72 and 35473/72). (Serial Nos. 1 399 239 and 1 399 239).

Some Examples will now be given. Parts and percentages are by weight unless otherwise stated.

Example 1.

A mixture of 15.7 parts of 2,2,6,6 - tetramethylpiperidin - 4 - ol and 12.5 parts of n-dodecyl bromide in 50 parts of ethyl alcohol was heated under reflux conditions for 72 hours. The cooled reaction mixture was filtered to remove 2,2,6,6 - tetramethylpiperidin - 4 - ol hydrobromide formed during the reaction and the ethyl alcohol

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solvent was removed by distillation under reduced pressure. The residue was treated with petroleum ether (b.p. 40—60°C) and filtered to remove the unreacted 2,2,6,6-tetramethylpiperidin - 4 - ol and the petroleum ether solvent was removed by distillation under reduced pressure. Fractional distillation of the residue gave 1 - n - dodecyl-2,2,6,6 - tetramethylpiperidin - 4 - ol having a melting point of 41—2°C and the following elemental analysis by weight:

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	FOUND	REQUIRED (for $C_{21}H_{43}NO$)
CARBON	77.75%	77.47%
HYDROGEN	12.74%	13.31%
NITROGEN	3.96%	4.30%

Example 2.

A mixture of 31.4 parts of 2,2,6,6 - tetramethylpiperidin - 4 - ol and 17.1 parts of benzyl bromide in 125 parts of ethyl alcohol was heated under reflux conditions for 96 hours. The cooled reaction mixture was filtered to remove 2,2,6,6 - tetramethylpiperidin - 4 - ol hydrobromide formed during the reaction and the ethyl alcohol solvent was removed by distillation under reduced pressure. Purification of the residue by chromatography on an alumina column using chloroform as the solvent gave 1-benzyl - 2,2,6,6 - tetramethylpiperidin - 4 - ol having a melting point of 151—2°C and the following elemental analysis by weight:

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	FOUND	REQUIRED (for $C_{18}H_{28}NO$)
CARBON	77.90%	77.68%
HYDROGEN	10.15%	10.19%
NITROGEN	5.38%	5.66%

Example 3.

A mixture of 78.5 parts of 2,2,6,6 - tetramethylpiperidine - 4 - ol and 30.25 parts of allyl bromide in 250 parts of ethyl alcohol was heated under reflux conditions for 48 hours. The cooled reaction mixture was filtered to remove 2,2,6,6 - tetramethylpiperidin - 4 - ol hydrobromide formed during the reaction and the ethyl alcohol solvent was removed by distillation under reduced pressure. The residue was triturated with cold petroleum ether (b.p. 40—60°C) to remove a small amount of unreacted 2,2,6,6-tetramethylpiperidin - 4 - ol. Crystallisation of the residue from 40—60°C petroleum ether gave 1 - allyl - 2,2,6,6 - tetramethylpiperidin - 4 - ol having a melting point of 84—5°C and the following elemental analysis by weight:

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	FOUND	REQUIRED (for $C_{22}H_{28}NO$)
CARBON	73.18%	73.04%
HYDROGEN	11.61%	11.75%
NITROGEN	6.79%	7.10%

Example 4.

A mixture of 3.14 parts of 2,2,6,6 - tetramethylpiperidin - 4 - ol, 10 parts of propylene oxide and 10 parts of isopropanol was charged to an autoclave. A pressure of 100 atmospheres of nitrogen was applied and the mixture heated at 160° for 6 hours. The isopropanol solvent and unreacted propylene oxide were removed by distillation under reduced pressure. Crystallisation of the residue from cyclohexane gave 3.0 parts of 1 - [2 - hydroxypropyl] - 2,2,6,6 - tetramethylpiperidin - 4 - ol having a melting-point of 97—98°C. [and which on further purification by redistillation and recrystallisation had a melting-point of 107—108°C] and the following element analysis by weight:

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	FOUND	REQUIRED (for $C_{12}H_{25}NO_2$)
CARBON	67.04%	66.93%
HYDROGEN	11.66%	11.70%
NITROGEN	6.32%	6.50%

Example 5.

A mixture of 3.14 parts of 2,2,6,6 - tetramethyl - piperidin - 4 - ol, 5 parts of ethylene oxide and 10 parts of isopropanol was charged to a previously cooled autoclave. A pressure of 100 atmospheres of nitrogen was applied and the mixture heated at 160°C for 6 hours.

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The isopropanol solvent was removed by distillation under reduced pressure. Crystallisation of the residue from toluene gave 1.1 parts of 1 - [2 - hydroxyethyl]-2,2,6,6 - tetramethylpiperidin - 4 - ol having a melting point of 182°C and the following elemental analysis by weight:

5		FOUND	REQUIRED (for $C_{11}H_{23}NO_2$)	5
	CARBON	65.90%	65.63%	
	HYDROGEN	11.52%	11.52%	
	NITROGEN	6.72%	6.96%	

Example 6.

10 38 Parts of polypropylene were homogenised with 0.076 part of n - octadecyl - β - (4' - hydroxy - 3',5' - di - t - butylphenyl)propionate in a kneading machine at a temperature of 200°C over a period of 3 minutes. 0.19 part of 1,2,2,6,6 - pentamethyl-
10 piperidin - 4 - ol was then added and homogenisation continued for another 7 minutes.

15 The homogenised mixture was removed from the kneader and pressed to a thickness of from 2 to 3 mm. in a press at a temperature of 200°C. 9 Parts of the polypropylene mixture were then charged into a press in which the press-plates were protected by 0.1 mm thick aluminium foil. The sample was surrounded by four strips of steel skim, 0.3 mm thick, in the form of a square, acting as spacers between the aluminium foils. The press was closed and for 2 minutes no pressure was applied.
20 The pressure was then increased over 2 minutes up to a maximum of 12 tons and this pressure held for a further 2 minutes, the temperature being 260°C. The pressure was released and the material (0.3 mm. thick) was cooled immediately under running water.

25 2.2 parts of this material was cut in the form of a square and recharged to the press. Conditions were as for the previous pressure except that 0.1 mm thick steel skim was used for spacing between the aluminium foils. The press was closed and no pressure was applied for 2 minutes. Over another 2 minutes the pressure was increased to 8 tons, the press temperature being 260°C. This pressure was maintained for 2 minutes and then the pressure released. The "sandwich" of the 0.1 mm thick polypropylene foil and the aluminium foils was then removed and tempered immediately
30 for 1 hour in a circulating-air oven maintained at 150°C. The "sandwich" was then quenched in running cold water and the aluminium foils were peeled from the inner polypropylene foil and the skin spacers removed.

35 A section measuring 44 × 100 mm was separated from the 0.1 mm tempered polypropylene foil and exposed to light irradiation in a fademeter device consisting of a circular bank of 28 alternate sunlight and blacklight lamps. The sunlight lamps were 2 feet long, 20-watt fluorescent lamps characterised by a peak emission of 3000 Angstrom units; the blacklight lamps were 2 feet long, 20-watt ultraviolet lamps characterised by a peak emission of 3500 Angstrom units. The sample was rotated concentrically within the bank of lamps so that the radiation therefore was uniformly distributed over the section under test.
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The exposed sample was examined periodically and the time (T) at which the sample reached 50% of the initial elongation at break was noted.

45 The time (Tc) for the elongation of a control sample (not containing the product of Example 1) to decrease to 50% of the initial elongation was then determined.

The performance of the compound of formula I as a light stabiliser could then be assessed by determining the factor T/Tc.

The results obtained including those relating to other compounds of formula I are summarised in the following Table.

TABLE

Example	Additive	Time (T) 50% initial elongation at break (hours)	Factor i.e. $\frac{T \text{ additive}}{T \text{ control}}$
—	none (control)	190	1
—	2-(2'-hydroxy-3',5'- di-t-butylphenyl)-5- chlorobenzotriazole	500	2.6
6	1,2,2,6,6-pentamethyl- piperidin-4-ol	890	4.7

Example 7.

5 A mixture of 15.7 parts of 2,2,6,6 - tetramethylpiperidin - 4 - ol and 6.85 parts
of epibromohydrin in 50 parts of ethyl alcohol was heated for 24 hours. The cooled
reaction mixture was filtered to remove 2,2,6,6 - tetramethylpiperidin - 4 - ol hydro-
bromide and the solvent removed by distillation *in vacuo*. The resultant material was
10 dissolved with heating in petroleum ether (of boiling range 100—120°C) and the
immediate crop of crystals of 2,2,6,6 - tetramethylpiperidin - 4 - ol removed. Evapora-
tion afforded 2 - (2',3' - epoxy - n - propyl) - 2,2,6,6 - tetramethylpiperidin - 4 - ol as
a colourless solid of melting point 49—53°C. This material gave the following
elemental analysis, by weight:

	FOUND	REQUIRED (for $C_{12}H_{23}NO_2 \cdot CH_3CH_2OH$)	
15	CARBON 64.87%	64.83%	15
	HYDROGEN 10.87%	11.27%	
	NITROGEN 5.99%	5.40%	

Example 8.

20 A mixture of 15.7 parts of 2,2,6,6 - tetramethylpiperidin - 4 - ol and 8.3 parts
of ethyl bromoacetate in 50 parts of ethyl alcohol was heated at reflux for 48 hours.
The cooled reaction mixture was filtered to remove 2,2,6,6 - tetramethylpiperidin - 4 -
ol hydrobromide and the solvent removed by distillation *in vacuo*. The residue was
triturated with 40—60°C petroleum ether to remove the unreacted 2,2,6,6 - tetra-
methylpiperidin - 4 - ol. The filtrate was then distilled under reduced pressure to
25 yield pure 1 - ethoxy - carbonylmethyl - 2,2,6,6 - tetramethylpiperidin - 4 - ol as a
colourless liquid (of boiling point 116°C at 0.2mmHg) which slowly solidified on
standing (melting point 42—52.5°C). This material gave the following elemental
analysis by weight:

	FOUND	REQUIRED (for $C_{13}H_{25}NO_3$)	
30	CARBON 64.27%	64.16%	30
	HYDROGEN 10.30%	10.36%	
	NITROGEN 5.57%	5.76%	

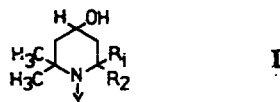
Example 9.

35 1-[2-hydroxy-2-phenylethyl]-2,2,6,6-tetramethylpiperidin-4-ol.
A mixture of 2.14 parts of 2,2,6,6 - tetramethylpiperidin - 4 - ol, 30 parts of
styrene oxide and 30 parts of n-hexanol was heated at reflux for 18 hours. The n-
hexanol solvent and unreacted styrene oxide were removed by distillation under reduced
pressure. Crystallisation of the residue from cyclohexane gave 4.2 parts of 1 - [2-
hydroxy - 2 - phenylethyl] - 2,2,6,6 - tetramethylpiperidin - 4 - ol having a melting
point of 123°C and the following elemental analysis by weight:

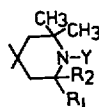
	FOUND	REQUIRED (for C ₁₇ H ₂₇ NO ₂)
CARBON	73.87%	73.61%
HYDROGEN	9.87%	9.81%
NITROGEN	5.22%	5.05%

5 WHAT WE CLAIM IS:—

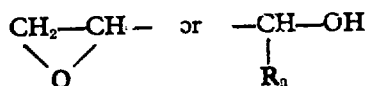
1. A composition comprising an organic material and, as stabiliser, a compound having the formula:—



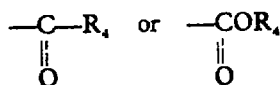
10 wherein R₁ and R₂ are the same or different and each is a straight- or branched alkyl residue having from 1 to 12 carbon atoms, or R₁ and R₂, together with the carbon atom to which they are attached, form a cycloalkyl residue having from 5 to 12 carbon atoms, or the group:—



15 wherein R₁ and R₂ have their previous significance and Y is a straight- or branched alkyl residue having from 1 to 20 carbon atoms, an alkenyl or alkynyl residue having from 3 to 20 carbon atoms, an aralkyl residue having from 7 to 12 carbon atoms or the group —CH₂X wherein X is the group



wherein R₃ is hydrogen, a methyl or phenyl residue, the group



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wherein R₄ is an alkyl residue having from 1 to 20 carbon atoms.

2. A composition as claimed in claim 1 wherein R₁ and R₂ are each a methyl residue.

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3. A composition as claimed in claim 1 or 2 wherein Y is an alkyl residue having from 1 to 20 carbon atoms, an alkenyl or alkynyl residue each having 3 or 4 carbon atoms, an aralkyl residue having 7 to 11 carbon atoms, a hydroxyethyl or hydroxypropyl residue or a hydroxyphenylethyl residue.

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4. A composition as claimed in claim 3 in which Y is an alkyl residue containing 1 to 4 carbon atoms.

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5. A composition as claimed in claim 4 wherein Y is methyl.

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6. A composition as claimed in any of the preceding claims wherein the organic material is low- or high density polyethylene or polypropylene, polystyrene a polymer of butene-1, pentene-1, 3-methylbutene-1, hexene-1, 4-methylpentene-1, 4-methylhexene-1, 4,4-dimethylpentene-1 or a copolymer of ethylene or propylene.

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7. A composition as claimed in any of claims 1 to 5 wherein the organic material is a natural or synthetic polymer.

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8. A composition as claimed in claim 7 wherein the synthetic polymer is polyvinyl chloride, polyvinylidene chloride, a vinyl chloride copolymer, polyvinyl acetate or a condensation polymer containing ether, ester (derived from carboxylic, sulphonic or carbonic acids), amide or methane groupings.

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9. A composition as claimed in any of the preceding claims wherein the amount of the compound of formula I is within the range of from 0.1% to 2% by weight of untreated organic material.

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10. A composition as claimed in any of the preceding claims wherein the composition consists of a binary, ternary or multi-component composition containing, as stabiliser, a compound of formula I together with one or more other functional additives for polymers.

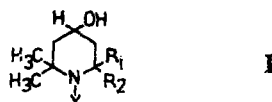
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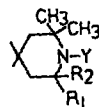
	FOUND	REQUIRED (for C ₁₇ H ₂₇ NO ₂)
CARBON	73.87%	73.61%
HYDROGEN	9.87%	9.81%
NITROGEN	5.22%	5.05%

5 WHAT WE CLAIM IS:—

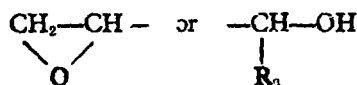
1. A composition comprising an organic material and, as stabiliser, a compound having the formula:—



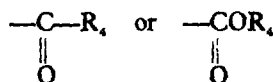
10 wherein R₁ and R₂ are the same or different and each is a straight- or branched alkyl residue having from 1 to 12 carbon atoms, or R₁ and R₂, together with the carbon atom to which they are attached, form a cycloalkyl residue having from 5 to 12 carbon atoms, or the group:—



15 wherein R₁ and R₂ have their previous significance and Y is a straight- or branched alkyl residue having from 1 to 20 carbon atoms, an alkenyl or alkynyl residue having from 3 to 20 carbon atoms, an aralkyl residue having from 7 to 12 carbon atoms or the group —CH₂X wherein X is the group



wherein R₃ is hydrogen, a methyl or phenyl residue, the group



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wherein R₄ is an alkyl residue having from 1 to 20 carbon atoms.

2. A composition as claimed in claim 1 wherein R₁ and R₂ are each a methyl residue.

25 3. A composition as claimed in claim 1 or 2 wherein Y is an alkyl residue having from 1 to 20 carbon atoms, an alkenyl or alkynyl residue each having 3 or 4 carbon atoms, an aralkyl residue having 7 to 11 carbon atoms, a hydroxyethyl or hydroxypropyl residue or a hydroxyphenylethyl residue.

30 4. A composition as claimed in claim 3 in which Y is an alkyl residue containing 1 to 4 carbon atoms.

5. A composition as claimed in claim 4 wherein Y is methyl.

35 6. A composition as claimed in any of the preceding claims wherein the organic material is low- or high density polyethylene or polypropylene, polystyrene a polymer of butene-1, pentene-1, 3-methylbutene-1, hexene-1, 4-methylpentene-1, 4-methylhexene-1, 4,4-dimethylpentene-1 or a copolymer of ethylene or propylene.

7. A composition as claimed in any of claims 1 to 5 wherein the organic material is a natural or synthetic polymer.

40 8. A composition as claimed in claim 7 wherein the synthetic polymer is polyvinyl chloride, polyvinylidene chloride, a vinyl chloride copolymer, polyvinyl acetate or a condensation polymer containing ether, ester (derived from carboxylic, sulphonic or carbonic acids), amide or methane groupings.

9. A composition as claimed in any of the preceding claims wherein the amount of the compound of formula I is within the range of from 0.1% to 2% by weight of untreated organic material.

45 10. A composition as claimed in any of the preceding claims wherein the composition consists of a binary, ternary or multi-component composition containing, as stabiliser, a compound of formula I together with one or more other functional additives for polymers.

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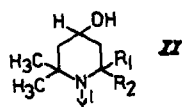
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11. A composition as claimed in claim 10 wherein the functional additive is an antioxidant of the phenol or amine type, a U.V. absorber or light protectant, a phosphite stabiliser, a peroxide decomposer, a polyamide stabiliser, a basic co-stabiliser, a polyvinylchloride stabiliser, a nucleation agent, a plasticizer, a lubricant, an emulsifier, an anti-static agent, a flame protectant, a pigment, carbon black, asbestos, glass fibres, kaolin or talc.

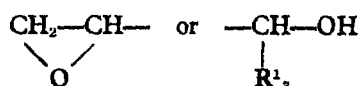
12. A composition as claimed in claim 7 wherein the synthetic polymer is a polyvinyl acetal, a polyacrylate, a polyamide, a urea-formaldehyde or melamine-formaldehyde resin or a cellulose plastic.

13. A composition as claimed in claim 1 substantially as described with reference to Example 6.

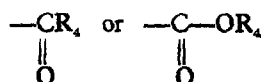
14. A compound having the formula:—



wherein R_1 , R_2 and Y are as defined in claim 1 and Y^1 is a straight- or branched alkyl residue having from 5 to 20 carbon atoms, an alkenyl or alkynyl residue having from 3 to 20 carbon atoms, an aralkyl residue having from 7 to 12 carbon atoms or the group $—CH_2X^1$ wherein X^1 is the group



wherein R_3^1 is hydrogen or methyl or X^1 is the group



wherein R_4 is as defined in claim 1.

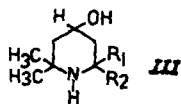
15. A compound as claimed in claim 14 wherein R_1 and R_2 are each methyl.

16. A compound as claimed in claim 14 or 15 wherein Y is an alkyl residue having from 5 to 20 carbon atoms, an alkenyl or alkynyl residue having 3 or 4 carbon atoms, an aralkyl residue having from 7 to 11 carbon atoms, or a hydroxyethyl or hydroxypropyl residue.

17. A compound as claimed in claim 14 substantially as described with reference to any of Examples 1 to 5.

18. A compound as claimed in claim 14 substantially as described with reference to any of Examples 7 to 9.

19. A process of producing a compound of formula II as defined in claim 14 comprising reacting a piperidinol of formula:—



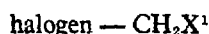
wherein R_1 , R_2 and Y are as defined in claim 1, with a compound IV capable of replacing the hydrogen atom on the nitrogen atom of the compound of formula III by the substituent Y^1 .

20. A process as claimed in claim 19 wherein the compound IV is an alkylating, alkenylating, alkynylating or aralkylating agent.

21. A process as claimed in claim 20 wherein compound IV is an alkyl, alkenyl, alkynyl or aralkyl halide.

22. A process as claimed in claim 19 wherein compound IV is the aldehyde or ketone corresponding to substituent Y^1 , together with formic acid under Leuckart reaction conditions.

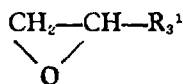
23. A process as claimed in claim 19 wherein compound IV has the formula:—



wherein X^1 is as defined in claim 14.



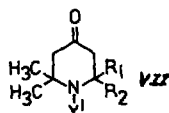
24. A process as claimed in claim 19 wherein compound IV has the formula:—



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wherein R_3^1 is as defined in claim 13.

25. A process of producing a compound of formula II as defined in claim 14 comprising hydrogenating or reducing a compound having the formula:—

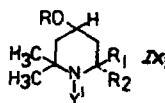


wherein R_1 , R_2 and Y are as defined in claim 1 and Y^1 is as defined in claim 14 with the proviso that Y^1 is not an unsaturated residue.

26. A process as claimed in claim 25 wherein a hydrogenation technique is used and the reaction is effected in the presence of a metal hydrogenation catalyst and in the presence of an organic solvent inert under the reaction conditions.

27. A process as claimed in claim 25 wherein a chemical reduction technique is used and the reducing agent is a metal hydride or a secondary alcohol.

28. A process for producing a compound of formula II as defined in claim 14 comprising hydrolysing an O-substituted derivative having the formula:—



wherein R_1 , R_2 and Y are as defined in claim 1 and Y^1 is as defined in claim 14 and R is an alkyl residue having from 1 to 20 carbon atoms, a cycloalkyl residue having from 5 to 12 carbon atoms, an alkenyl or alkynyl residue having from 3 to 20 carbon atoms, an acyl residue having from 1 to 20 carbon atoms or a carbamoyl or thio-carbamoyl residue having from 1 to 20 carbon atoms.

29. A process for producing a compound of formula II as defined in claim 14 substantially as described with reference to any of Examples 1 to 5.

30. A process of producing a compound of formula II as defined in claim 14 substantially as described with reference to any of Examples 7 to 9.

31. A compound of formula II as defined in claim 14 when produced by a process claimed in any of claims 19 to 29.

32. A compound of formula II as defined in claim 14 when produced by a process claimed in claim 30.

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